INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE PRODUCTION OF SUGARCANE

R.B. KHANDAGAVE

DEPARTMENT OF AGRONOMY
COLLEGE OF AGRICULTURE, DHARWAD
UNIVERSITY OF AGRICULTURAL SCIENCES,
DHARWAD-580 005

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By
R.B. KHANDAGAVE

DEPARTMENT OF AGRONOMY
COLLEGE OF AGRICULTURE, DHARWAD
UNIVERSITY OF AGRICULTURAL SCIENCES,
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DHARWAD
MAY, 2000

(C. J. ITNAL)
MAJOR ADVISOR
Director of Instruction (Agri.)
College of Agriculture, UAS, Dharwad

Approved by :

Chairman : _____
(C. J. ITNAL)

Members :

1. _____
(A. S. PRABHAKAR)

2. _____
(S. LINGAPPA)

3. _____
(G. K. HIREMATH)

4. _____
(A. D. JANAWADE)

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INTRODUCTION

I. INTRODUCTION

Sugarcane [*Saccharum officinarum* L.] is one of the important commercial crops of tropical countries and is the main source of sugar in the world. Globally sugarcane is cultivated over an area of 18.32 million hectares with production of 1147.99 million tonnes having productivity level of 62.70 tonnes per hectare [Anon.,1995]. India achieved the unique distinction of numero uno in the world sugar production and is cultivated over an area of 4.05 million hectares with annual production of 267.50 million tonnes with the sugar yield of 10.60 million tonnes and the average sugar recovery is 10.30 percent . Sugarcane productivity of the country is slightly higher [66.10 t/ha] than the world average [Anon.,1998]

In Karnataka, sugarcane occupies an area of 2.55 lakh hectares with a production of 214.00 lakh tonnes of cane [Anon., 1998]. The productivity of sugarcane in the state is high [83.90 t/ha] as compared to national average [66.10 t/ha].

The sugar industry occupies an important place in the economy of our country. Being second largest agro-based industry, it plays a dominant role in both agricultural and industrial development. Nearly 40 million growers and their dependents are involved in the cultivation of sugarcane. This

industry provides employment to more than 3.5 lakhs skilled and unskilled workers. The industry is also instrumental in generating sizeable employment and wealth through ancillary industries and activities. The contribution of sugar industry to the central exchequer by way of central excise duty is over Rs.1000 crores annually. Besides, the state governments, also collect about 550 crores per annum as purchase tax and cess on sugarcane.

Indian Council of Agricultural Research., New Delhi while preparing perspective plan for Sugarcane Breeding Institute., Coimbatore and "Vision 2020", has projected that country will have to restrict to 4.15 million hectares of irrigated land under sugarcane to produce 415 million tonnes of sugarcane with productivity of 100 t/ha and 11 per cent sugar recovery. These projections are made keeping in view the population growth, per capital consumption and export obligations and also considering the fact that by 2020 A.D., the sugarcane production system would under go marked changes due to scarcity of water, land, labour, high costs of inputs, vigorous competitions from other crops and price of sugar in the international market. The above targets can only be achieved by improving sugar recovery and productivity with input efficiency and profit maximisation to

farmers. [Anon., 1997]. Coimbatore canes and fertilizers have brought miraculous changes in sugarcane cultivation in India during early thirties to mid-sixties. Sugarcane productivity jumped from 37.7 tonnes per hectare in 1932 to 48.3 tonnes per hectare in 1970. Since then, though productivity is steadily increasing but the trend is highly fluctuating [Yadav, 1986].

These uncertainties thus, warrant to think of sustaining cane yields at a desired level. Sustainable productivity levels, however, differ with climatic regions [tropical to subtropical], input levels and cultivation systems [Irrigated to un-irrigated/or partially irrigated]. Accordingly, agro-technologies for such sustainable productivity may also differ. However, the cultivation practices, which give maximum output from the land without depleting its fertility, are the most suitable ones for yield sustenance.

Among various inputs of sugarcane production, although fertilizers contribute maximum [30 per cent] to the increase in yield [Tolia, 1989 and Yadav, 1990] but these cannot help to maintain and enhance soil's organic matter content which is the ultimate key to sustainability. Organic matter is essential to maintain porous soil structure, higher water holding capacity

and penetration of oxygen for use by soil organisms that breakdown manure, crop residues and other organic matter.

The time-honoured practices of good cane cultivation show that there are several valuable sources of plant nutrients other than chemical fertilizers. In fact, earlier to the introduction of chemical fertilizers in cane cultivation, the fertility of fields used to be sustained not only by animal and plant wastes, as is generally known, but also by certain practices of mixed cropping, crop-rotation and soil conservation. These practices have in fact been followed for centuries in India, but have been rapidly given up in recent years due to input-intensive agriculture. Similarly, increased soil erosion on river banks [where most of the sugarcane is grown for assured availability of water] has played havoc with the fertility of land.

There is no doubt that sugar cane crop needs higher levels of fertilizers. A crop of 125 tonnes per hectare removes 83 kg nitrogen, 37.2 kg phosphorus and 168 kg potassium per hectare from the soil [Lakshmikanthan, 1973]. The tendency to supply all these nutrients only through chemical fertilizers, however, has to be avoided as these have deleterious effect on soil productivity on long- term basis [Anon.,1995d] Moreover, chemical fertilizers are only one of the several important sources of crop

nutrients and should be accorded only that much importance and further to sustain sugarcane production under intensive cultivation as practiced in the hot climate of India, organic matter content of soil must be maintained either by re-cycling of organic wastes or by use of farm yard manures or of green manures. Therefore, in recent years a renewed interest has developed in the use of renewable sources of plant nutrients due to considerations of ecology, escalating cost of chemical fertilizers and yield stability .Of course, no single source of plant nutrients, be it chemical fertilizers, can meet the entire nutrient needs of crops, rather they need to be used in an integrated manner following a management technology that is appropriate, economically viable, socially acceptable and ecologically sound. Organic manures not only provide essential plant nutrients but also lead to build up of organic carbon and improve the soil physical conditions. A higher significant correlation exists between soil organic carbon content and the lowering of bulk density which is a measurable characteristic of soil structure. The lower bulk density is associated with better aggregation, increased soil porosity, higher infiltration rate, better aeration, drainage and root growth.

Modern agriculture production has raised the hope that hunger can be eliminated through a combination of political will, professional skill and farmers toil to feed the growing mass of world population. On the contrary, doubts are expressed about the ecological sustainability of intensive farming. This is due to the associated problem of soil degradation, pesticide accumulation, atmospheric and waters pollution. Today, the general recognition of long term danger of chemical farming has renewed interest in alternate methods of agriculture. Interest in natural farming /organic farming is tremendously increasing in the minds of several people around the globe. Organic farming doesn't mean without chemicals or fertilizers. It means a commitment to the land.

The basic principle of integrated nutrient supply system (INSS) is the maintenance and possibly improvement of soil fertility for sustaining crop productivity on long term basis which may be achieved through combined use of all possible sources of nutrition and their scientific management for optimum growth, yield and quality of crop in an integrated manner in specific agro-ecological situations.

INSS primarily relates to combined application of different sources of plant nutrients (organic and inorganic) for sustainable

crop production without degrading the natural resource base and on sustainable basis. It, therefore, provides an ideal nutrition for a crop through a proper combination of various nutrient resources and their optimum utilization along with maintenance of soil productivity and ecology. Combined use has been favoured for improving soil physical, chemical and biological conditions. This also helps in raising minerlization efficiency and nutrient recovery from organic resource.

A sizeable proportion of the nutrient needs of crops can be met through appropriate recycling of agricultural wastes, organic manures are however, not to be used as substitute of chemical fertilizers but only a component in the whole nutrient management system as the nutrient needs essential for high yield goals and cannot be met exclusively through them particularly for reasons of insufficiency.

Among different crop residues, sugarcane trash is available in large quantity [10 to 12 per cent of cane yield] and its management assumes special significance because it is hard to decompose and farmers burn them in the sugarcane fields.It is estimated that total sugarcane trash produced in India is 1.57 million tonnes having total N,P and K potentiality of 27.07 lakh tonnes[Bhardwaj and Gaur,1985]. By recycling the cane trash

as manure @ 7.5 t/ha both chopped and unchopped increased cane yield significantly from 141 to 154 t/ha and 152 t/ha respectively apart from improving C.C.S percentage, soil microbial population and organic carbon. [Jadhav, 1996] Similarly another important organic source in sugarcane farming is the pressmud or its by-product from the sugar industry. They are very good source of organic manures which include all the essential plant nutrients. Integration of chemical fertilizers and pressmud has shown improvement in yield attributes, yield in addition to increased organic carbon and availability of major nutrients [Yaduvanshi and Yadav, 1990]. Sugarcane, being initially a slow growing crop with wider row spacing is quite amenable to raise a short duration, quick growing inter crop like a green manure crop which can be of great advantage in fixing atmospheric nitrogen and adding organic matter to the soil. Experiments revealed that green manuring with sunnhemp [*Crotalaria juncea* L.] increased the cane yield by 20-40 per cent [Singh, 1963].

Therefore integrated nutrient management holds great promise in meeting the growing nutrient demands of intensive sugarcane agriculture and maintaining productivity at higher levels with over all improvement in the quality of resource base.

Despite the existing constraints in availability and usage of different organic and biological sources, efforts should be made to synthesize the available experimental data for developing agro-ecology specific and practically feasible integrated nutrient management package for different situations of sugarcane farming.

In view of the above importance, the present investigations aim basically to find out practical utility of sugarcane trash which is now being burnt by cane growers, the importance of its addition in comparison with other organic residues. Considering the above aspects in mind, field experiments were conducted at the Karnataka Institute of Applied Agricultural Research. Sameerwadi [Dist-Bagalkot] during 1996 to 1998 seasons on Integrated nutrient management in sugarcane with the following objectives.

* to study the effect of integrated nutrient management for sustained sugarcane production.
* to workout the effect of integrated nutrient management on growth, development, yield parameters and quality of sugarcane
* to find out the effect of integrated nutrient supply system on soil physical, chemical and biological properties and
* to workout the economics of usage of different organics in conjunction with chemical fertilizers in sugarcane.

REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

The literature pertaining to the influence of organics, inorganics and integrated use of both on growth, yield and quality of sugarcane is cited in the following pages.

2.1 CHEMICAL COMPOSITION OF DIFFERENT ORGANIC MANURES

2.1.1 Farm yard manure [FYM]

The nutrients content of FYM were 0.64, 0.07 and 0.29 per cent N, P and K respectively (Chatterjee *et al.*, 1979) whereas, Parameswaran *et al.* (1995) reported that FYM contained 0.87 per cent N, 0.48 per cent P and 0.93 per cent K on oven dry basis.

2.1.2 Vermicompost

Giraddi (1993) stated that vermicompost contained 0.8 per cent , 1.1 per cent P_2O_5 and 0.5 per cent K_2O. In comparison with FYM, the vermicompost contained two times more N and four times more P_2O_5 and K_2O. However, Shinde *et al.* (1992) opined that there is need to assess the additional merits of vermicompost over conventional FYM/ composts, because the overall nutrient status and the comparative performance of

vermicompost was in similar range of conventional FYM. Kale *et al.* (1992) reported that vermicompost was like any other organic manure, depending on the nature of wastes used as feed for worms, the nitrogen level varied between 0.5 and 2.0 per cent. Similar variation was observed with respect to phosphorus and potassium in their opinion, vermicompost should be used in bulk quantities like other manures.

2.1.3 Pressmud and trash

Parameswaran *et al.* (1995) observed 0.40 per cent N, 0.13 per cent P and 0.40 per cent K in sugarcane trash with C:N ratio of 113:1 while pressmud contained 1.90 per cent N, 1.50 per cent P and 0.5 per cent K as reported by Kumaraswamy (1995). Pressmud contained approximately 1.0 to 1.5 per cent N, 2.5 to 3.5 per cent P_2O_5 and 0.5 to 0.8 per cent K_2O and organic carbon of 35 to 37 per cent (Kale, 1981).

2.2 EFFECT OF ORGANICS ON GROWTH, YIELD AND JUICE QUALITY OF SUGARCANE

2.2.1 Farm yard manure (FYM)

Padwick (1983) was of the opinion that when the availability of farm yard manure and compost are in short

supply green manuring might be considered as an alternative source of bulky organic manures. Dhillon *et al.* (1993) observed that application of FYM @ 20 t/ha significantly increased cane length, NMC and also cane and sugar yield. The added advantages of 15.6 and 3.1 t/ha of cane and sugar yields respectively were noticed due to application of FYM over no application of the same. The experiments conducted at Kolhapur (Maharashtra) also indicated that FYM application @ 10 t/ha significantly increased cane yield and sugar recovery without affecting NMC, plant height and cane girth over chemical fertilizers (Hapase, 1993).

Tamilsel and Jayabal (1993) recorded significantly higher cane yield (111.16 t/ha) under mulched conditions due to application of FYM @ 18.8 t/ha along with @ 338 kg N per ha compared with unmulched condition and also with various lesser doses of chemical fertilizers.Similar trend was also recorded with respect to sugar yield. However, they found that FYM @ 12.5 t/ha in conjunction with recommended nitrogen levels proved insufficient for both mulched and unmulched conditions. The higher doses of FYM (@ 25 t/ha) along with N, P and K fertilizers increased cane yield significantly as compared to NPK fertilizers

(44%) or FYM alone (172%) and cane yield was 177 and 123 t/ha due to application of RDF in conjunction with FYM (@ 25 t/ha) and only RDF respectively.

Durai (1997) observed that both coir waste and pressmud application have registered higher cane population and yield over FYM and without FYM.

2.2.2 Pressmud

Sahi and Rai (1978) recorded significantly higher cane yield (54.5 t/ha) when pressmud @ 20 t/ha was applied inconjunction with chemical fertilizers and further sulphitation pressmud with inorganic fertilizers recorded significantly higher yield of sugarcane than FYM and cane trash compost promoting maximum productivity among all organic sources. Further Patil and Shingate (1981) recorded significantly higher cane and sugar yield due to application of pressmud @ 15.5 t/ha (105.47 and 12.32 t/ha respectively) and 224.2, 336.4 kg N/ha.

A field experiment conducted at Padegaon revealed that application of pressmud @ 12.5 t/ha and 25 t/ha to the first crop produced 41 and 49 per cent more yield than the recommended dose of chemical fertilizers in case of second crop however,

sugarcane yields were slightly better due to inorganic fertilizers over pressmud but the second crop yielded better production with pressmud than the inorganic fertilizers and has not only compensated the loss in the first crop but also increased the production of the two crops added together. Since pressmud contains cane wax to the extent of 8 to 15 per cent, the rate of decomposition was slow and hence it might have benefitted for the second crop as reported by Patil and Kale (1983).

Chalapathi (1991) and Patel *et al.* (1991) reported that pressmud was effective only when it was supplemented with NPK and further when the quantities were increased from 12.5 to 25 t/ha, there was depression in cane yield. Adverse effects of pressmud were also noted by Patil *et al.* (1978). Zende *et al.* (1991) of the opinion that application of organics in the form of green manure or pressmud in conjunction with chemical fertilizers influenced significantly cane height, cane girth, cane and sugar yield. However, number of internodes and NMC were not affected due to application of these organics either singly or incombination. Yet another experimental results obtained at Padegaon revealed that the highest cane yield of 120.2 t/ha and C.C.S yield 18.19 t/ha was obtained in the treatment where 7.5

t/ha of spent wash pressmud was applied each to plant and ratoon crop. This was closely followed by the treatment of 10 t/ha FYM applied each to plant and ratoon (119.2 and 17.89 t/ha cane and sugar yield, respectively). Further there was 10 t/ha increase in cane yield due to application of organic manures to plant and ratoon as compared to application of manure to plant crop followed by application of one tonne per ha organic manure to ratoon. In general there was more than 28 t/ha increase in yield in all the treatments where trash was used as manure compared to burning it (Jadhav *et al.,* 1993).

The residual effects on 3rd and 4th ratoon crops of filter cake applied to plant and 1st and 2nd ratoons were determined in a trial at Drasa Estate in Fiji. Significant increase in cane and sugar yields were obtained in both 3rd and 4th ratoons where filter cake had been broadcast. The increase in yield (11-61 per cent) relative to the untreated control depended almost linearly on the amount applied (50, 100 and 150 t/ha) where the filter cake had been applied in band @ 50 and 100 t/ha, the cane yields in the 3rd ratoons were 26 and 41 per cent greater respectively, than those by applying 150:100:100 kg/ha N:P:K alone, while the results for the 4th ratoon crop were 44 and 56

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per cent greater respectively. Where filter cake had been applied to three earlier crop at 25 t/ha plus N:K at 75:50 kg/ha, the cane yield was no lower for 3rd ratoon cane after brand spread application of filter cake alone at 50 t/ha and was only slightly lower for 4th ratoons, but was decidedly lower than the yields where 100 t/ha filtercake alone had been brand spread to the earlier crops (Anon, 1995c). The increased and readily availability of nutrients in the recommended dose of fertilizer treatment enhanced cane yield despite of the fact that the soil analysis indicated higher levels of carbon and phosphorus status under the pressmud case treatment (@ 12.5, 18.5 and 25 t/ha) as compared to the artificial fertilizer treatment. It is the N:P_2O_5 ratio of the soil that governs the yield. This ratio being wider under pressmud cake treatments, the yield showed depression trend (Anon, 1995a).

Experiments conducted at Ghaghraghat (U.P.) indicated that application of pressmud @ 30 t/ha plus 120 kg N/ha increased the ratoon yield by 32 per cent over recommended dose of 150 kg N/ha plus 60 and 50 kg P_2O_5 and K_2O per ha respectively. However, total cane was 5.5 per cent higher with pressmud @ 30 t/ha plus 120 kg N/ha compared with 150 kg N

plus 60 kg P_2O_5 and 50 kg K_2O per ha. Significant increase in tillers, millable canes, cane length, weight and girth due to application of pressmud @ 30 t/ha compared to control and they too were of the opinion that the slow decomposition of pressmud due to presence of cane wax (8.18 per cent) might has benefitted the ratoons more than plant (Singh *et al.,* 1995). Bhanavase *et al.* (1996) of the opinion that increasing input of pressmud with phosphorus fertilizer proportionately enhanced cane yield upto 6 t/ha. Pressmud plus 2/3rd P_2O_5 of recommended dose can contribute towards reducing 1/3rd recommended phosphorus. Dineshkumar *et al.* (1996) from the experimental results conducted at Gangawati revealed that application of pressmud (equivalent to 25 per cent RDN) along with 75 per cent RDF remained on par with 100 per cent RDF in terms cane and sugar yields. Similar trend was observed with 12.5 per cent RDF and 100 per cent RDF plus 25 per cent (equivalent to RDN) pressmud and also with paddy husk. The correlation between cane yield and yield attributes viz., cane length, diameter and weight were significant.

2.2.3 Green manuring

Incorporation of sunnhemp (*Crotolaria juncea* L.) before planting of sugarcane increased cane yield by 19 per cent. However, roots part incorporation enhanced cane yield by 8 per cent and tops only by 12 per cent (Singh, 1963). Misra (1971) reported that incorporation of green manure legume crop viz., sunnhemp, dhaincha, gaur and lobia increased cane yield to the tune of 42.8, 30.4, 27.5 and 43.0 per cent respectively over control and the average response of cane per kg N was 2.9, 2.6, 3.2 and 2.8, respectively. Hunsigi (1982) obtained the highest cane yield of 171 t/ha due to incorporation of sunnhemp compared to incorporating of other legume intercrops viz., greengram, frenchbean, cowpea. Further, he observed better cane yield due to incorporation of sunnhemp as an intercrop even with 20 per cent reduced recommended dose of nitrogen and more pronounced effect of incorporation of legumes in conjunction with chemical fertilizers compared with only application of chemical fertilizer at R.R.S., Mandya. Bose and Thakur (1980) indicated that incorporation of legumes viz., sanai and hobie resulted in higher yield over unmanuring and average

increase in cane yield was 45 per cent. The increase in yield was attributed due to increased availability of the nutrients in the soil system, the plant uptake was increased which might have resulted in higher cane and sugar yield.

Pandit and Sinha (1981) from the study conducted at I.I.S.R., Lucknow reported that growing green manure (cowpea) along with ratoon crop and incorporation at 60 days after ratoon initiation and in conjunction with inorganic N increased the yield even at 200 kg N/ha due to interaction of green manure and fertilizer N which was significant. However, yield data showed that in case of inorganic fertilizer N application, the response of doses declined beyond 150 kg N/ha level but when applied along with green manure this decline was not only arrested but a positive yield response upto 200 kg N/ha was obtained. Again at Lucknow, intercropping of legume and incorporation after picking up pods in sugarcane improved cane yield, however only blackgram intercropping recorded (128.8 t/ha) significantly higher yield compared to sugarcane alone (109.4 t/ha) other legumes viz., soybean cowpea, moong and urd produced on par yield to that of sugarcane alone (Parashar and Prasad, 1985).

Rao (1990) reported that green manuring with single row of sanai and cowpea in the standing crop of sugarcane increased the yield of cane and sugar by 15.1 and 4.0 per cent respectively. Shrivastava *et al.* (1992) observed significantly higher cane yield in ratoon crop due to intercropping and incorporation of mung in plant cane, by virtue of significantly higher NMC in ratoon crop. However, it failed to produce any significant improvement of NMC and cane yield of plant cane, mean cane weight was unaltered for both plant and ratoon crop. Green manuring prior to planting and incorporation of cowpea, sunnhemp, cluster bean and dhaincha increased cane yield to the tune of 43.0, 42.8, 27.5 and 30.4 per cent over control (Hegde and Dwivedi, 1993).

Patil (1994) observed that green manuring with dhaincha and cowpea in the standing crop of sugarcane had an adverse effect on tiller production, but increased the NMC and thereby the cane yield. Reduction in the yield attributes from low levels of N than the recommended level resulted in the depressive effect on the above parameters. This might be due to higher competition for the limited resources available. In consonance results were also reported by Singh and Yadav (1994) with respect to application of chemical fertilizers in conjunction with

organic manures. Kathiresan and Ayyamperumal (1996) while conducting on farm trials in Tamil Nadu with Co8021 and CoSi 8671 cultivars observed that dhaincha sown in single continuous line with RDN application produced 145.4 and 125.4 t/ha of cane yield by CoSi 86071 and Co8021 respectively. Green manure incorporation, N levels and their interactions were significant for both the varieties. Dhaincha incorporation either continuous line or hill sown registered maximum cane length. Among N levels, the recommended level registered maximum cane yield and it was on par with 25 per cent of recommended N plus dhaincha green manuring.

Experiments conducted at Mandya revealed that growing sunnhemp (2-3 rows), french bean (2 rows) and soybean (cv. Monetta or KBH-79) as intercrops in sugarcane and incorporating into soil increased cane yield by 24 t/ha. Similarly in Australia and Thailand growing sunnhemp and sesbania two months prior to planting and incorporating into soil increased cane yield by 20 t/ha (Perumal, 1996). Similarly Prammanee *et al.* (1996) also obtained 12 t/ha more cane yield due to increased tillers. However, they were of the opinion that chemical fertilizers were necessary for cane even when green manuring was

practiced. With 50 per cent reduction in RDN in conjunction with dhaincha (14 t/ha) recorded 98.6 t/ha cane yield which was on par with only 100 per cent RDN (85.5 t/ha) at Tungabhadra Project (T.B.P) (Srinivas, 1996).

Another study at R.R.S., Mandya revealed that growing of legumes viz., sunnhemp, greengram, lucerne, frenchbean, as intercrops and incorporation produced significantly higher cane yield compared to sugarcane alone. Sunnhemp and frenchbean in corporation produced 144.00 and 153.33 t/ha cane yield respectively compared to sugarcane alone (127.66 t/ha) (Shankaraiah and Nagaraju, 1997). Further they also recorded increased cane yield of 163.04 t/ha from 148.23 t/ha due to intercropping and incorporation of frenchbean in sugarcane compared to sugarcane alone and the increase was to the tune of 9.21 per cent Nasir Ahmed *et al* (1998) at Cuddalore obtained higher cane yield due to raising of green manure crops viz., sunnhemp or dhaincha and caused 25 per cent reduction in RDN. Increased in millable canes in intercropped plots as compared to sole sugarcane perhaps due to incorporation of green manure crop *in situ* which might have facilitated the reduction of mortality from tiller to millable canes by providing essential plant nutrients to intercropped sugarcane.

2.2.4 Vermicompost

Hapase (1993) reported that application of vemicompost @ 5 t/ha increased cane yield to the tune of 12.66 per cent and sugar recovery by 0.95 per cent. Zhao Shi-Wei and Huong Fu-Zhen (1992) showed in their study that chemical fertilizer application along with vermicompost increased net production of sugarcane. The results of experiment conducted at Sankeshwar (Karnataka) indicated that use of various organic manures including vemicompost and vermiculture did not influence the growth parameters of cane yield of sugarcane (Anon, 1995d).

Application of 500 kg vermicompost with 100 per cent recommended nitrogen gave highest cane yield of 112.5 t/ha. However this treatment was very much nearer to the treatment of one tonne of vermicompost with 4 kg of azatobacter and 4 kg of phosphobacterium (106.84 t/ha) and 3 tonnes of vermicompost with 4 kg of acetobacter and 4 kg of phosphobacterium (103.82 t/ha). The treatment control i.e., 100 per cent recommended nitrogen alone gave 98.48 t/ha. The increase in yield ranged from 8.40 to 34.1 t/ha (Solayappan *et al.*, 1995).

Application of pressmud based vermicompost enriched with Azotobacter and P solubiliser (@ half kg each per tonne of

vermicompost) @ 5 t/ha in conjunction with 100 RDF produced significantly higher cane yield (97.85 t/ha) and sugar yield (12.73 t/ha) and it was on par with 50 and 75 per cent RDF along vermicompost indicating reduction in 50 per cent of RDF by using such quality vermicompost. Yet another report by Perumal (1996) concluded that application of vermicompost beyond 5 t/ha was not beneficial. The increase in cane yield upto 5 t/ha was attributed to the increased germination, millable canes, height and cane girth.

2.2.5 Trash and others

Shinde *et al.* (1984) observed significantly higher germination due to incorporation of chopped trash @ 2.5 and 5.0 t/ha. The incorporation of trash significantly increased cane yield over control. Further, the conjunctive use of trash with nitrogen enhanced the yield and interaction effects were found to be non significant. The per cent increase in yield as observed to the extent of 10 to 18 per cent over control at both levels. Further Jadhav *et al.* (1985) observed while working with adasali crop cv. Co740 during 1979-82 that the direct incorporation of chopped trash @ 10 t/ha plus urea @ 8 kg/tonne of trash plus mixture of cellulose degrading organism @ 1 kg per tonne of trash was

found beneficial and gave significantly higher yield (126.83 t/ha) over control (99.73 t/ha) followed by the treatment decomposed sugarcane trash @ 5 t/ha (134.51 t/ha). There was no adverse effect of incorporation of trash on germination and tillering. Increase in the cane yield to the tune of 14.12 per cent over control was observed due to application of FYM @ 5 t/ha which was equivalent with that of unchopped trash incorporation @ 10 t/ha plus 8 kg urea per tonne of trash without mixture of decomposing culture. In Brazil trash blanket found better in control of weeds but it was claimed that on some reasons yield reduction may occur because of allelo-chemical being leached from the trash blanket (Lorenzi *et al.*, 1986).

Incorporation of trash *in situ* plus FYM @ 10 t/ha produced significantly higher ratoon cane (109.5 t/ha) and sugar (16.02 t/ha) yield compared to burning of trash after harvest of plant cane which yielded 79.86 and 11.33 t/ha of cane and sugar yield respectively at C.S.R.S., Padegaon (Anon., 1993). Channabasavanna and Setty (1995) observed that application of 125 per cent NPK through fertilizers plus 25 per cent NPK through rice husk recorded on par cane yield with that of 150 per cent NPK through fertilizers showing the efficiency of rice husk in substituting the chemical fertilizers by 25 per cent.

Weight per cane followed similar trend and millable canes/ha were not found significantly affected. Further they observed incorporation of pressmud incombination with chemical fertilizer did not increase the cane yield of main crop, but its effect was seen on succeeding ratoon crop.

Turambekar and Lubree (1995) at Kolhapur on black clay (vertisol)soil observed that application of *bioearth* @ 10 t/ha in conjunction with RDF increased cane yield (105.54 t/ha) by 23 per cent compared with the use of chemical fertilizers alone (85.76 t/ha) and application of *bioearth* alone indicated equivalent and comparable yield to that of recommended dose of chemical fertilizers (130.60 and 130.34 g fodder yield of maize /pot, respectively). Similarly they also observed 20 per cent increase in grain yield of rice with simultaneous reduction in 25 per cent recommended doses of fertilizers. The comparative study of *bioearth* with farm yard manure indicated that *bioearth* was better than farm yard manure in increasing grain yield.

Results of the experiment conducted at Padegaon indicated that the incorporation of trash @ 7.5 t/ha both chopped and unchopped increased cane yield significantly from 141 to 154 t/ha and 152 t/ha respectively. Similar trend was also observed

for growth parameters viz., germination, tillering ratio, millable cane and cane girth (Jadhav, 1996).

Ramalingaswamy *et al.* (1996) at Anakapalle (A.P.) obtained significantly higher cane and sugar yield due to trash mulching @ 3 t/ha plus culture @ 1 kg/tonne of trash plus urea @ 10 kg/ha and soil incorporation during earthning up. In this study urea appears to be the best source of energy for the native or added micro-organisms in the decomposition of cane trash and absorption of major nutrients which might have led to high cane and sugar yields but number of millable canes were unaltered.

2.2.6 Integrated use of organic and inorganic fertilizers

Compost prepared from pressmud @ 10 t/ha and sunnhemp green manure grown along with sugarcane and burried in the soil at 1.5 month of age with and without chemical fertilizer i.e., @ 250, 115 and 150 kg N,P, K kg/ha was tried and cane yield increase was to the tune of 14 to 29 t/ha.

Application of FYM @ 10 t/ha (on oven dry basis) in conjunction with RDF increased the cane yield to the tune of 24.2 t/ha of adsali sugarcane (Co740) i.e., RDF and FYM @ 10 t/ha recorded significantly higher cane (168.38) and C.C.S (23.14) yield over only RDF (144.2 and 19.19 t/ha and C.C.S

yield respectively) at Padegaon (Jadhav *et al.,* 1992). Further Jadhav *et al.* (1992) observed that application of 7.5 t/ha spentwash-pressmud cake compost (oven dry basis) with adjusted dose of N, P_2O_5 and K_2O (324:101:129 kg per ha) was beneficial to get higher cane yield (168.96 t/ha) and C.C.S yeild (23.03 t/ha) over other treatments without affecting soil properties adversely. This dose (7.5 t/ha) was economical as compared to application of 10 t/ha FYM and recommended dose of N, P_2O_5, K_2O (400:170:170) indicating saving in nitrogen by 76 kg, P_2O_5 by 69 kg and K_2O by 41 kg per ha.

Integrated use of 20 t/ha FYM to plant crop only and 5 t/ha trash plus 15 t/ha sulphitation pressmud to plant cane only each with RDF increased the yield of first ratoon over that obtained with RDF alone.

Reduction in N application by 50 per cent with full P and K each with and without green manuring in kharif could not sustain the cane productivity. On the other hand, application of half of the recommended N dose to ratoon was as effective to sustain cane productivity as 100 per cent of the recommended N dose when former was grown in plots supplemented earlier each

with 20 t/ha plus half N and 5 t/ha trash plus 15 t/ha sulphitation pressmud plus half N to kharif crop (Anon., 1993). Application of pressmud compost @ 4 t/ha along with 5 kg/ha Azotobacter and 75 per cent RDN resulted into cane yield equal to that of RDF indicating 25 per cent saving in nitrogen (Anon., 1995b). On the contrary different doses of pressmud cake did not show differential behavior. The number of tillers were increased by incorporation of pressmud @ 18.5 t/ha. Remaining pressmud treatment as well as RDF did not exert any appreciable influence in tiller production. The plant population recorded was maximum in RDF followed by 18.5 t/ha of pressmud. The minimum being in 25.0 t/ha. The highest yield potential was seen in RDF followed by 12.5 t/ha of pressmud the percentage reduction in yield being 4.31 over RDF (N,P,K). Higher doses of pressmud appeared to be detrimental (Anon., 1995a).

Integrated use of 20 t FYM or 5 t trash plus 15 t pressmud/ha to plant cane with RDF helped in sustaining higher cane yield (Anon., 1997a). Dey *et al.* (1997) in Assam obtained significantly higher cane and sugar yield due to application of pressmud compost @ 10 t/ha, *mukta* @ 10 t/ha (a locally prepared compost) and cowdung @ 10 t/ha over only NPK

application. Application of FYM @ 10 t/ha and cowpea grown as green manure (@ 6 t/ha) in conjunction with RDF recorded significantly higher cane yield by virtue of higher NMC, cane weight and cane length (Gangawar and Sharma, 1997).

Jayapaul *et al.* (1997) at Madurai observed that application of 100 and 75 per cent recommended N exerted comparable effects on cane yield. Tiller production was affected by dhaincha intercropping where as tiller mortality was lower under intercropping system compared to sole crop of sugarcane. Number, length and weight of millable canes as well as internodal characters were higher due to intercropping of two rows of dhaincha intercropped on 45 DAP. Application of 100 per cent RDN was comparable with 75 per cent RDN in influencing yield attributes. There is a possible indication that early formed shoots survive better due to their physiological age and vertical growth in search of sunlight which might have suppressed the production of late tillers. Higher yield of cane under two rows of dhaincha intercropping and incorporation on 45 DAP was mainly due to optimum shoot population and better survival capacity of tillers which resulted in more NMC, increased cane length, girth

and weight inconfirmity results were also obtained by Kadirvel and Devaraj (1997).

At Sehore (M.P.) on clayloam soils having pH 7.5 and low available N and P and high K application of decomposed pressmud and biogas slurry @ 6 t/ha in conjunction with 50 per cent recommended doses of NPK is beneficial for higher growth characters viz., diameter, height, cane and sugar yield (Tiwari *et al.*, 1997).

An integrated use of 20 t/ha FYM or 10 t/ha cane trash with 10 t/ha pressmud along with RDF in North-West zone recorded significantly higher cane yield (63.9 to 66.2 t/ha) compared to control and East-Coast zone the same treatment (91.1 t/ha) produced significantly higher cane yield than RDF alone (81.4 t/ha) (Anon., 1995b). At Rahuri application of 7.5 t/ha *bioearth* an organic manure with RDF had significantly increased cane yield. The yield increase was attributed to significant increase in the length, girth and number of internodes of cane due to the same treatments similar trend was noticed for tiller and NMC. Further, FYM @ 10 t/ha along with RDF produced significantly higher yield over RDF alone and it gave

lesser yield than *terracare* application @ 7.5 t/ha (Tambe *et al.*, 1998).

A field experiment conducted at Buralikson (Assam) revealed that the green manure crop of cowpea incorporated at 45 DAP in combination and fertilizers (100 and 50 per cent RDF) increased cane yield and NMC as compared to sole application of fertilizers but effect was more pronounced when organics sources were applied with 100 per cent RDF. (Buragohain and Medhi, 1999). Field experiments carried out at S.B.I., Coimbatore on vertisol indicated that trash mulching and later incorporation and *in situ* trash incorporation at the time of ratooning treatments improved the 2nd and 3rd ratoon crop yields significantly (Sundara and Tripathi, 1999). Mathukali *et al.* (1999) from experiment conducted at Junagadh (Gujarat) on clayey soil texture with cv. CoC671 reported that application of FYM @ 25 t/ha plus 100 per cent RDF recorded significantly higher cane yield but was on par with treatment FYM @ 25 t/ha plus 50 per cent RDF, green manure @ 5 t/ha plus 100 per cent RDF. Similarly vermicompost @ 5 t/ha, green manure @ 5 t/ha along with 50 per cent RDF produced on par yield with that of 100 per cent RDF. However single cane weight was not differed due to various treatments but millable canes were found significantly

higher with organics along with chemical fertilizers. The combined application of organic manure and chemical fertilizers might be complementary to each other which resulted in adequate and regular supply of nutrients.

2.3 EFFECT OF INTEGRATED USE OF ORGANICS AND FERTILIZERS ON QUALITY ATTRIBUTES OF SUGARCANE

Sahi and Rai [1978] observed no difference in the quality of juice due to application of pressmud @ 20 t/ha, FYM @20 t/ha and trash compost @20 t/ha individually and also in combination with chemical fertilizers. However, Patil and Shingate [1981] reported that application of FYM and pressmud cake [12.4 t/ha] gave more or less similar commercial cane sugar. This might be attributed to higher content of P_2O_5 present in pressmud which improved the sucrose per cent in the juice, and further increase in the rate of pressmud cake application had sufficiently adverse effect on the sucrose content.

Patil and Kale [1983] obtained better juice quality parameters viz., brix, sucrose, purity coefficient and commercial cane sugar due to application of pressmud @ 12.5 and 25.0 t/ha in second crop over application of inorganic chemical fertilizers

alone. But Zende *et al.*[1991] observed that C.C.S percentage was not influenced due to application of pressmud or green manure or combination of both in conjunction with chemical fertilizers. However, application of spent wash-pressmud compost @ 7.5 t/ha each to plant and ratoon crop and also FYM @ 10 t/ha in addition to trash incorporation for ratoon crop maintained juice quality [brix from 20.23 to 21.63, C.C.S from 13.87 to 15.13 per cent]. In this case, juice quality was improved due to application of higher doses [5 to 10 t/ha] or organic manures to ratoon crop [Jadhav *et al.*, 1993].

Yet another study indicated that the juice sucrose increased up to 21.00 per cent from 17.3 per cent due to application of FYM @ 25 t/ha in conjunction with RDF compared to no fertilizer and FYM alone [Anon.,1994] An increase in sucrose content of juice was noticed with application of 12.5 t/ha of pressmud over RDF. Maximum purity was observed in case of pressmud applied @ 12.5 t/ha [94.85 per cent] and the minimum being with application of pressmud @ 18.5 t/ha [89.54 per cent] C.C.S per cent showed considerable increase over the rest of treatments due to RDF and 12.5 t/ha of pressmud. Higher doses of pressmud showed an inverse relationship with C.C.S per cent [Anon.,1995a].

Integrated use of FYM @ 20t/ha and also 5t/ha trash plus 15t/ha pressmud and growing of green manure *in situ* to sugarcane did not influence the various juice quality parameters [Anon., 1995 b]. But Singh *et al.* [1995] observed significantly improved commercial cane sugar [per cent and tonnes/ha] over the control due to pressmud application @ 30 t/ha. However, pressmud @ 30 t/ha plus 120 Kg N/ha resulted significantly better sucrose per cent and sugar yield compared with RDF. These results are inconformity with those of Singh *et al* .[1986] and Kanwar and Kapur[1987]

Improvement in juice quality parameters viz. brix, polarity, purity and recovery were observed due to application of *bioearth* @ 10t/ha in conjuction with chemical fertilizers and so also due to FYM. [Turambekar and Lubree [1995] Bhanavase *et al.* [1996] observed that increased levels of pressmud cake and phosphorus fertilizers improved juice quality parameters like sucrose, C.C.S. and purity percentage however, these results were non-significant. Similar results were also observed by Ramalingswamy *et al.* [1996] due to trash incorporation at Anakapalle. Similar observations were made at Kolhapur,

Lucknow, Uchani and Padegaon [Anon., 1997 a] and Durai [1997].

Higher brix, sucrose and C.C.S percent [21,7, 20.4 and 14.7 respectively] were produced by application of RDF with 7.5 t *terracare* /ha as compared to FYM and control. The higher brix and sucrose recorded might be due to better photosynthesis translocation and accumulation of sugars in the internodes of cane [Tambe *et al.,* 1998]. Similar results were also reported by Boramanikar *et al.* [1993] and Buragohain and Medhi [1998].

Tiwari *et al.* [1997] observed that higher levels of fertilizers application significantly decreased the juice quality but application of organic manures either biogas slurry or pressmud with 50 per cent RDF increased juice quality parameters viz., brix and sucrose per cent.

Due to intercropping of sunnhemp as well as dhaincha in sugarcane commercial sugar in cane did not vary significantly [Nasir Ahamed *et al.,* 1998]. However, Mathukia *et al.* [1999] obtained significantly higher sucrose in juice, C.C.S percent and C.C.S yield only in pooled analysis due to application of FYM @ 25 t/ ha inconjuction with 100 per cent RDF and also with the same combination of vermicompost [5t/ha] and green manure [5t/ha].

2.4 INTEGRATED USE OF ORGANICS AND CHEMICAL FERTILIZERS ON NUTRIENT UPTAKE OF SUGARCANE AND PHYSICO CHEMICAL PROPERTIES OF SOILS

Burying of trash in the soil brings out improvement in soil moisture status, organic matter content, nitrogen status and also maximum water holding capacity of the soils. Pressmud cake is rich in its content of organic carbon as well as P_2O_5. Naturally, when It is applied to soil as an organic manure, it increases the status of organic carbon or available P_2O_5 in the soil. Bawaskar *et al.* [1978] made similar observations. Sapkal[1974] noted a fair improvement in E.C values, hydraulic conductivity, maximum water holding capacity, bulk density, porosity and status of organic carbon. In respect of infiltration rate, it was found to be inferior to FYM when compared with trash compost, it was observed to be much better in improving the organic carbon status of the soil and water stable aggregates. The material of high C:N ratio such as cane trash applied directly to soil has been found to decompose at the expense of soil nitrogen with the result that the level of available nitrogen eventually falls and there is reduction in period of decomposition by maintaining C:N ratio less than 30:1 and the direct utilization of organic material is possible by enriching them with

nitrogenous fertilizers and added to this the method of pre-composting of material for certain period with soil before sowing of crop to over come the effects of immobilization of nitrogen and phytotoxic substances produced in the initial phase of decomposition [Bawaskar, 1968].

Zende [1968], while summarising the work on different materials in improving the saline and alkali soils at Padegoan, Maharashtra pointed out that the application of pressmud reduce the pH level by 0.5 units and total soluble salts from 1.70 to 1.32 with increase in humus content from 0.25 per cent to 0.44 per cent.

Pandit and Sinha [1981] observed that incorporation of cowpea as green manure grown along with ratoon and incorporated at 60 days after ratoon initiation did not show significant differences of organic carbon content in the post harvest surface soil. As such the easily decomposable cowpea green manure did not seem to act in anyway different from the fertilizer N, so far as the build up of organic matter was concerned ,similar results were also reported by Russel [1972] and Mariappa *et al.* [1983] , Yeh [1968] was of the opinion that physico chemical properties may be temporarily improved and

helped in a better utilisation of added N fertilizers leading to higher yield response of sugarcane.

Rai *et al.* (1980) observed improvement in saline sodic soils pH, EC, percent sodium saturation and available phosphate content in the soils of Bihar due to applications of sulphitation pressmud @ 20 t/ha. Apparently, the green manure treatments did not affect the N uptake of sugarcane in any way different from that by other N fertilizer treatments as N uptake depended on the total quantity of N made available to the plants without any discrimination of organic, inorganic or a combinations of organic and inorganic sources (Pandit and Sinha, 1981).

Patil and Kale (1983a) at Padegaon, [Maharashtra] observed higher levels of organic carbon (0.90 per cent) , total N (0.07 per cent), available P_2O_5 (31.40 kg/ha) and K_2O (390.0 kg/ha) in soil at harvest of sugarcane @ 25 t/ha pressmud application compared to RDF alone which produced 0.79 per cent, 0.060 per cent, 15.0 kg and 388.40 kg values respectively. Further they observed higher C/N ratio in fertilizer treatment (13.17 from 12.24). However, it was decreased in pressmud application (12.67 to 12.42) may be due to mineralisation of organic nitrogen from pressmud and they also recorded maximum uptake of 112.82 kg

N, 69.21 kg P_2O_5 and 109.32 kg K_2O per ha due to pressmud application owing to more availability of nutrients in the soil.

Incorporation of sugarcane trash in the soil increased organic carbon status of soil, overcame ill effects of soil compaction and allowed good air and water relationship in the rhizosphere and further physico-chemical properties of soil such as water holding capacity, organic carbon and total nitrogen content of soil increased considerably over no application of sugarcane trash (Shinde *et al.*, 1984).

When companion crops such as greengram *(Vigna radiata* L.) and blackgram [*Vigna mungo* L.] were turned in as green manures after pod picking an overall improvement in cane yields was observed because of enhanced efficiency of nitrogen and phosphorous due to legumes, as deep root system created better soil structure. Release of enzyme and vitamins during decomposition of legume roots *in situ* are other factors for their advantageous effects of companion crops [Yadav and Prasad, 1986].

Owing to humification of the cane trash there was significant increase in organic carbon content of the soil after 120 days due to incorporation of chopped trash @ 20 t/ha incubated at 60 per

cent water holding capacity and 27±2°C temperature [Yadav, 1987]. Soil analysis data initially and after harvest at Padgaon, showed that pH and EC values were lower due to trash incorporation [@ 7.5 t/ha]. Organic carbon content in the soil improved with increasing [upto 0.74 per cent] levels of trash. It was also observed that the availability of N [upto 249 kg/ha] and P [up to 46 kg /ha] in the soil increased considerably with in corporation of trash over the control [no trash] indicating the addition of organic matter to the soil would modify its reaction, enhance availability of nutrients [Rasal *et al.*, 1986] Jadhav *et al.* [1990] reported that due to use of 5 to 10 tonnes of green manure there was increase in organic matter and 20 to 50 kg N/ha get fixed.

Incorporation of trash along with FYM @ 10 t/ha after ratoon recorded lower pH 7.9 from 8.06, highest EC [dSm^{-1}] 0.30 from 0.20 and organic carbon of 0.95 from 0.60 per cent. Available N, P and K were 235, 23 and 311 kg/ha from 198, 14 and 286 kg/ha. Similarly bulk density [g/cc], spore space per cent and maximum water holding capacity per cent were 1.33, 60.6 and 70.4 from their corresponding initial values of 1.29, 57.3 and 66.7 respectively [Anon., 1993] Hapase [1993] reported that soil properties viz., electrical conductivity, available P_2O_5 , K_2O and

organic carbon were significantly superior due to application of *bioearth* @10 and 20 t/ha along with RDF. However pH values did not differ significantly due to any of these treatments. But applications of vermicompost @ 5 t/ha increased the available N and P content of soil at harvest of cane. However, pH and EC as well as clay content also increased due to use of vermicompost indicating use of vermicompost was not much beneficial compared to FYM and even trash incorporation along with microbial culture in improving the soil properties [Jadhav *et al.*, 1993a].

There was decrease in soil pH due to application of trash and use of organic manures. However, electrical conductivity was slightly increased upto 0.4 dSm^{-1} from 0.2 dSm^{-1} in the treatment where 7.5 t/ha spent wash compost was applied each to plant and ratoon crops. This might be due to increase in solubility of salts due to formation of organic acids. The organic carbon was also increased to a considerable extent [from 0.60 to 1.00 per cent]. Soil available NPK were also increased from 8 to 10 per cent. Where trash was used there was slight increase in bulk density. However, there was considerable improvement in porespace and maximum water holding capacity [Jadhav *et al.*, 1993]. Tamilsel and Jayabal [1993] obtained significantly higher

nitrogen uptake of sugarcane due to application of FYM in conjunction with nitrogen 338 kg /ha under mulched conditions compared to other lower levels of nitrogen and also FYM @ 12.5 t/ha.

Application of FYM 25 t/ha alone, in combination with RDF and RDF alone produced organic carbon. 0.79, 0.81 and 0.68per cent respectively. Similarly, available $P_2 O_5$ was 22.6, 24.2 and 21.6 kg/ha respectively and so also for potash [187.3, 312.5 and 280 kg /ha respectively]. The bulk density was 1.72, 1.66 and and1.71 g/c c respectively . The maximum water holding capacity also increased from 35.1 per cent to 38.6 per cent due to RDF alone to FYM inconjunction with RDF treatments [Anon., 1994]. In an another experiment, though organic carbon content of the soil did not show significant variation but a little depression was noticed when urea was used. FYM alone or in combinations with urea improved the organic carbon content of the soil only i.e., by 0.01 unit [Yadav, 1995]. The organic matter content of soil was found to increase considerably as observed due to application of only *bioearth* [@ 5 t/ha], 75per cent RDF plus *bioearth*. Only RDF and no fertilizer application produced 2.17, 1.91, 1.81 and 1.73 per cent organic matter in the soil after harvest of fodder maize. Similarly *bioearth* alone @ 5 t/ha was

improved organic carbon content of soil significantly and it was to the tune of 23 per cent in rice crop. [Turambekar and Lubree, 1995]. Bhanavase *et al.* [1996] observed linear increasing trend in nitrogen and phosphorus content of sugarcane with increasing doses of in organic fertilizer and pressmud. Maximum of 0.862 and 0.402 per cent content of nitrogen and phosphorus respectively were noticed in the treatments receiving pressmud @ 9 t/ha indicating higher absorption of these nutrients by sugarcane crop.

Incorporation of green manure *in situ* improved the organic matter content of the soil and uptake of applied nutrients by sugarcane [Kathiresan and Ayyamperumal, 1996]. Further green manuring of sesbania [*Sesbania rostrata*] and sunnhemp [*Crotolaria juncea* L.] before planting in Thailand tended to increase soil organic matter, leading to improved soil physical conditions as reflected by bulk density. The improved soil physical properties resulted in increased cane yields although they were not statistically significant [Prammanee *et al.*, 1996].Similar results were also reported by Perumal [1996] wherein due to incorporation of green manure [sunnhemp or sesbania] decreased the bulk density. The recovery of N may be

as low as compared to chemical fertilizers. This may be due to immobilisation favoured by green manure crops or due to leaching of nitrate below 10 cm layer. However after 45 DAP the recovering improved to the level of chemical fertilizer and improved in cane yield was attributed to mineralization of N and P and dehydrogenase activity. Organic carbon content remained fairly constant and increased activity of dehydrogenase enzyme which ensured steady release of nitrate nitrogen. Pressmud based enriched [microbial culture] vermicompost @ 5 t/ha application increased organic carbon, decreased bulk density and improved in available N, P_2O_5 and K_2O content in the soil at harvest of sugarcane compared to RDF alone . However, pH of the soil was increased to 7.5 from 7.2 [Perumal, 1996]. Incorporation of trash along with 10 kg /ha urea and compost culture @ 1 kg per tonne of trash improved availability of major nutrients as result of better decompostion of trash, release of nutrients and absorption by the crop. Soil moisture content was also higher [Ramalingaswamy *et al.*, 1996] .

Application of 50 per cent RDN inconjunction with dhaincha incorporation @ 14 t/ha in Tungabhadra project, [Karnataka] enhanced soil moisture 27.6 from 23.5 per cent and organic matter 1.28 from 1.23 per cent and 241.2 from 226.3 kg N/ha

after harvest. These values were improved 50 per cent RDN [Srinivas,1996] An integrated use of 20 tonnes FYM or 5 tonnes trash plus 15 tonnes pressmud per ha to plant cane with RDF helped in increasing residual fertility [available N, P and K] with an addition of organics [Anon., 1997]. Jayapaul *et al.,* [1997] increased availability of N, P and K nutrients in soil due to incorporation of dhaincha [inconsonance results were also obtained by Bose and Thakur, 1980] . Further Shankaraiah and Nagaraju [1997] obtained improved physico chemical properties viz, B.D., pH, E.C. organic carbon and available N, P_2O_5 and K_2O due to intercropping and incorporation of frenchbean in sugarcane and also with soybean [two cultivars, intercropping and incorporation]at R.R.S. Mandya, Karnataka. Tiwari *et al.* [1997] observed a positive effect of FYM pressmud and P-solubilizing bacteria in inducing higher uptake of P_2O_5 with reduced rate of P application.

Kumar and Sagwal [1998] obtained significantly increased infiltration rate of the soil, the percent moisture retained at field capacity and decreased bulk density due to trash incorporation with various levels of nitrogen. These improvements were possibly due to excreted microbial cell, decomposition product which act as binding agents for stable aggregates. Nasir Ahmed

et al. [1998] were observed slight improvement in soil pH., E.C. and organic carbon and also available N, P and K after harvest of sugarcane due to growing of green manure crop as intercrop and ploughed *in situ* at 45 DAP .

The uptake of N, P and K by sugarcane were increased with increasing levels of terra care and significantly higher uptake of N [256.3 kg/ha], P [92.6 kg/ha] and K [397.3 kg/ha] at harvest than that of control [Tambe *et al.*, 1998]. Buragonhain and Medhi [1999] observed that available N buildup in the soil after harvest of each ratoon crop was significantly higher in RDN plus green manure and 50 per cent nitrogen plus green manure application than N alone revealing that green manure could add significant amount of N in the soil and thus increased the productivity and fertility status of the soil.

2.5 EFFECT OF INTEGRATED USE OF ORGANICES AND CHEMICAL FERTILIZERS ON BIOLOGICAL PROPERTIES OF THE SOIL

Mulching of wheat straw at I.A.R.I. NewDelhi stimulated substantially the microbial populations in the soil. Due to mulching more bacteria, azotobacter, fungi and actinomycetes colonies were counted at all three stages of sampling. The

average of 3 plantings of maize and green gram showed that bacterial population was increased by 2-3 folds azotobacter was stimulated by one and half folds [greengram and more than 4 folds in maize crop]. Actinomycetes and fungal population was also increased by 3-4 folds and 2-3 folds in greengram and maize respectively. The beneficial effect of mulching on soil microflora may be explained due to the regulation of temperature, conservation of moisture and improvement in humic content of the soil which are important factors in increasing their numbers and activity and hence greater nutrient availability [Gaur and Mukherjee, 1980]. Jadhav *et al.* [1993a] also noticed considerable improvement in microbial population of azotobacter, fungi and actinomycetes due to application of spentwash pressmud cake compost @ 7.5 t/ha along with trash both for plant and ratoon and then followed by FYM @ 10 t/ha in conjunction with trash incorporation.

Perumal [1996] reported that the microbial count was more due to application of vermicompost [25.46 $X10^6$/g soil] compared to control [8.62 X 10^6/g f soil]. Increased microbial population was attributed due to increase in organic carbon, aeration and conservation of soil moisture by deposition of more humus material.

Jadhav [1996] observed that the microbial population increased significantly, particularly with addition of 7.5 t/ha chopped and unchopped trash at earthing up and at harvest. It was observed that the microbial population increased at earthing up and at harvest due to improved biological activities in the soil with incorporation of trash. Organic matter supplemented with N and P further enhanced the microbial population. Similar results were obtained by Parkhe and Shinde[1981] and Rasal *et al.* [1988].

2.6 EFFECT OF INTEGRATED USE OF ORGANICS AND CHEMICAL FERTILIZERS ON ECONOMICS OF SUGARCANE.

Rai *et al.* [1980] observed that application of sulphitation pressmud @ 20 t/ha increased cane yield to the tune of 26.3 t /ha giving economic gain about Rs. 3,000 per ha. and Yaduvanshi and Yadav [1991] obtained the highest economic gain of Rs 17,430 with B: C ratio of 4.74 due to application of pressmud @ 30 t/ha along with 150 kg N/ha. However the highest B:C ratio was observed with 75 kg N per ha in conjunction with pressmud @ 10 t/ha.

Due to use of sugarcane trash *in situ* coupled with application of spent wash pressmud cake compost @ 7.5 t/ha for ratoon

crop, there was of 5 percent extra in total cost and about 35 per cent increase in yield which resulted Rs. 18,600 extra profit over burning of trash [Jadhav *et al.,* 1993a]. Tamilsel and Jayabal [1993] obtained higher net income and was significantly superior due to application of farm yard manure @ 25 t/ha along with 338 kg N/ha [Rs.15,008/ha] under mulched condition, however, it was Rs.14,229/ha under unmulched conditions.

The economics of incorporation of graded levels of pressmud as against recomended dose of NPK showed that the maximum net profit of Rs.7,222/ha was derived from 12.5 t/ha of pressmud followed by 25.0t/ha pressmud. On comparing the increase in the net profit per ha and increase on percentage basis with the recommended dose of NPK , it was revealed that the application of 12.5 t/ha pressmud recorded the maximum net profit over all the treatments [Anon., 1995a]. Singh *et al.* [1995] noticed that the inorganic source 150: 60:50 kg NPK /ha showed higher net return [Rs.38,000/ha] in plant cane but pressmud @ 30t/ha plus 120 kg N/ha gave highest return [Rs, 23,336/ha in ratoon crop. However total return and benefit cost ratio were higher by 6.2 per cent and 33.9 per cent respectively under pressmud @ 30 t/ha plus 120 kg N/ha than those under RDF

alone. The lowest B:C ratio of 9.35 was recorded under 75:30:25 kg NPK /ha.

Jayapaul *et al.* [1997] of the opinion that two rows of dhaincha incorporated at 45 DAP combined with 75per cent RDN for getting higher net return, return per rupees invested and also for exploiting productive potential of sugarcane crop. Dineshkumar *et al.* [1996] observed that the application of pressmud in conjunction with 100 per cent in organics realised the highest additional B: C ratio of 8.65 followed by the treatment which recieved 125per cent inorganic fertilizers applied along with pressmud [5.2]. However paddy husk although improved the yields when applied in conjunction with in organics the B:C ratio did not favour its use owing to higher application rate i.e., 12 tonnes /ha as against 3.25 tonnes in case of pressmud [on dry weight basis].

There was an increase in the cost benefit ratio when green manure crops inter cropped with sugarcane as compared to sole crop of sugarcane. The increase was Rs.2.46 and 2.43 for sunnhemp and dhaincha respectively as compared to sole sugarcane which gave Rs.1.98 as B:C ratio. [Nasir Ahmed *et al.*, 1998].

MATERIAL AND METHODS

III. MATERIAL AND METHODS

Field experiments were conducted at the Karnataka Institute of Applied Agricultural Research, Sameerwadi [Taluk: Mudhol, Dist: Bagalkot] during 1996-97 and 1997-98 to evaluate the integrated nutrient management in sugarcane [Cv. CoC 671] under irrigated conditions. The details of material used and methods adopted during the course of investigations are described in this chapter.

3.1 Location of experimental site

The experiments were conducted at the Karnataka Institute of Applied Agricultural Research, Sameerwadi Tq : Mudhol Dist : Bagalkot which lies between 16^0 $24^{|}$ N latitude and 75^0 $10^{|}$ E longitude and at an altitude of 589.84 mts MSL [Mean Sea Level]. This institute is located in the Northern Dry Zone [Zone No.3] of Karnataka state.

3.2 Weather conditions of the experimental site

The monthly meteorological data on rainfall, temperature and relative humidity for the January 1997 to December 1998 and also average rainfall, temperature and relative humidity for the last 17 years [1980 - 1996] are furnished in Table1 and

Table 1. Mean monthly meteorological data for the year 1997 to December 1998 and the average of 19 years at K.I.A.A.R Sameerwadi.

Months	Rainfall [mm]			Temperature [°C] Mean Maximum			Mean minimum			Relative humidity [%]		
	1980-98	1997	1998	1980-98	1997	1998	1980-98	1997	1998	1980-98	1997	1998
January	6.47	0.00	0.00	28.96	29.52	29.89	13.29	14.08	15.54	77.61	71.00	72.85
February	0.00	0.00	0.00	31.79	32.02	31.46	15.05	14.18	14.93	74.42	64.00	60.07
March	5.30	78.00	0.00	35.64	36.72	34.80	18.50	18.14	17.34	70.33	41.07	50.19
April	17.19	0.00	0.00	36.94	39.46	39.27	21.83	20.29	22.53	67.08	46.83	39.64
May	75.22	0.00	0.00	37.25	40.14	37.93	22.15	20.11	23.96	67.79	76.80	44.51
June	59.02	47.80	91.02	32.13	30.36	33.57	22.41	22.25	23.18	77.89	63.98	69.43
July	74.49	23.10	73.00	28.63	29.75	28.70	21.87	22.02	23.40	83.59	74.73	79.21
August	74.48	42.00	48.80	28.65	27.48	28.65	21.77	21.66	23.53	83.11	74.08	74.90
September	108.91	164.00	307.20	29.80	30.47	28.48	20.64	22.93	21.78	87.02	66.41	75.47
October	177.87	92.40	188.10	29.47	31.22	29.44	20.40	20.97	21.34	80.71	66.38	74.39
November	33.33	26.20	24.70	29.06	29.43	30.00	16.75	20.37	17.03	79.07	70.94	69.36
December	0.00	17.00	12.07	28.46	29.43	27.28	13.23	15.32	13.40	79.00	78.29	74.73
Total	630.23	591.50	745.70									

depicted in figures 1a and 1b. The average rainfall [past 17 years] was 630.23 mm which was received from May to October. The mean maximum temperature varied from 28.46 °C [December] to 37.25 °C [May] whereas, mean minimum temperature ranged from 13.23 °C [December] to 22.41 °C [June] respectively.

The average rainfall for the year 1997 was 591.50 mm which was 38.73 mm less than the average of past 17 years and by 115.47mm excess during 1998. The higher and the lower mean maximum temperature during the crop period was 39.27 °C [April 1998] and 28.48 °C [September, 1998].While, the higher and lower mean minimum temperature was 23.60 °C [May,1998]and 13.40 [Dec,1998] respectively .The mean relative humidity ranged from 39.64 percent in April 1998 to 79.20 per cent in July 1998.

3.3 SOIL CHARACTERS OF EXPERIMENTAL SITE

The soil of experimental sites was medium deep black clay loam. The composite surface soil samples were collected from 0 to 30 cm depth of the experimental sites before planting and was analysed for physical and chemical properties of the soil. The soil analysis data along with methods employed are presented in Table 2.

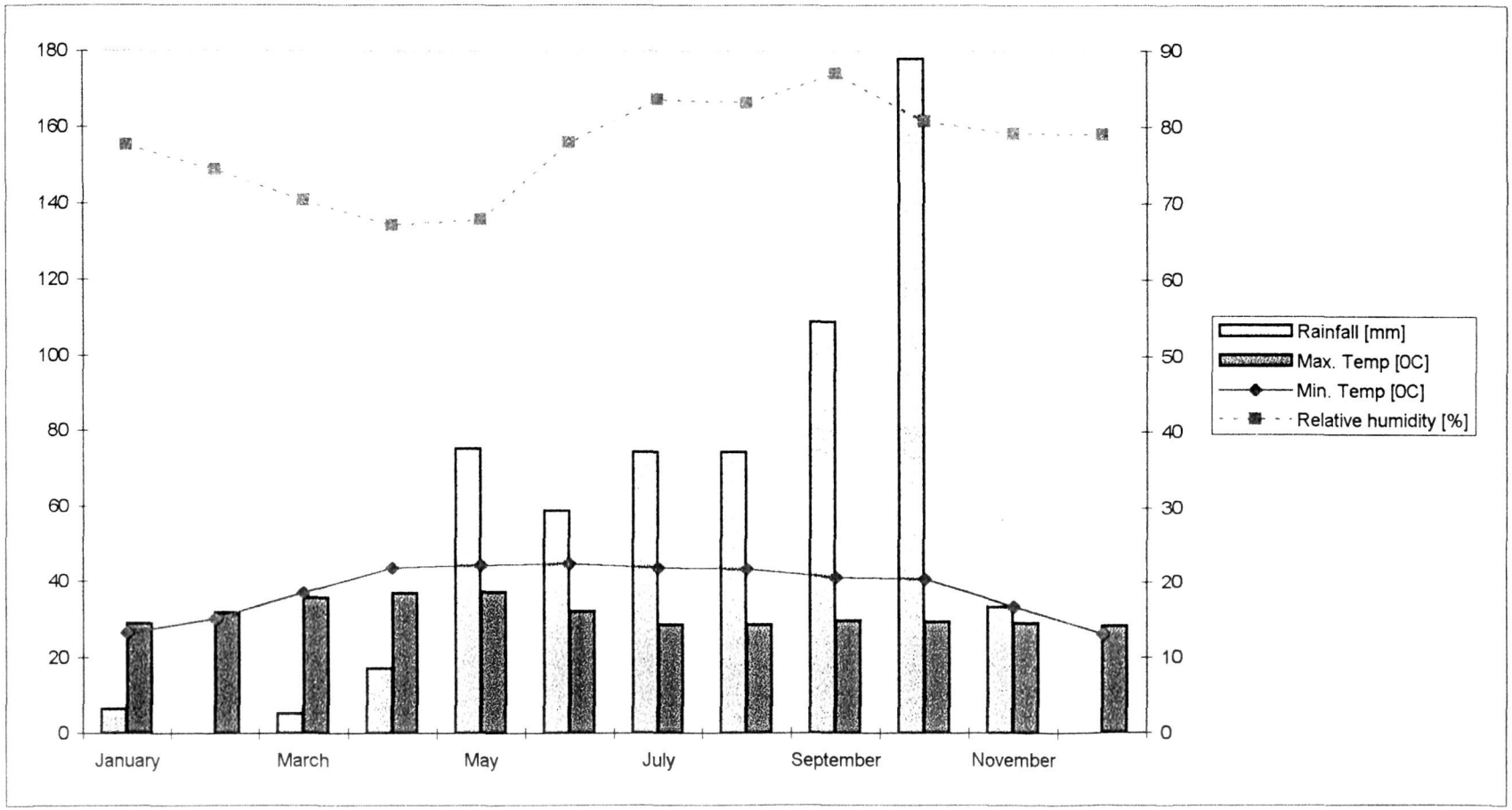

Fig. 1a. Mean monthly meteorological data of 19 years [1980-98] recorded at the Karnataka Institute of Applied Agricultural Research, Sameerwadi.

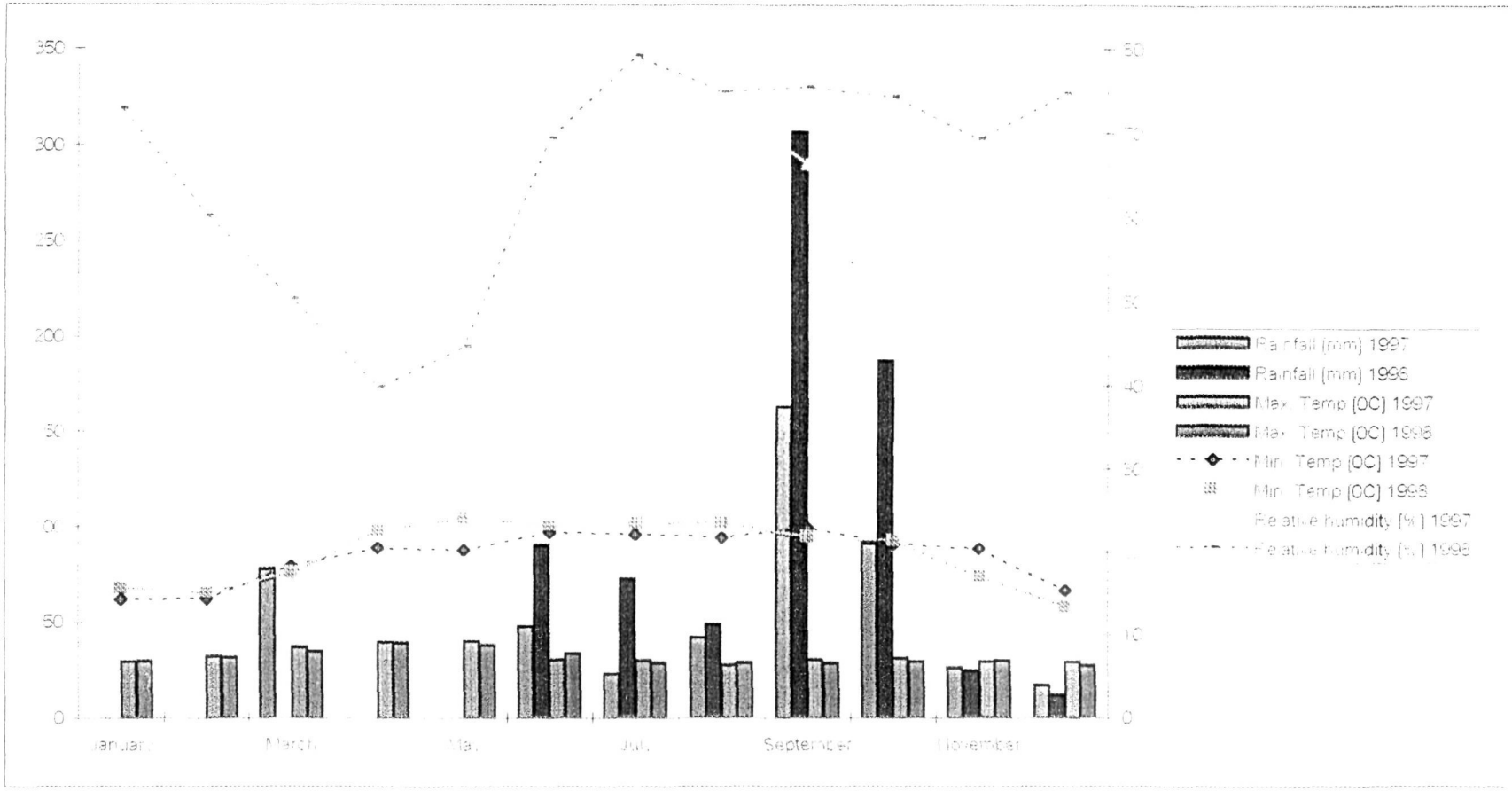

Fig. 1b. Monthly meteorological data for the years 1997 and 1998 as recorded at the Karnataka Institute of Applied Agricultural Research, Sanneervadi

Table 2. Physical and chemical properties of soil of experimental fields.

Particulars	**Value obtained**		**Method employed**
	Experiment I	**Experiment II**	
Physical properties			
Sand [%]	47.60	47.10	International pipette method [Piper, 1966]
Silt [%]	18.70	18.60	International pipette method [Piper, 1966]
Clay [%]	32.70	33.10	International pipette method [Piper, 1966]
Bulk density [g/cc]	1.44	1.47	Core sampler method [Dastane, [1967]
WHC (%)	29.83	29.36	-do-
Chemical properties			
pH	8.0	8.1	Beckman's pH meter [Piper,1966]
Electrical conductivity [dSm^{-1}]	0.33	0.34	Electrical conductivity bridge [Jackson, 1967]
Organic carbon [%]	0.39	0.38	Walkley and Black's wet oxidation method [Jackson, 1967]
Available N [kg/ha]	210.50	220.40	Alkaline permanganate method [Subbiah and Asija,1956]
Available P_2O_5 [kg/ha]	19.80	20.20	Olsen's method [Jackson,1973]
Available K_2O [kg/ha]	332.40	330.20	Ammonium acetate method [Jackson, 1973]

3.4 PREVIOUS CROP OF EXPERIMENTAL SITE

A general crop of maize was grown in the experimental sites during previous year following all the recommended package of practices.

3.5 EXPERIMENTAL DETAILS

The details of the experiments conducted are given below.

3.5.1 Experiment-I

The experiment involving various organics and different level of fertilizers [N, P and K] was conducted during 1996-1997 and 1997-1998 seasons for plant and ratoon crops in a fixed site.

Title: Integrated nutrient management in sugar cane

Objectives

1. to evaluate the effect of various organics in conjunction with inorganic fertilizers on the growth, productivity and quality of sugarcane
2. to assess the possibility of reducing the quantity of fertilizers.
3. to workout the economics of integrated nutrient management vis-a-vis organic manures and inorganic fertilizers

The details of treatments are as follows.

Main plot : Organic manures [A]

a_1 = Trash incorporation @ 8 t / ha [TR]

a_2 = Farmyard manure @ 25 t / ha [FYM]

a_3 = Vermicompost @ 5 t/ha[VC]

a_4 = *Bhumilabh* @ 10 t/ha*[BL}

a_5 = Green manure [sunnhemp] grown *in situ[GM]*

a_6 = Control

Sub plot : Chemical Fertilizers.[B]

b_1 = 100 per cent RDF [250:75: 187.5 kg NPK/ha][RDF_1]

b_2 = 50 per cent RDF [125:37.5:93.75 kg NPK/ha] [RDF_2]

b_3 = No fertilizer[RDF_3]

Design and plan of Layout

Replications : Four

Design : Split plot

Gross plot size : 6 m X 5.4 m=32.4 m^2

Net plot size : 5 m X3.6 m = 18 m^2

Plan of layout is in fig 2

Other details

Spacing : 90 cm between rows

Variety : Co C 671[Early]

Date of planting : 31st, December, 1996

Date of Harvest : 2nd October, 1997 [Plant crop]

Date of Harvest : 2nd, Aug, 1998 [Ratoon crop]

The plan of layout is presented in fig 2

**Bhumilabh* is a biocompost prepared out of pressmud, distillery spentwash and a composite cellulolytic decomposing microbial culture.

Bhumilabh, Vermicompost and Farmyard manure were applied in the furrows and incorporated in the soil prior to 15 days of planting and for the ratoon crop they were provided during off-barring . Trash incorporation was also made in the furrows and sprayed with cellulolytic decomposing microbial culture and urea @ 1 and 8 kg/tonne of trash respectively. The trash for ratoon crop was mulched after off-barring and then incorporated at the time of earthing up. Sunnhemp [*Crotolaria juncea* L.] was grown in between two rows of sugarcane [3 rows] and it was incorporated at 45 days after sowing.

The earthing up operation was carried out for both plant and ratoon crops three months after planting and ratoon initiation, respectively.

3.5.2 Fertilizers application

Fertilizers as per the treatments were applied. Similarly organic manures were also incorported into the soil as per the treatments. Recommended levels of phosphorus and potassium

LEGEND

Main plot : Organic manures [A]

a_1 = Trash incorporation @ 8 t / ha

a_2 = Farmyard manure @ 25 t / ha

a_3 = Vermicompost @ 5 t/ha

a_4 = *Bhumilabh* @ 10 t/ha

a_5 = Green manure [sunnhemp] grown *in situ*

a_6 = Control

Sub plot : Chemical Fertilizers.[B]

b_1 = 100 per cent RDF [250:75: 187.5 kg NPK/ha]

b_2 = 50 per cent RDF [125:37.5:93.75 kg NPK/ha]

b_3 = No fertilizer.

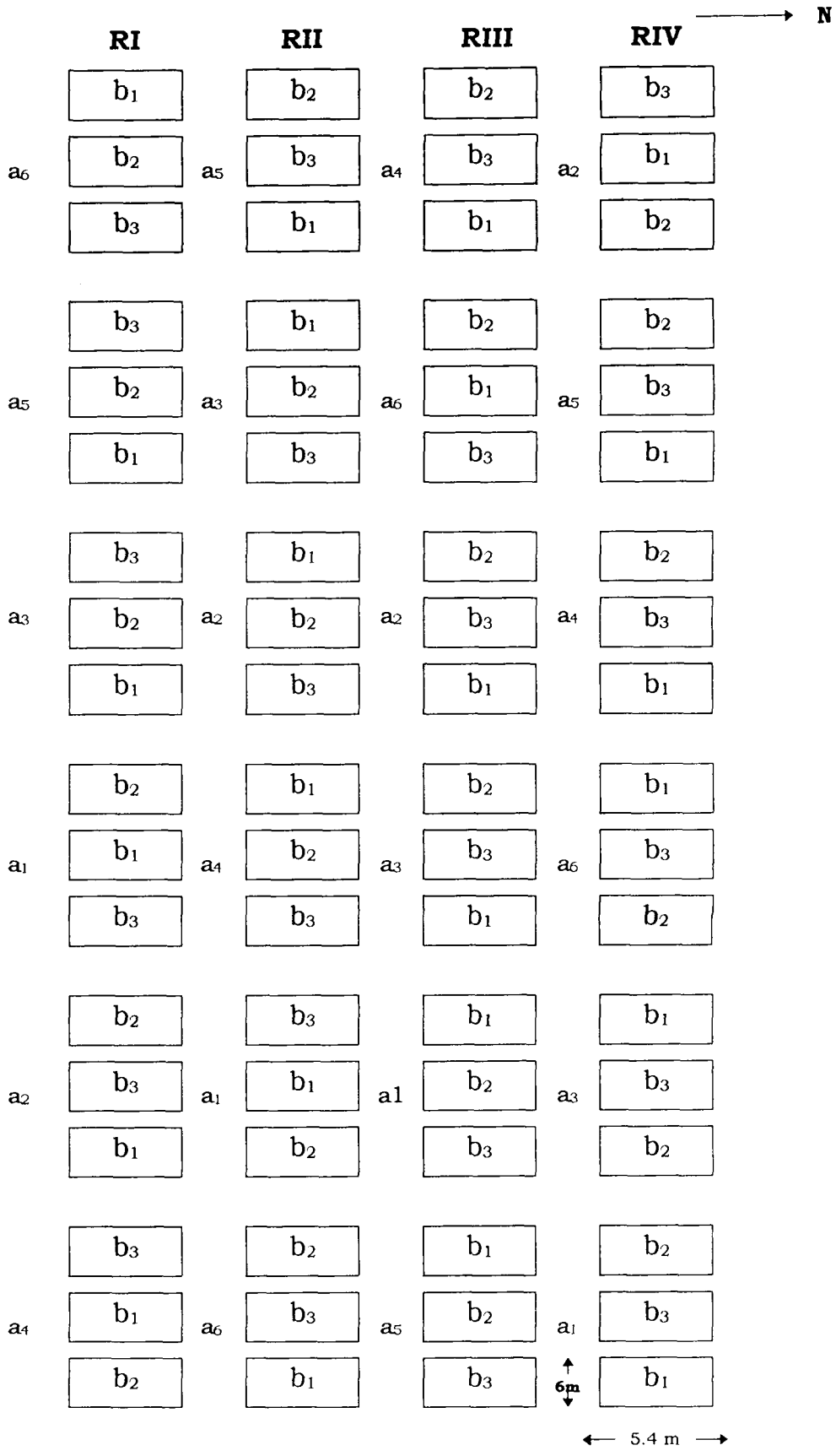

Fig. 2. Experimental layout [Expt. I]

along with 10 per cent recommended nitrogen was applied while the remaining 20, 30 and 40 per cent nitrogen was applied at 6, 10 and 14th weeks after planting and ratoon initiation for plant and ratoon crop respectively and mixed with the soil.

3.5.3 Planting of sugarcane

Planting material was selected from 9 months old nursery which was raised of variety CoC 671. The harvested cane was detrashed, cut in to two eye budded setts and only good healthy seeds were selected for planting the setts. The setts so selected were treated with one per cent Emissan [Fungicide] solution before planting . The setts were planted in normal furrow row of 90 cm apart @ 45,000 setts ha^{-1}. The setts were pushed down into the soil by placing eye buds sideward to a depth of 5 cm by following wet method of planting.

Immediately after harvest of the cane, stubble shaving, gap filling [poly bag raised seedlings] and off barring was carried out for raising ratoon crop so as to ensure appropriate plant population.

3.5.4 Weed control

Two hand weedings were carried at 40 and 80 days ofter planting [DAP] and after ratoon initiation [DAR] for plant and

ratoon crops respectively. However, all plots were kept clean all along the experimental period by manual uprooting of weeds.

3.5.5 After care

As a preventive measure, soil application of 4:4G savidol @ 2 kg a.i per ha was done to control early shoot borer.

3.5.6 Irrigation

The experimental plots were irrigated on the day of planting. There after seven days irrigation interval was followed during germination phase [0-40 days] and 8-10 days interval during tillering and grand growth phases of the crop [30-270 days], and there after one irrigation till 15 days prior to harvest. Irrigation was stopped during rainy periods.

3.5.7 Experiment II

This experiment involving different levels of pressmud and *bhumilabh* in conjunction with different levels of recommended chemical fertilizers was conducted during 1996-97 and 1997-98 season for plant and ratoon crops in a fixed site.

Title : Performance of *bhumilabh* vis-a-vis pressmud in integrated nutrient management system of sugarcane.

Objectives

1. To evaluate the comparative effect of *bhumilabh* and raw pressmud inconjunction with inorganic fertilizers on growth, productivity and quality of sugarcane
2. To study the extent of reduction in inorganic fertilizer requirement of sugarcane with the use of *bhumilabh* and pressmud.
3. To work out the benefit : cost ratio of various treatment combinations.

The details of treatments are as follows

Main plot : Organic manure[A]

a_1 = Pressmud @ 12.5 t / ha [PM_1]

a_2 = Pressmud @ 25.0 t /ha PM_2]

a_3 = *Bhumilabh* @ 2.5 t / ha [BL_1]

a_4 =*Bhumilabh* @ 5.0 t / ha [BL_2]

a_5 =Control[No]

Subplot : Chemical fertilizers [B]

b_1 = 100 per cent RDF [250: 75: 187:5 kg NPK / ha][RDF_1]

b_2 = 75 per cant RDF [187.5:56.25:140. 6 kg NPK / ha] [RDF_2]

b_3 = 50 per cent RDF [125:37.5:93.75 kg NPK/ha] [RDF_3]

b_4 =No fertilizer [RDF_4]

Design and plan of layout

Replication : Three

Design : Split plot

Gross plot size : 6 m x 5.4 m = 32.4 m^2

Net plot size : 5m x 3.6m = 18 m^2

Plan of layout is given in Fig. 3

Other details

Spacing : 90 cm between rows

Variety : CoC671 [Early]

Date of planting : 3rd March, 1997

Date of Harvest : 2nd, Jan, 1998(Plant crop)

Date of Harvest : 3rd, Nov, 1998(Ratoon crop)

Application of *bhumilabh* and pressmud were done in the furrows and incorporated in the soil prior to 15 days of planting and during off- barring operation for ratoon crop. The fertilizer application, planting of sugarcane, weed control aftercare and irrigation were done by following methodology as explained for experiment I

3.6 OBSERVATIONS ON SUGARCANE

For recording biometric observations, five plants were selected at random from each net plot. The average values were used for analysis.

LEGEND

Main plot : Organic manure[A]

a_1 = Pressmud @ 12.5 t / ha

a_2 = Pressmud @ 25.0 t /ha

a_3 = *Bhumilabh* @ 2.5 t / ha

a_4 =*Bhumilabh* @ 5.0 t / ha

a_5 =Control

Subplot : Chemical fertilizers [B]

b_1 = 100 per cent RDF [250: 75: 187:5 kg NPK / ha]

b_2 = 75 per cant RDF [187.5:56.25:140. 6 kg NPK / ha]

b_3 = 50 per cent RDF [125:37.5:93.75 kg NPK/ha]

b_4 =No fertilizer

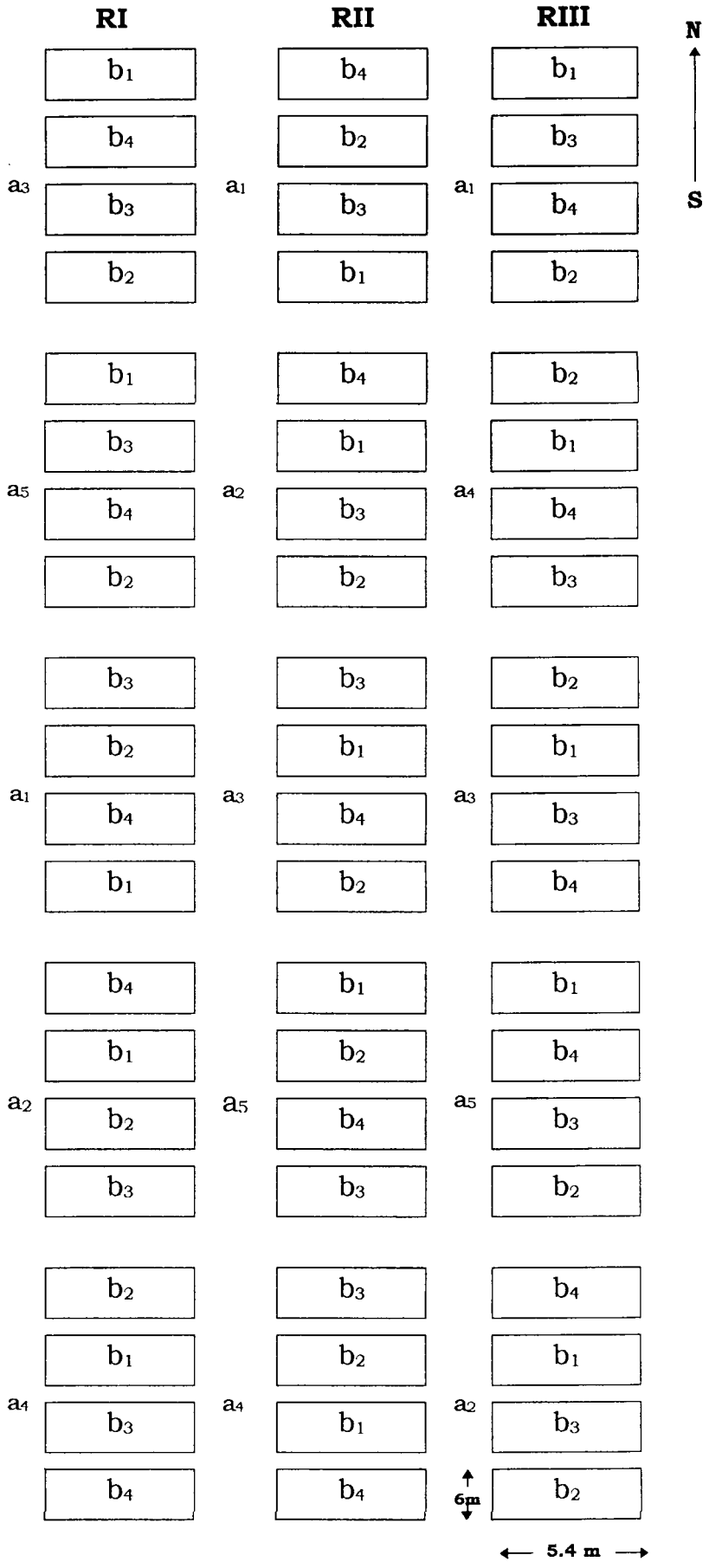

Fig. 3. Experimental layout [Expt. II]

3.6.1 Growth and yield components of sugarcane

3.6.1.1 Germination count [%]

Germination was recorded on 40 Days after planting and expressed in percentage.

3.6.1.2 Number of tillers [Lakh/ha]

The green tillers present in each plot were counted and recorded as number of tillers at 120 days after planting and ratoon initiation and expressed in lakh per hectare

3.6.1.3 Plant height [cm]

The plant height was recorded from ground level to the base of the last fully opened leaf [last internode] from randomly selected five plants at 60, 120, 180 and 240 DAP and DAR for plant and ratoon crops,respectively and also at harvest

The mean height of five plants was recorded as plant height in centimeter

3.6.1.4 Number of internodes

Number of internodes were recorded from base of plant to fully opened leaf base. The average number of internodes of five randomly selected plants were recorded at 60,120, 180, and 240 DAP and DAR for plant and ratoon crop respectively and at harvest for both crops

3.6.1.5 Diameter of cane [cm]

The diameter of canes was recorded at 60, 120, 180 and 240 DAP and DAR for plant and ratoon crop respectively and also at harvest for both crops. This was recorded from exactly central internodal top portion using Vernier calliper and expressed in centimeters.The top, middle and bottom portion of cane was selected and averaged.

3.6.1.6 Leaf area [LA] [dm^2/ plant]

Leaf area of third, fourth, fifth and sixth leaves from the top was determined in one of the five selected plants. The leaf area of individual leaves of the plant was calculated by determining with a factor, 0.75 [Romero, 1987]. The mean leaf area of selected leaves was multiplied by number of leaves per plant to arrive at the leaf area per plant and experessed in square decimeters.

3.6.1.7 Leaf Area Index [LAI]

Leaf area index is defined as leaf area [assimilatory source] per unit land area. It was calculated by dividing the leaf area per plant by the land area occupied by a single plant [Sestak *et al.*, 1971]

$$LAI = \frac{A}{P}$$

Where, L.A.I. = Leaf Area Index

A = Leaf area

P = Unit land area.

3.6.1.8 Dry matter production and its accumulation into stem and leaf

Canes which were selected for growth observations were removed from each treatment. They were separated in to stem and leaves and chopped separately and kept for drying in the sun. The semi dried materials were dried at 65 to 70 ^{o}C in hot air oven to a constant weight and then weight was recorded. After weighing the materiel, total dry matter production was calculated and was expressed in grams per plant. The mean total dry matter [TDM], stem weight and leaf dry weight per plant was recorded at 60, 120 , 180, 240 DAP and DAR and harvest for plant and ratoon crops respectively.

3.6.1.9 Length of internode [cm]

Length of the internodes present at top, middle and bottom portion of each cane was recorded at harvest of plant and ratoon crop and the average of these top, middle and bottom

portion intrenodal length was recorded as mean inter nodal length and is expressed in centimeters.

3.6.2.0 Number of millable canes [' 000/ha]

All the canes from each net plot were cut at the ground level, detrashed and detopped , counted and recorded as number of millable canes per plot. These were expressed as millable canes per hectare.

3.6.2.1 Single cane weight [kg]

The weight of five millable canes was recorded at harvest and the average of those was worked out and expressed as single cane weight in kilograms.

3.6.2.2 Cane yield [t/ha]

All the millable canes in the net plot were cut close to the ground level. After detrashing and detopping cane yield per plot was recorded. The cane yield was expressed in tonnes per hectare.

3.6.2.3 Sugar yield or C.C.S yield [t/ha]

Sugar yield was calculated by using the following formula.

$$\text{Sugar yield [t/ha]} = \frac{\text{C.C.S [\%] X Cane yield [t/ha]}}{100}$$

Where,

C.C.S = Commercial cane sugar

3.6.3 Quality parameters of sugar cane

3.6.3.1 Brix [%]

Brix reading was recorded by using the brix hydrometer. Corrected brix reading were worked out by adjusting brix values to the room temperature at the time of observation with help of bur standards.

3.6.3.2 Pol or Sucrose [%]

It was estimated by Horne's dry lead acetate clarification method using polariscope

3.6.3.3 Purity [%]

It is the ratio between sucrose per cent and the corrected brix value expressed as per cent purity of Juice.

$$\text{Purity percentage[\%]} = \frac{\text{Sucrose percent}}{\text{Corrected brix percent}} \times 100$$

3.6.3.4 Commercial Cane Sugar percentage [C.C.S %]

It is the amount of white commercial sugar obtained from cane juice after removing total soluble solids. It was calculated by using the following formulas.

C.C.S %= [Sucrose % -[Brix %- Sucrose %] X 0.40] X 0.73

3.6.3.5 Reducing sugars [%]

Percentage of reducing sugars was obtained by using the Lane and Eynon [original] method by using Fehling A and Fehling B solutions as explained by Varma [1988].

3.6.3.6 Fibre [%]

Cane fibre percent was computed by using washing method as explained by Varma [1988].

3.6.3.7 Moisture [%]

The loss in weight of 100g weighted fibre [from shredder] after drying to a constant weight at about 102°C in a weighted shallow tray with a perforated bottom and expressed based on percentage basis.

3.6.4 Plant Nutrient Analysis

Plant samples of sunnhemp at 45 days after sowing and sugarcane at 60, 120, 180, 240 DAP and harvest were dried in the oven for finding out dry matter production.These were powdered and used for estimating the N,P and K contents.

Using the data of dry matter production and nutrient concentration ,the uptake values were calculated.

Nitrogen was determined by Microkjeldahi's method as suggested by Yoshida *et al.*, [1972]. The tri acid mixture was used for digestion of samples for estimation of Phosphorus and

Potassium as suggested by Yoshida *et al.*, [1972] Phosphorus was determined by Vanado- molybdo Phosphoric acid yellow colour method [Jackson, 1967]. Whereas, Potassium was estimated using the flame photometer method.

3.6.5 CHEMICAL ANALYSIS OF SOIL

Composite soil samples were collected before planting of sugarcane from the experimental sites to find out the initial soil properties. Both the experiments were continued at the fixed sites for raising ratoon crop. Soil samples were collected from 0-30 cm depth were dried under shade and finely powdered with wooden pestle and mortar to pass through 2 mm sieve. This soil was used for analysing available nitrogen, available phosphorus and available potassium by following alkaline permanganate method [Subbiah and Asija,1956], Olsen's method [Muhr *et al.*, 1965] and Flame photo meter method [Muhr *et al.*, 1965], respectively. Soil pH and organic carbon were estimated by the pH meter method and Walkley and Blacks method respectively. [Jackson, 1967]. Electrical conductivity was determined in 1:2.5 soil water extract using conductivity bridge and values were expressed in dSm^{-1}.

Bulk density was determined by core sampler method as described by Black [1965].

3.6.6 Microbial analysis

A composite sample of soil was collected at random, before planting and after harvest of plant and ratoon crop of sugarcane, for analysis of Fungi, Actinomycetes, Azotobacteria and Phosphate solubilizing bacteria. Ten gram of soil samples were transferred separately to 90 m1 sterile water blanks and the flasks were shaken on a mechanical rotary shaker for five minutes to ensure uniform depression of soil particles in water which will make 10^{-1} dilution, from this 10^{-1} diluent, further ten fold dilutions were prepared by pipette out one ml of the original suspension using sterile pipette out in to nine ml sterile water blanks so as to obtain the appropriate dilution [10^{-2} ,10^{-3} ,10^{-4}, 10^{-5} and 10^{-6}]. Nutrient agar, Rose Bengal agar, Kasteri agar, Waksmann No.77 and Pikovskaya's media were used for isolation of these microorganisms @ 15 ml per petridish. Four replications were maintained for all the groups of organisms mentioned above. Incubation of petridishes was done at 28 ± 2 ^{0}C using an incubator for 5 days. The colonies were counted and expressed per unit weight of soil.

3.6.7 Statistical analysis of the data

The data collected from different experiments at different stages were subjected to statistical analysis as described by Gomez and Gomez [1984]. The level of significant used in 'F' test was P = 0.05. The mean values of main plot, subplot and interaction were separately subjected to Duncan's Multiple Range Test using the corresponding error mean sum of squares and degrees of freedom values. The means followed by the same lower case letters do not differ significantly at the 0.05 probability level. Correlation studies were made between the cane yield and other related characters. The values of correlation Co-efficient [r] were calculated and tested for their significance as per procedure out lined by Panse and Sukhatme [1967]. Correlation studies were made between the cane yield and other related characters. The values of correlation coefficient [r] were calculated and tested for their significance as per procedure out lined by Panse and Sukhatme [1967].

EXPERIMENTAL RESULTS

IV. EXPERIMENTAL RESULTS

The field experiments were conducted to study the effect of integrated nutrient management in sugarcane for plant and ratoon crops were conducted at the Karnataka Institute of Applied Agricultural Research, Sameerwadi during 1996-97 and 1997-98. The results of the experiments are presented in this chapter. Although cane yields were lower in ratoon crop compared to plant crop, but the trend of sugarcane production to various organics and inorganic sources of fertilizer was similar for both plant and ratoon crops. Therefore, mean data of the two crops (pooled) are highlighted and further wherever necessary individual crop performance is also indicated.

Experiment I

4.1.1 GROWTH PARAMETERS

4.1.1.1 Germination [%]

The germination percentage of plant crop as influenced by organic and inorganic fertilizers is presented in Table.3

The germination percentage did not differ significantly due to application of either organic or inorganic fertilizers in sugarcane. Further, the interaction effects due to organic and

inorganic fertilizers also failed to produce significant variationson germination.

4.1.1.2 Tiller count (lakh/ha)

The tiller count in sugarcane at 120 DAP/R (Days after planting/ratoon initiation) as influenced by organic and inorganic fertilizers is presented in Table.3

The tiller count (lakh/ha) in sugarcane at 120 DAP/R due to application of organic and inorganic fertilizers varied significantly. The pooled analysis data indicated that application of BL had significantly higher tiller count of 1.34 over application of GM (1.26) and no organic treatment (1.25) and was on par with other sources of organics. However, in case of plant cane, significantly lesser tiller count (1.22) was observed due to application of GM over other treatments, which did not differ significantly themselves with respect to tiller count. Application of BL registered significantly higher tiller count in ratoon which was on par with application of FYM and VC over TR, GM and no organic. Significantly lower tiller count was recorded due to no organic treatment.

Application of RDF_1 (1.32) gave significantly higher tiller count over only RDF_3. The same trend was noticed in case of

Table 3. Germination and tiller count in sugarcane as influenced by organic and inorganic fertilizers

Treatment	Germination [%]	Tiller count [Lakh/ha]		
		120 DAP	120 DAR	120 DAP/DAR
A.Organic manures				
TR	72.96	1.26	1.31	1.29
FYM	72.22	1.27	1.32	1.30
VC	71.83	1.31	1.37	1.34
BL	72.83	1.31	1.37	1.34
GM	73.13	1.22	1.29	1.26
NO	74.04	1.25	1.24	1.25
SEm ±	1.089	0.022	0.016	0.018
C D at 5 %	NS	0.065	0.048	0.049
B.Chemical fertilizers				
RDF_1	72.89	1.29	1.35	1.32
RDF_2	72.45	1.26	1.30	1.28
RDF_3	72.68	1.25	1.27	1.26
SEm±	0.831	0.031	0.025	0.021
C D at 5%	NS	NS	0.068	0.058
Interaction [AXB]				
SEm±	2.034	0.075	0.121	0.068
C D at 5%	NS	NS	NS	NS

DAP = Days after planting and DAR= Days after ratoon initiation.

DAP/DAR = Days after planting & Days after ratoon initiation.

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

ratoon crop. However, plant crop failed to exhibit any significant difference in tiller count due to varied doses of inorganic fertilizers.

The interaction effects due to organic and inorganic fertilizers were not significant both on pooled and as well as individual plant and ratoon crops.

4.1.1.3 Total dry matter (TDM) production (g/plant)

The TDM production in sugarcane at various growth stages as influenced by organic sourcesand chemical fertilizers is presented in Tables. 4,4a and 4b

The total dry matter production (g/plant) averaged over two years as influenced by various organic and levels of chemical fertilizers differed significantly at different stages of crop growth except at 60 DAP . The TDM production increased progressively from 60 DAP/R (Days after planting/Ratoon initiation) (51.43) till harvest (310.93).

Among the various organics, application of BL had significantly higher (56.27) total dry matter production when compared to without organic treatments. However, former was on par with TR, FYM, VC and GM at 60 DAP/R, but only at 60 DAP

different organics failed produced significant results on TDM production.

With advance in age of the crop, application of BL exerted significant influence on TDM production compared to other sources of organics at all stages except at 180 DAP/R and 240 DAP wherein application of BL registered on par TDM values with FYM. Further application of all these organics exhibited significantly higher TDM over no organic treatment in all stages of crop growth except 60 DAP. Application of TR enhanced TDM of ratoon crop at all stages compared to plant crop and it was significantly superior over VC and NO only in case of ratoon crop. In case of plant cane, FYM had significantly higher TDM at all the growth stages compared to VC, GM, TR and NO. At harvest TDM was significantly higher due to BL (384.28) over rest of the treatments followed by FYM which in turn recorded significantly higher TDM (313.39) over other treatments and next being due to GM (305.28) which again was significantly superior over TR, VC and NO. However, application of TR and VC showed on par TDM.

Significant difference in the TDM production on pooled basis was observed due to application of chemical fertilizers at various levels in all the growth stages of sugarcane. Application

Table 4. Dry matter production in sugarcane at various growth stages as influenced by organic and inorganic fertilisers [Pooled]

60 DAP/R

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	57.82	49.02	58.09	61.65	58.85	55.38	56.83
RDF_2	52.52	55.09	52.19	55.00	51.18	48.41	52.39
RDF_3	43.82	44.55	43.33	52.16	47.61	38.81	45.05
Mean	51.39	49.62	51.21	56.27	52.77	47.53	-

120 DAP/R

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	157.79	139.24	128.91	190.94	134.39	121..21	145.41
RDF_2	100.49	95.36	90.72	139.41	93.69	82.14	98.98
RDF_3	87.81	73.92	76.08	108.54	73.53	66.36	81.04
Mean	115.36	107.51	98.57	142.99	100.58	89.91	-

180 DA/R

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	256.67	271.22	224.95	356.47	235.74	217.78	260.47
RDF_2	143.87	149.25	141.68	247.28	154.36	127.45	160.45
RDF_3	125.06	116.01	137.69	141.64	111.32	107.14	123.14
Mean	175.20	178.83	168.11	248.46	167.14	150.79	-

240DAP/R

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							328.32
RDF_1	245.01	341.59	209.97	437.77	336.60	298.97	252.34
RDF_2	137.82	266.45	211.82	363.14	236.15	198.64	181.98
RDF_3	110.85	173.34	177.57	253.30	189.37	137.47	-
Mean	214.56	260.46	233.12	351.41	254.04	211.69	

At harvest

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	389.51	403.73	360.51	474.69	366.97	353.41	391.47
RDF_2	277.17	305.96	271.47	397.16	305.53	259.42	302.87
RDF_3	208.08	231.66	234.03	381.00	243.34	192.64	231.79
Mean	291.59	313.39	288.84	384.28	305.28	268.49	-

Source of variation	60DAP/R	120DAP/R	180DAP/R	240DAP/R	At harvest
SEm± for chemical fertiliser	0.968	1.415	2.009	1.403	1.431
CD at 5% for chemical fertiliser	2.683	3.922	5.568	3.889	3.966
SEm± for Organic manures	1.545	2.152	3.079	1.390	1.994
CD at 5% for Organic manures	4.243	5.965	8.535	3.853	5.527
SEm± for interaction	2.371	4.903	6.958	4.589	4.958
CD at 5% for interaction	6.572	13.590	19.286	13.468	13.742

DAP=Days after planting/ratoon initiation

RDF_1=100%RDF TR = Trash incorporation@8 t/ha BL=*Bhumilabh* @10 t/ha

RDF_2= 50%RDF FYM=Farmyard manure @25 t/ha GM=Green manure grown *in situ*

RDF_3=No fertiliser VC= Vermicompost @ 5t/ha NO=No organics

Table 4a. Dry matter production in sugarcane at various growth stages as influenced by organic and inorganic fertilisers

60 DAP

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	40.50	41.72	42.63	43.10	42.55	41.38	41.98
RDF_2	38.30	39.58	42.00	41.45	39.13	38.38	39.80
RDF_3	36.25	36.69	37.43	39.00	36.37	36.05	36.97
Mean	38.35	39.33	40.68	41.18	39.35	38.60	-

120 DAP

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	132.05	135.53	127.27	183.53	132.72	120.43	138.59
RDF_2	98.55	95.85	88.54	126.39	91.55	81.01	96.98
RDF_3	86.90	72.20	74.07	106.78	71.30	64.34	79.27
Mean	105.83	101.19	96.63	138.89	98.52	88.59	-

180 DAP

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	167.55	276.95	243.81	364.08	240.51	225.48	269.39
RDF_2	149.33	155.53	147.73	252.22	159.92	134.05	166.46
RDF_3	131.45	123.83	144.77	147.68	116.93	118.49	129.53
Mean	182.77	185.43	178.77	253.99	172.45	157.34	-

240DAP

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	151.37	351.51	332.51	444.72	342.36	310.09	319.93
RDF_2	144.81	273.21	217.81	368.62	242.45	203.95	258.48
RDF_3	162.49	180.51	184.72	259.42	194.38	142.90	187.40
Mean	186.22	267.76	241.35	357.58	259.73	218.98	-

At harvest

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	384.35	418.13	365.92	463.34	347.12	363.59	390.41
RDF_2	267.30	296.74	282.67	381.18	325.55	170.23	303.95
RDF_3	200.88	240.72	241.42	258.26	247.06	198.04	231.06
Mean	284.17	318.53	296.67	367.59	306.58	277.29	-

Source of variation	60DAP	120DAP	180DAP	240DAP	At harvest
SEm± for chemical fertiliser	0.828	1.478	3.205	2.800	2.747
CD at 5% for chemical fertiliser	2.295	4.096	8.883	7.762	7.614
SEm± for Organic manures	1.162	2.447	4.964	2.847	3.883
CD at 5% for Organic manures	3.453	7.271	14.740	8.459	11.539
SEm± for interaction	2.028	3.620	7.849	6.859	6.729
CD at 5% for interaction	5.621	10.034	21.759	19.012	18.652

DAP=Days after planting

RDF_1=100%RDF
RDF_2= 50%RDF
RDF_3=No fertiliser

TR = Trash incorporation@8 t/ha
FYM=Farmyard manure @25 t/ha
VC= Vermicompost @ 5t/ha

BL=*Bhumilabh* @10 t/ha
GM=Green manure grown *in situ*
NO=No organics

Table 4b. Dry matter production in sugarcane at various growth stages as influenced by organic and inorganic fertilisers

60 DAR

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	75.14	76.72	73.56	80.20	75.15	69.38	71.69
RDF_2	66.74	70.59	62.39	68.55	62.24	58.44	64.99
RDF_3	51.78	52.41	49.24	65.31	58.85	41.56	83.13
Mean	64.42	59.91	61.78	71.35	65.75	56.46	-

120 DAR

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	183.52	142.95	130.54	198.35	135.98	122.05	152.23
RDF_2	107.43	98.87	92.90	132.59	95.84	83.26	100.98
RDF_3	88.72	75.63	78.09	110.30	75.76	68.37	82.81
Mean	124.89	105.82	100.51	147.08	107.53	91.23	-

180 DAR

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	245.79	265.50	206.08	350.86	230.97	210.07	251.55
RDF_2	138.41	142.58	135.63	242.24	148.79	120.85	154.83
RDF_3	118.67	108.19	130.02	135.38	105.70	101.78	116.76
Mean	167.62	172.22	157.44	142.93	161.82	144.23	-

240 DAR

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	338.65	333.66	298.42	430.82	330.84	287.84	336.71
RDF_2	246.19	249.66	205.83	357.67	229.85	192.33	246.19
RDF_3	176.56	166.17	170.41	247.19	184.36	132.04	176.56
Mean	142.90	253.16	124.89	145.23	248.35	204.40	-

At harvest

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	394.68	389.34	355.10	486.04	386.82	343.23	392.53
RDF_2	287.04	315.90	261.27	430.14	285.51	248.62	301.79
RDF_3	215.28	222.61	226.64	303.75	239.61	187.24	232.52
Mean	299.00	209.04	281.00	400.98	303.98	254.69	-

Source of variation	60DAR	120DAR	180DAR	240DAR	At harvest
SEm± for chemical fertiliser	1.750	2.414	2.422	1.169	1.805
CD at 5% for chemical fertiliser	4.850	6.691	6.713	3.245	5.003
SEm± for Organic manures	2.772	3.354	3.477	1.232	1.989
CD at 5% for Organic manures	8.117	9.966	10.331	3.661	5.909
SEm± for interaction	4.289	5.914	5.933	3.416	4.971
CD at 5% for interaction	11.883	16.393	16.445	9.469	13.779

DAR=Days after ratoon initiation

RDF_1=100%RDF — TR = Trash incorporation@8 t/ha — BL=*Bhumilabh* @10 t/ha

RDF_2= 50%RDF — FYM=Farmyard manure @25 t/ha — GM=Green manure grown *in situ*

RDF_3=No fertiliser — VC= Vermicompost @ 5t/ha — NO=No organics

of RDF_1, recorded significantly higher TDM production (56.83) compared to RDF_2 (52.39) and RDF_3 (45.05) and latter two treatments too exhibited significant difference with respect to TDM production. Similar trend was noticed at all the crop growth stages and it was observed that reduced doses of chemical fertilizers significantly reduced the TDM production.

The interaction effects of organic and chemical fertilizers on TDM showed significant difference at all the stages of crop growth. Application of BL X RDF_1 (61.65) exerted significantly highest TDM production compared to other treatments except FYM X RDF_1 (55.09), GM X RDF_1 (58.85) and NO X RDF_1 (55.38) at 60 DAP/R. However as the growth stage advanced, BL X RDF_1 exerted significantly higher TDM at all the latter stages. Further it was observed that application of different organics inconjunction with fertilizers exhibited significantly higher TDM production compared to only chemical fertilizers at all the stages of crop growth.

4.1.1.4 Dry matter (DM) production in stem (g/plant)

The DM production in stem at various growth stages as influenced by organic and chemical fertilizers is presented in Tables. 5,5a and 5b

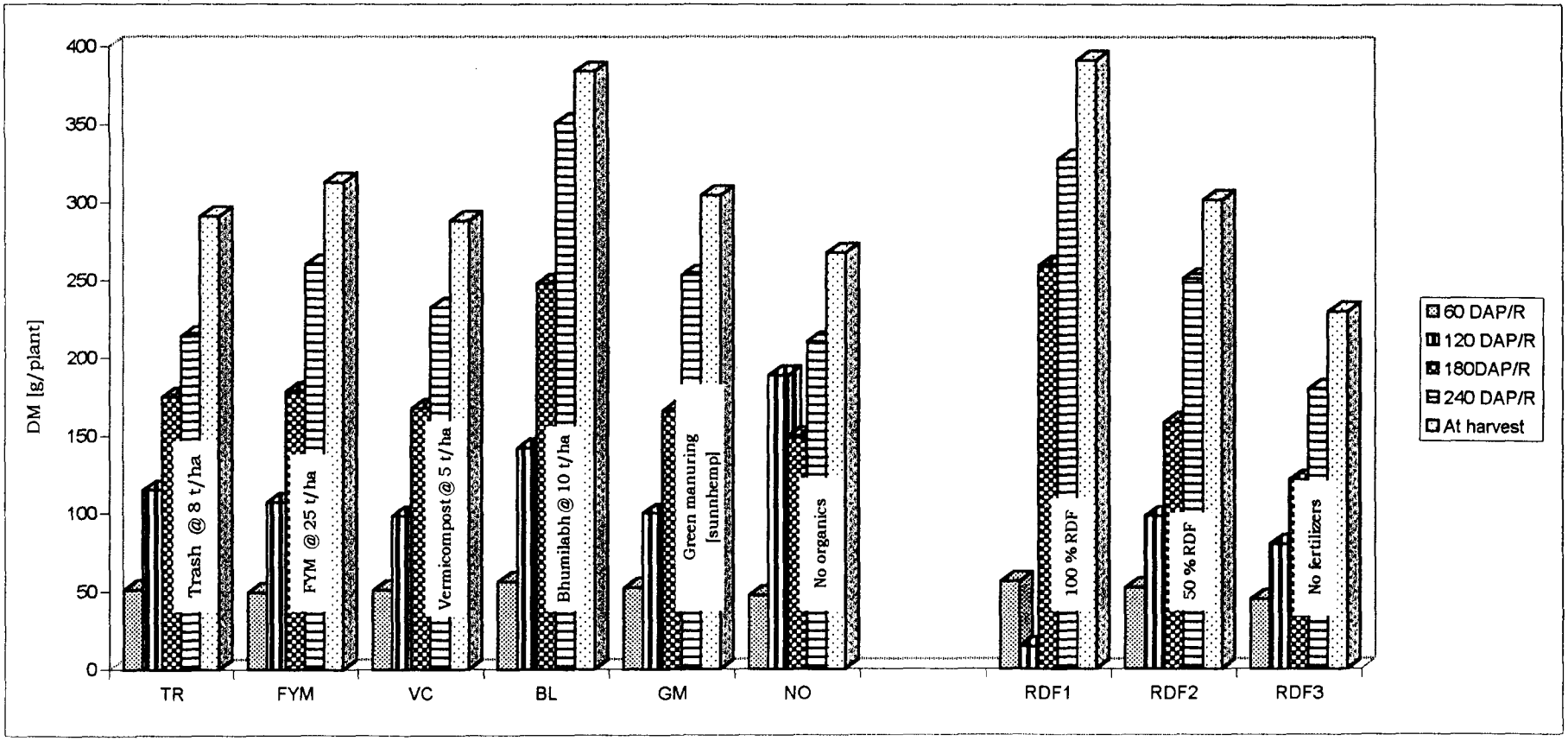

Fig. 4. Dry matter production [g/plnat] in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

The dry matter production in stem increased progressively from 60 DAP/R (Days after planting/ratoon initiation) (21.19) to harvest (234.75). The various sources of organic manures had significant influence on stem dry matter production at all the growth stages except 60 DAP/R. Significantly the highest dry matter production in stem was recorded due to application of BL again at all the stages except 60 DAP/R. The trend of response of dry matter production in stem due to application of other sources of organics was different at 120, 180 and 240 DAP/R. However, at harvest application of BL registered significantly the highest stem dry matter (292.53) followed by GM (239.86), FYM (239.35), TR (225.76), VC (220.29) and NO (189.02) in the descending order.

Application of varied doses of fertilizers produced significant difference in production of dry matter in stem at all the stages of crop except at 60 DAP/R. The pooled data basis, RDF_1 recorded significantly the highest dry matter in stem compared to RDF_2 and RDF_3 at all the stages except 60 DAP/R. Significantly lower values of dry matter in stem was observed owing to lesser quantities of fertilizers and the highest dry matter in stem was recorded in RDF_1 while, the least was in RDF_3.

Table 5. Dry matter accumulation in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Dry matter accumulation in stem [g/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	21.09	56.44	97.66	125.06	225.76
FYM	21.19	52.50	99.09	147.13	239.35
VC	20.91	50.05	95.59	136.30	220.29
BL	23.02	64.22	137.98	205.35	292.53
GM	21.52	50.93	92.75	148.64	239.86
NO	19.38	44.15	76.84	120.04	189.02
SEm ±	0.292	0.375	1.948	1.685	1.792
C D at 5 %	NS	1.039	5.399	4.671	4.967
B.Chemical fertilizers					
RDF_1	23.79	68.14	144.18	190.43	298.26
RDF_2	21.25	50.07	88.17	145.09	230.40
RDF_3	18.51	40.93	67.62	105.74	174.75
SEm±	0.244	0.244	1.342	1.493	1.148
C D at 5%	NS	0.676	3.179	4.138	3.182
Interaction [AXB]					
TR X RDF_1	23.59	73.57	142.56	141.96	297.43
TR X RDF_2	21.35	50.98	79.86	139.09	222.26
TR X RDF_3	18.34	44.77	70.57	94.14	157.59
FYM X RDF_1	23.74	70.62	150.65	191.71	308.17
FYM X RDF_2	21.58	49.39	82.86	141.06	233.09
FYM X RDF_3	18.24	37.49	63.78	100.61	176.81
VC X RDF_1	23.83	65.56	131.89	181.23	274.61
VC X RDF_2	21.32	46.01	78.48	123.84	207.71
VC X RDF_3	17.58	38.59	76.46	100.84	178.54
BL X RDF_1	25.16	71.26	197.90	255.78	361.61
BL X RDF_2	22.56	66.33	137.26	212.34	302.47
BL X RDF_3	21.35	55.06	78.78	146.94	213.50
GM X RDF_1	24.08	68.15	130.90	196.77	299.00
GM X RDF_2	20.83	47.53	85.67	138.12	234.05
GM X RDF_3	19.66	37.11	61.67	111.04	186.53
NO X RDF_1	22.33	59.69	111.16	167.14	248.70
NO X RDF_2	19.89	40.21	64.94	116.09	182.85
NO X RDF_3	15.92	32.55	54.43	76.89	135.51
SEm±	0.597	0.852	3.288	3.658	3.975
C D at 5%	NS	2.542	9.114	10.139	11.018

DAP = Days after planting or ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 5a. Dry matter accumulation in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in stem [g/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	15.61	55.18	103.14	109.15	229.90
FYM	16.23	52.62	103.46	147.39	250.05
VC	16.72	50.33	99.99	142.16	232.83
BL	16.99	55.63	142.30	210.47	288.34
GM	16.37	51.23	96.55	153.27	254.79
NO	15.72	46.28	80.07	127.66	203.81
SEm ±	0.319	0.608	3.006	3.290	3.554
C D at 5 %	NS	1.807	8.932	9.775	10.559
B.Chemical fertilizers					
RDF_1	17.18	63.69	149.11	187.01	309.98
RDF_2	16.43	50.65	91.95	148.28	240.24
RDF_3	15.22	41.29	71.69	109.77	179.64
SEm±	0.385	0.438	2.012	2.982	2.231
C D at 5%	NS	1.214	5.576	8.266	6.184
Interaction [AXB]					
TR X RDF_1	16.56	68.67	149.94	187.51	301.71
TR X RDF_2	15.57	51.25	83.62	144.03	232.12
TR X RDF_3	14.70	45.62	75.87	95.90	155.88
FYM X RDF_1	17.20	70.47	155.27	205.86	128.23
FYM X RDF_2	16.40	48.84	87.08	131.49	132.94
FYM X RDF_3	15.10	37.54	68.06	104.84	188.97
VC X RDF_1	17.65	66.44	136.38	189.37	187.22
VC X RDF_2	17.18	46.02	82.21	128.29	121.91
VC X RDF_3	15.33	38.52	81.08	108.83	189.36
BL X RDF_1	17.80	44.34	202.93	261.68	363.57
BL X RDF_2	17.14	67.02	141.24	271.22	299.23
BL X RDF_3	16.04	65.53	182.74	152.50	202.22
GM X RDF_1	17.50	68.99	134.69	201.65	311.75
GM X RDF_2	16.36	47.61	89.49	142.80	256.81
GM X RDF_3	15.25	37.08	65.48	115.37	195.83
NO X RDF_1	16.36	63.25	115.19	175.97	167.42
NO X RDF_2	15.94	48.13	68.09	125.84	198.44
NO X RDF_3	14.87	33.46	56.94	81.17	145.56
SEm±	0.943	1.072	5.139	7.303	5.465
C D at 5%	NS	2.971	14.245	20.242	15.148

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 5b. Dry matter accumulation in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in stem [g/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	26.58	55.18	92.18	140.97	221.62
FYM	26.14	52.62	94.73	146.86	228.66
VC	25.10	50.33	91.18	130.44	207.74
BL	29.05	55.63	133.66	200.23	296.71
GM	26.67	51.33	88.98	144.02	224.93
NO	23.04	46.28	73.62	112.42	174.23
SEm ±	0.456	0.608	2.359	2.233	2.738
C D at 5 %	NS	1.807	7.009	6.635	8.135
B.Chemical fertilizers					
RDF_1	30.40	63.69	139.24	193.86	286.53
RDF_2	26.08	50.65	84.38	141.89	220.57
RDF_3	21.81	41.29	63.54	101.71	169.86
SEm±	0.299	0.438	1.252	1.168	1.539
C D at 5%	NS	1.214	3.470	3.237	4.266
Interaction [AXB]					
TR X RDF_1	30.04	68.67	135.17	196.41	293.16
TR X RDF_2	27.12	51.25	76.09	134.15	212.40
TR X RDF_3	21.98	45.62	65.27	92.34	159.31
FYM X RDF_1	30.28	70.47	146.03	193.57	288.11
FYM X RDF_2	26.76	49.84	78.65	150.62	133.23
FYM X RDF_3	21.38	37.54	59.50	96.38	164.64
VC X RDF_1	30.01	66.44	127.11	173.08	262.00
VC X RDF_2	25.04	46.02	74.59	119.38	193.51
VC X RDF_3	19.04	38.52	71.84	98.85	167.71
BL X RDF_1	32.53	44.34	192.88	249.88	359.65
BL X RDF_2	27.98	67.02	133.29	207.45	305.71
BL X RDF_3	26.65	55.53	174.82	243.37	224.78
GM X RDF_1	30.65	68.99	127.11	191.89	286.25
GM X RDF_2	20.50	47.61	81.85	133.44	211.29
GM X RDF_3	24.06	37.08	57.87	106.71	177.23
NO X RDF_1	28.31	63.23	107.14	158.31	229.18
NO X RDF_2	23.81	42..13	61.79	106.33	167.25
NO X RDF_3	16.96	33.46	51.91	72.63	125.46
SEm±	0.733	1.072	3.618	5.413	2.319
C D at 5%	NS	2.971	10.028	15.004	6.428

DAP = Days after planting or ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Except at 60 DAP/R, the interaction effects were significant. Application of various organic sources in conjunction with chemical fertilizers significantly enhanced the dry matter in stem compared to chemical fertilizers alone. Significantly the highest dry matter in stem was observed due to application of BL X RDF_1 (361.61) over other treatments. However, application of TR X RDF_1 (297.43), BL X RDF_2 (302.47) and GM X RDF_1 (299.00) and FYM X RDF_1 (308.17) registered on par dry matter production in stem at harvest. Similar trend was also observed at180 and 240 DAP/R.

4.1.1.5 Dry matter production of leaves (g/plant).

The dry matter production in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.6, 6a and 6b

The dry matter production of leaves increased progressively from 60 DAP/R (Days after planting/Ratoon initiation) (30.70) to 240 DAP/R (105.93) and there after it decreased and it was 76.15 at harvest. The dry matter production in leaves averaged over two years across various organic and inorganic fertilizers differed significantly at various growth stages except at 60 DAP/R.

Among the organic manures application of BL was found to have significantly the highest dry matter production in leaves at all the growth stages except 60 DAP/R, compared to all other treatments. Application of organics viz., TR, FYM, VC and GM failed to register significant difference at all the growth stages.

The dry matter production of leaves at 60 DAP/R did not differ significantly due to application of varied levels of inorganic fertilizers. However, at latter stage i.e. at 120 DAP/R, the dry matter in leaves was significant due to application of different levels of inorganic fertilizers. Applications of RDF_1 recorded significantly higher dry matter production in leaves over RDF_2 and RDF_3 at all the latter stages.

The interaction effects were nonsignificant at 60 DAP/R due to various organic and inorganic fertilizers. However, at 180 DAP/R and latter stages, there was significant influence of fertilizers. Application of BL X RDF_1 had significant influence on dry matter production at 120, 180, 240 DAP and at harvest recording 93.71, 158.18, 181.77 and 113.03 respectively. Other sources of organics also inconjunction with inorganic fertilizers recorded significantly higher dry matter in leaves compared to only fertilizers.

Table 6. Dry matter accumulation in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Dry matter accumulation in leaves [g/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	30.62	54.72	77.53	89.37	69.31
FYM	30.59	51.01	79.45	104.61	74.38
VC	30.19	48.61	76.58	96.85	68.38
BL	33.25	70.53	110.52	145.97	91.63
GM	31.09	49.59	74.09	105.59	74.39
NO	28.46	45.76	74.25	93.90	78.18
SEm ±	0.286	0.646	1.373	0.883	2.011
C D at 5 %	NS	1.790	3.806	2.447	6.057
B.Chemical fertilizers					
RDF_1	34.43	70.89	118.46	137.71	96.92
RDF_2	30.68	49.12	72.50	103.97	74.53
RDF_3	26.99	40.11	55.24	76.11	57.00
SEm±	0.237	0.377	0.920	0.689	0.719
C D at 5%	NS	0.872	2.550	1.909	1.993
Interaction [AXB]					
TR X RDF_1	34.14	71.72	114.09	102.52	92.25
TR X RDF_2	30.96	49.52	63.98	98.76	66.05
TR X RDF_3	26.75	49.92	54.51	66.83	49.64
FYM X RDF_1	34.26	68.62	120.78	141.89	95.56
FYM X RDF_2	31.19	47.97	66.39	100.42	72.88
FYM X RDF_3	26.34	36.43	51.16	71.52	54.69
VC X RDF_1	34.42	63.63	105.69	128.81	85.38
VC X RDF_2	30.51	44.69	62.81	87.99	64.36
VC X RDF_3	25.66	37.49	61.24	73.75	55.39
BL X RDF_1	36.32	93.71	158.18	181.77	113.03
BL X RDF_2	32.58	64.42	110.36	151.02	94.68
BL X RDF_3	30.86	53.48	63.01	105.12	67.19
GM X RDF_1	34.75	66.60	104.87	139.83	92.98
GM X RDF_2	30.28	46.19	68.64	98.09	72.24
GM X RDF_3	28.27	36.43	48.77	78.86	57.95
NO X RDF_1	32.72	61.47	107.16	131.44	102.31
NO X RDF_2	28.56	41.92	62.83	87.56	76.96
NO X RDF_3	24.09	33.90	52.75	60.58	57.14
SEm±	0.581	0.924	3.188	1.687	1.763
C D at 5%	NS	2.561	8.837	4.676	4.887

DAP = Days after planting or ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 6a. Dry matter accumulation in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in leaves [g/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	22.65	50.57	79.58	76.69	77.75
FYM	23.24	48.57	81.30	102.8	80.28
VC	23.86	46.45	78.56	99.20	72.98
BL	24.34	66.78	111.98	146.94	104.25
GM	23.27	47.29	76.78	106.96	79.02
NO	23.49	42.26	77.91	94.57	85.81
SEm ±	0.428	1.096	2.542	1.874	2.257
C D at 5 %	NS	3.257	7.553	5.568	8.735
B.Chemical fertilizers					
RDF_1	24.75	66.28	120.66	132.63	106.02
RDF_2	23.39	46.75	74.46	103.55	81.43
RDF_3	22.29	37.93	57.94	77.44	62.59
SEm±	0.410	0.697	1.826	1.362	1.208
C D at 5%	NS	1.931	5.062	3.775	3.318
Interaction [AXB]					
TR X RDF_1	23.79	63.38	117.42	82.81	102.62
TR X RDF_2	22.57	47.30	65.70	69.46	74.63
TR X RDF_3	21.61	41.03	55.62	66.79	55.99
FYM X RDF_1	24.58	65.05	121.98	143.64	101.23
FYM X RDF_2	23.50	45.01	68.44	91.76	81.97
FYM X RDF_3	21.65	34.66	53.50	73.24	57.64
VC X RDF_1	25.33	61.33	107.39	132.14	92.06
VC X RDF_2	24.08	42.48	64.59	89.53	67.95
VC X RDF_3	22.18	35.58	63.70	75.93	58.93
BL X RDF_1	25.45	87.23	59.46	182.59	126.36
BL X RDF_2	24.58	61.87	111.47	151.81	107.41
BL X RDF_3	23.03	51.25	65.01	106.42	78.99
GM X RDF_1	25.00	63.68	105.82	140.71	100.57
GM X RDF_2	23.12	43.98	70.31	99.65	74.24
GM X RDF_3	21.69	34.22	54.20	80.51	62.25
NO X RDF_1	24.37	57.01	111.88	133.51	113.27
NO X RDF_2	22.53	38.88	66.22	88.11	82.38
NO X RDF_3	23.58	30.88	55.63	61.73	61.79
SEm±	1.005	1.704	4.473	3.337	2.575
C D at 5%	NS	4.723	12.398	9.249	7.138

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 6b. Dry matter accumulation in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in leaves [g/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	38.58	58.86	75.47	102.05	77.75
FYM	37.59	53.44	71.59	106.34	80.28
VC	36.54	50.76	74.60	94.50	72.98
BL	42.15	74.28	109.05	144.99	104.25
GM	38.93	51.89	71.41	104.93	79.02
NO	33.42	49.27	70.58	91.82	85.81
SEm ±	0.346	0.659	1.579	1.390	2.257
C D at 5 %	NS	1.958	4.692	4.130	8.735
B.Chemical fertilizers					
RDF_1	44.11	75.49	116.27	142.79	106.02
RDF_2	37.97	51.48	70.55	104.39	81.43
RDF_3	31.70	42.28	52.54	74.78	62.59
SEm±	0.338	0.493	1.231	1.201	1.208
C D at 5%	NS	1.367	3.412	3.329	3.318
Interaction [AXB]					
TR X RDF_1	44.48	80.05	110.76	142.22	102.62
TR X RDF_2	39.36	51.74	62.76	97.05	74.63
TR X RDF_3	31.89	44.80	52.40	66.87	55.99
FYM X RDF_1	43.94	72.019	119.61	140.14	101.23
FYM X RDF_2	38.87	49.93	64.34	109.08	81.97
FYM X RDF_3	31.03	38.19	48.82	169.79	57.64
VC X RDF_1	43.51	65.94	103.99	125.48	92.06
VC X RDF_2	36.95	46.91	61.103	86.48	67.95
VC X RDF_3	29.15	39.44	58.78	71.57	58.93
BL X RDF_1	47.18	100.19	156.89	180.94	126.36
BL X RDF_2	40.58	66.96	109.25	150.22	107.41
BL X RDF_3	38.67	55.70	61.01	103.82	78.99
GM X RDF_1	44.49	68.65	103.93	138.95	100.57
GM X RDF_2	37.44	48.39	66.97	96.54	74.23
GM X RDF_3	34.84	38.64	43.34	77.20	62.25
NO X RDF_1	41.07	64.93	102.43	129.02	113.27
NO X RDF_2	34.59	44.96	59.45	87.00	82.38
NO X RDF_3	24.60	36.92	49.87	59.42	61.79
SEm±	0.882	0.916	3.566	2.492	2.575
C D at 5%	NS	2.539	9.884	6.907	7.138

DAR = Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

4.1.1.6 Leaf area (LA) (dm^2/plant)

The leaf area at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables. 7, 7a and 7b.

The leaf area (dm^2/plant) at various growth stages averaged over two years as influenced by organic and inorganic fertilizers showed significant difference. Application of organics, exerted significantly higher leaf area recording a maximum with application of BL over GM at 120, 180 DAP/R and at harvest. At 240 DAP/R except GM, all other organics produced significantly higher leaf area over no organic treatment.

The application of RDF_1 significantly registered higher leaf area at all the growth stages except at 60 DAP/R over RDF_2 and RDF_3 except at 180 DAP/R wherein RDF_1 and RDF_2were exhibited on par leaf area. Further it was also observed that the leaf area was on par with RDF_2 and RDF_3 at harvest.

The interaction effects due to various organic and inorganic fertilizers at various stages of growth differed significantly except at 60 DAP/R. Application of TR X RDF_1, FYM X RDF_1, FYM X RDF_2, VC X RDF_1, BL X RDF_1, BL X RDF_2 and GM X RDF_1 exerted significantly higher leaf area compared to other treatment

Table 7. Leaf area in sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Leaf area [dm2/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	16.02	48.19	53.56	70.47	73.14
FYM	15.81	49.04	53.39	70.47	72.79
VC	15.91	48.05	53.20	70.65	74.19
BL	16.37	50.76	59.63	74.58	74.04
GM	15.96	45.83	49.72	68.65	72.86
NO	15.82	47.75	51.44	68.52	71.35
SEm ±	0.392	1.150	0.994	1.552	1.015
C D at 5 %	NS	3.192	2.752	4.302	2.814
B.Chemical fertilizers					
RDF_1	15.84	51.23	55.08	74.33	75.81
RDF_2	16.08	48.56	54.29	71.09	71..61
RDF_3	16.02	45.32	51.11	66.43	71.77
SEm±	0.242	0.649	0.766	0.819	0.969
C D at 5%	NS	1.803	2.123	2.472	2.682
Interaction [AXB]					
TR X RDF_1	16.16	52.77	55.39	72.92	75.45
TR X RDF_2	15.61	48.83	54.42	69.85	72.83
TR X RDF_3	16.29	44.97	50.88	68.64	71.14
FYM X RDF_1	15.62	51.26	55.82	74.55	75.45
FYM X RDF_2	15.91	50.22	54.19	70.67	71.48
FYM X RDF_3	16.02	45.62	50.18	67.33	71.46
VC X RDF_1	15.23	51.35	52.62	75.10	75.99
VC X RDF_2	16.67	48.46	54.65	71.34	73.44
VC X RDF_3	15.82	46.12	52.35	65.52	73.15
BL X RDF_1	16.47	53.29	61.57	76.92	79.42
BL X RDF_2	16.36	50.49	59.75	11.62	69.43
BL X RDF_3	16.27	48.49	57.58	69.15	73.26
GM X RDF_1	15.93	50.18	52.23	73.32	74.43
GM X RDF_2	15.95	45.08	50.81	68.69	71.29
GM X RDF_3	15.90	42.24	46.12	63.89	72.85
NO X RDF_1	15.75	50.49	53.02	74.01	73.28
NO X RDF_2	15.98	48.28	51.94	68.39	71.18
NO X RDF_3	15.75	44.47	49.55	64.05	68.77
SEm±	0.690	1.592	1.876	2.182	2.374
C D at 5%	NS	4.972	5.207	6.082	6.581

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table7a. Leaf area in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Leaf area [dm²/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	16.38	48.18	51.55	70.03	72.71
FYM	15.99	48.53	51.98	70.64	72.15
VC	16.20	48.56	53.43	70.67	74.79
BL	16.16	49.76	57.73	73.41	77.27
GM	16.19	45.43	48.92	68.72	72.32
NO	16.34	47.44	50.99	69.49	72.37
SEm ±	0.686	1.498	1.013	1.503	1.273
C D at 5 %	NS	4.452	3.012	4.462	3.782
B.Chemical fertilizers					
RDF_1	16.13	50.97	54.15	72.99	76.37
RDF_2	16.49	48.04	52.89	70.86	72.76
RDF_3	16.24	44.93	50.26	67.62	72.16
SEm±	0.469	0.956	0.893	0.961	0.793
C D at 5%	NS	2.652	2.472	2.662	2.0205
Interaction [AXB]					
TR X RDF_1	16.43	50.81	52.89	71.84	75.18
TR X RDF_2	16.16	48.74	52.53	69.49	71.66
TR X RDF_3	16.56	44.99	49.23	68.77	71.29
FYM X RDF_1	15.34	51.08	53.79	74.55	75.81
FYM X RDF_2	16.34	48.92	52.71	67.67	71.84
FYM X RDF_3	16.28	45.58	49.46	67.69	71.79
VC X RDF_1	15.34	51.26	56.14	74.01	76.53
VC X RDF_2	17.15	48.37	53.25	70.85	74.19
VC X RDF_3	16.11	46.03	50.90	67.15	73.64
BL X RDF_1	16.79	52.17	58.03	73.55	81.63
BL X RDF_2	16.61	49.64	57.76	77.73	75.99
BL X RDF_3	16.43	47.47	57.40	68.73	74.19
GM X RDF_1	16.25	49.64	51.44	71.84	74.19
GM X RDF_2	16.25	44.76	49.64	67.88	71.66
GM X RDF_3	16.07	41.87	45.67	66.42	71.12
NO X RDF_1	16.61	50.86	58.62	52.82	73.10
NO X RDF_2	16.43	47.83	51.44	69.31	71.25
NO X RDF_3	15.97	83.64	48.92	66.97	70.94
SEm±	1.150	2.342	1.902	2.354	1.944
C D at 5%	NS	6.492	5.272	6.521	5.382

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 7b. Leaf area in sugarcane at various growth stages as influenced by organic and inorganic fesrtilizers

Treatment	Leaf area [dm²/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	15.66	48.19	55.58	70.91	73.57
FYM	15.64	49.55	54.81	71.10	72.44
VC	15.62	48.74	52.98	70.64	73.50
BL	16.13	51.76	61.54	75.76	70.80
GM	15.73	46.24	50.53	68.59	73.40
NO	15.31	48.10	51.88	67.54	70.34
SEm ±	0.531	1.622	0.989	1.659	1.392
C D at 5 %	NS	4.820	2.947	4.932	NS
B.Chemical fertilizers					
RDF_1	15.56	51.48	56.00	75.67	75.24
RDF_2	15.67	49.10	55.70	71.33	70.46
RDF_3	15.81	45.70	51.95	65.24	71.30
SEm±	0.312	0.880	0.710	1.298	0.993
C D at 5%	NS	2.494	1.972	3.602	2.682
Interaction [AXB]					
TR X RDF_1	15.88	50.72	57.8	74.05	75.72
TR X RDF_2	15.07	48.92	56.32	70.22	74.00
TR X RDF_3	16.02	44.94	52.53	68.50	70.98
FYM X RDF_1	15.69	51.44	57.85	74.55	75.10
FYM X RDF_2	15.48	51.53	55.68	71.66	71.12
FYM X RDF_3	15.75	45. 67	50.90	66.92	71.12
VC X RDF_1	15.12	51.44	49.10	76.17	75.45
VC X RDF_2	16.20	48.56	56.05	71.84	72.69
VC X RDF_3	15.52	46.21	53.79	63.89	72.65
BL X RDF_1	16.16	54.42	65.12	80.39	77.21
BL X RDF_2	16.11	51.35	61.73	77.30	62.86
BL X RDF_3	16.11	49.50	57.76	69.58	72.34
GM X RDF_1	15.61	50.72	53.02	74.91	74.68
GM X RDF_2	15.66	45.39	51.98	69.49	70.94
GM X RDF_3	15.93	42.59	46.52	61.32	74.59
NO X RDF_1	14.89	50.13	53.62	72.20	74.91
NO X RDF_2	15.52	48.74	52.44	67.46	71.12
NO X RDF_3	15.52	45.31	50.18	61.15	66.61
SEm±	0.764	2.156	1.863	2.801	2.189
C D at 5%	NS	5.972	5.167	7.777	6.062

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

except due to RDF_1 at all the latter stages. Except at 180 DAP/R as at this stage only BL in conjunction with all levels of fertilizers exhibited significantly higher leaf area compared to all other treatment combinations.

4.1.1.7 Leaf area index (LAI)

The leaf area index at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.8, 8a and 8b.

The leaf area index at various growth stages averaged over two years as influenced by various growth stages differed significantly at all the stages except 60 DAP/R (Days after planting/ratoon initiation). At all the stages, application of BL exerted significantly higher LAI over no organic treatment and only at 180 DAP/R, 240 DAP/R and at harvest wherein it was on par with GM, VC and rest of the organics with their respective stages. No organic treatment recorded significantly lower LAI compared to all other organic treatments except GM at 180 and 240 DAP/R.

Application of inorganic fertilizers significantly influenced the LAI at various growth stages except at 60 DAP/R. The LAI was significantly higher (2.84) due to application of RDF_1 over

Table 8. Leaf area index in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Leaf area index				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	0.89	2.67	2.97	3.91	4.05
FYM	0.88	2.72	2.96	3.93	4.03
VC	0.89	2.70	2.95	3.92	4.11
BL	0.97	2.82	3.30	1.13	4.10
GM	0.89	2.54	3.25	3.81	4.04
NO	0.90	2.65	2.85	3.80	3.95
SEm ±	0.038	0.079	0.049	0.095	0.068
C D at 5 %	NS	0.221	0.143	0.256	0.192
B.Chemical fertilizers					
RDF_1	0.89	2.84	3.10	4.12	4.20
RDF_2	0.91	2.69	3.01	3.94	3.97
RDF_3	0.89	2.51	2.84	3.69	3.98
SEm±	0.026	0.047	0.036	0.051	0.035
C D at 5%	NS	0.135	0.108	0.143	0.111
Interaction [AXB]					
TR X RDF_1	0.91	2.82	3.07	4.04	4.18
TR X RDF_2	0.80	2.71	3.02	3.87	4.01
TR X RDF_3	0.91	2.49	2.82	3.80	3.94
FYM X RDF_1	0.85	2.84	2.10	4.13	4.18
FYM X RDF_2	0.90	2.78	3.01	3.92	3.96
FYM X RDF_3	0.90	2.53	2.78	3.73	3.96
VC X RDF_1	0.85	2.85	2.92	4.16	4.21
VC X RDF_2	0.95	2.69	3.03	3.96	4.07
VC X RDF_3	0.89	2.56	2.90	3.63	4.06
BL X RDF_1	0.93	2.96	3.42	4.27	4.40
BL X RDF_2	0.92	2.80	3.31	4.30	3.85
BL X RDF_3	0.91	2.69	3.19	5.77	4.06
GM X RDF_1	0.90	2. 78	2.90	4.07	4.13
GM X RDF_2	0.90	2.50	2.82	3.81	3.93
GM X RDF_3	0.89	2.34	2.56	3.54	4.04
NO X RDF_1	0.92	2.80	2.93	4.03	4.11
NO X RDF_2	0.91	2.68	2.88	3.79	3.95
NO X RDF_3	0.88	2.47	2.75	3.53	3.81
SEm±	0.064	0.111	0.089	0.129	0.101
C D at 5%	NS	0.311	0.247	0.362	0.276

DAP/R = Days after planting or Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure@ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 8a. Leaf area index in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Leaf area index				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	0.90	2.67	2.86	3.88	4.03
FYM	0.85	2.69	2.88	3.91	4.05
VC	0.87	2.69	2.96	3.92	4.14
BL	0.91	2.76	3.19	4.07	4.28
GM	0.88	2.52	2.71	3.81	4.01
NO	0.88	2.63	2.83	3.85	4.01
SEm ±	0.027	0.083	0.093	0.115	0.071
C D at 5 %	NS	0.252	0.283	0.345	0.208
B.Chemical fertilizers					
RDF_1	0.88	2.82	3.00	4.04	4.23
RDF_2	0.89	2.66	2.23	3.93	4.03
RDF_3	0.89	2.49	2.79	3.75	3.99
SEm±	0.016	0.053	0.076	0.053	0.044
C D at 5%	NS	0.154	0.215	0.152	0.122
Interaction [AXB]					
TR X RDF_1	0.90	2.83	2.73	3.98	4.17
TR X RDF_2	0.87	2.70	2.91	3.85	3.97
TR X RDF_3	0.90	2.49	2.73	3.81	3.95
FYM X RDF_1	0.86	2.83	2.98	4.13	4.20
FYM X RDF_2	0.88	2.71	2.92	3.86	3.98
FYM X RDF_3	0.89	2.53	2.74	3.75	3.97
VC X RDF_1	0.84	2.84	3.11	4.10	4.24
VC X RDF_2	0.92	2.68	2.95	3.93	4.11
VC X RDF_3	0.88	2.55	2.82	3.72	4.08
BL X RDF_1	0.91	2.89	3.23	4.08	4.52
BL X RDF_2	0.91	2.75	3.20	4.32	4.21
BL X RDF_3	0.90	2.63	3.18	3.81	4.11
GM X RDF_1	0.88	2.75	2.85	3.98	4.11
GM X RDF_2	0.88	2.48	2.75	3.76	2.92
GM X RDF_3	0.89	2.32	2.53	3.68	3.94
NO X RDF_1	0.87	2.82	2.92	4.00	4.15
NO X RDF_2	0.89	2.65	2.85	3.84	3.95
NO X RDF_3	0.87	2.42	2.71	3.71	3.93
SEm±	0.039	0.131	0.186	0.130	0.108
C D at 5%	NS	0.362	0.523	0.365	0.302

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure@ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 8b. Leaf area index in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Leaf area index				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	0.85	2.67	3.08	3.93	4.07
FYM	0.86	2.75	3.04	3.94	4.01
VC	0.86	2.70	2.94	3.91	4.08
BL	0.89	2.87	3.41	4.19	3.92
GM	0.87	2.56	2.79	3.80	4.02
NO	0.84	2.66	2.87	3.74	3.89
SEm ±	0.029	0.089	0.055	0.110	0.157
C D at 5 %	NS	0.254	0.157	0.327	0.457
B.Chemical fertilizers					
RDF_1	0.80	2.85	3.10	4.14	4.17
RDF_2	0.86	2.72	3.08	3.95	3.90
RDF_3	0.87	2.53	2.88	3.62	3.96
SEm±	0.017	0.049	0.037	0.083	0.096
C D at 5%	NS	0.143	0.105	0.231	0.272
Interaction [AXB]					
TR X RDF_1	0.88	2.81	3.21	4.10	4.19
TR X RDF_2	0.83	2.71	3.12	3.89	4.10
TR X RDF_3	0.88	2.49	2.91	3.79	3.93
FYM X RDF_1	0.80	2.85	3.21	4.13	4.16
FYM X RDF_2	0.85	2.85	3.09	3.97	3.94
FYM X RDF_3	0.87	2.53	2.82	3.71	3.74
VC X RDF_1	0.83	2.85	2.72	4.22	4.18
VC X RDF_2	0.89	2.69	3.10	3.98	4.03
VC X RDF_3	0.86	2.56	2.98	3.54	4.00
BL X RDF_1	0.89	3.02	3.61	4.45	4.22
BL X RDF_2	0.89	2.85	3.42	4.28	3.48
BL X RDF_3	0.89	2.74	3.20	3.86	4.01
GM X RDF_1	0.86	2.81	2.94	4.15	4.14
GM X RDF_2	0.86	2.52	2.88	3.85	3.93
GM X RDF_3	0.88	2.36	2.58	3.40	4.13
NO X RDF_1	0.82	2.78	2.94	4.10	4.06
NO X RDF_2	0.86	2.70	2.91	3.74	3.74
NO X RDF_3	0.86	2.51	2.78	3.39	3.69
SEm±	0.042	0.119	0.092	0.204	0.200
C D at 5%	NS	0.334	0.257	0.567	0.667

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure@ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

RDF_2 and RDF_3 and further these latter levels too significantly varied at 120 DAP. Similar trend was also observed at 240 DAP/R. However at 180 DAP/R LAI though recorded significantly highest with RDF_1 but it was on par with RDF_2, but RDF_2 was on par with RDF_3 at harvest.

Except at 60 DAP/R, the interaction effects at various growth stages due to organic and inorganic fertilizers were significant. The pooled data indicated that application of BL X RDF_1, BL X RDF_2, TR X RDF_1, FYM X RDF_1, VC X RDF_1, GM X RDF_1 recorded significantly higher LAI value compared to sole application of RDF_1 at all the stages of growth except at 180 DAP/R wherein only BL X RDF_1, BL X RDF_2 and BL X RDF_3 exerted significantly higher LAI compred to all other treatment combinations.

4.1.2 NUTRIENT UPTAKE

4.1.2.1 Nitrogen (mg/plant)

The nitrogen uptake at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.9, 9a and 9b.

The nitrogen uptake [mg/plant] at various growth stages averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The application BL2 exhibited significantly higher nitrogen uptake (12.13) over other treatments except application of TR, VC and GM. Application of FYM had on par uptake with no organics at 60 DAP/R (Days after planting/ratoon initiation). However, as growth stages advanced, application of BL showed significantly higher nitrogen uptake at all the latter stages over other treatments. Further it was also revealed that application of other organic manures viz., TR, FYM, VC and GM were also found superior interms of nitrogen uptake over inorganic treatments and were on par with each other except at 120 and 240 DAP/R wherein the nitrogen uptake due to application of GM was on par with no organics treatment.

Application of inorganic fertilizers significantly enhanced the nitrogen uptake. At 60 DAP/R, the nitrogen uptake was significantly higher due to RDF_1 (12.41) over RDF_2 (10.91) and RDF_3 (6.76) and latter two treatments also differed significantly. Significantly lower nitrogen uptake was observed in RDF_3. Similarly, at all other stages, reduction in levels of inorganic fertilizers significantly decreased the nitrogen uptake.

Table 9. Nitrogen uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Nitrogen uptake [mg/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	10.82	19.02	28.19	32.43	38.65
FYM	9.57	17.04	30.28	39.32	41.26
VC	10.88	16.71	27.98	36.23	37.82
BL	12.13	30.12	43.23	56.04	53.80
GM	10.63	15.74	27.49	39.24	41.37
NO	9.55	14.12	24.58	31.43	34.43
SEm ±	0.054	0.896	1.034	2.264	1.904
C D at 5 %	1.534	2.482	2.863	6.272	5.275
B.Chemical fertilizers					
RDF_1	12.41	30.71	51.85	56.16	48.15
RDF_2	10.91	16.05	27.57	38.21	40.13
RDF_3	6.76	10.71	15.81	25.02	29.32
SEm±	0.659	1.175	1.295	1.037	1.115
C D at 5%	1.827	3.256	3.421	2.872	3.089
Interaction [AXB]					
TR X RDF_1	12.99	34.49	50.54	49.95	54.67
TR X RDF_2	10.92	15.28	23.01	35.59	36.34
TR X RDF_3	8.75	11.04	15.85	23.48	26.12
FYM X RDF_1	10.87	30.10	54.91	58.06	56.72
FYM X RDF_2	11.71	15.14	26.22	39.03	39.95
FYM X RDF_3	11.56	9.02	14.99	23.40	25.84
VC X RDF_1	12.63	28.36	44.64	52.91	50.65
VC X RDF_2	11.11	15.52	24.51	34.08	34.93
VC X RDF_3	8.92	8.98	17.70	24.05	29.12
BL X RDF_1	14.01	43.35	73.13	77.48	69.52
BL X RDF_2	11.63	27.99	45.23	57.55	57.09
BL X RDF_3	16.76	20.58	18.91	36.21	37.76
GM X RDF_1	12.41	28.68	46.79	58.56	51.92
GM X RDF_2	10.38	11.68	25.99	36.12	41.84
GM X RDF_3	7.27	8.57	14.13	25.94	30.90
NO X RDF_1	11.54	25.82	41.87	49.32	48.95
NO X RDF_2	9.64	11.51	21.83	28.79	32.94
NO X RDF_3	7.57	7.81	13.54	18.56	23.59
SEm±	0.835	2.349	3.495	1.995	1.887
C D at 5%	2.314	6.508	9.682	5.527	5.226

DAP/R = Days after planting or Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 9a. Nitrogen uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Nitrogen uptake [mg/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	8.17	16.93	28.88	27.93	37.23
FYM	8.30	16.40	3.97	40.16	41.73
VC	8.54	16.23	29.50	36.69	38.27
BL	8.77	28.75	44.19	56.50	51.46
GM	8.11	15.27	28.11	39.74	41.39
NO	7.80	13.55	25.65	32.19	35.49
SEm ±	0.077	0.936	1.342	2.058	2.210
C D at 5 %	0.229	2.779	3.986	6.112	6.564
B.Chemical fertilizers					
RDF_1	9.19	30.07	53.88	54.07	40.95
RDF_2	8.36	15.23	28.13	38.51	39.82
RDF_3	7.36	10.23	16.32	25.49	28.88
SEm±	0.858	1.321	1.452	1.252	1.420
C D at 5%	2.377	3.659	4.022	3.468	3.933
Interaction [AXB]					
TR X RDF_1	8.99	28.25	52.17	41.98	53.28
TR X RDF_2	8.16	14.19	23.59	35.25	34.21
TR X RDF_3	7.43	10.60	16.04	22.42	25.11
FYM X RDF_1	9.26	28.46	55.67	59.07	58.54
FYM X RDF_2	8.31	14.86	27.06	393.62	38.28
FYM X RDF_3	7.34	8.66	15.60	24.37	24.07
VC X RDF_1	9.29	27.87	48.27	54.18	51.23
VC X RDF_2	8.86	14.70	25.41	33.98	35.62
VC X RDF_3	7.49	8.81	18.24	24.57	29.45
BL X RDF_1	9.69	41.48	75.73	78.27	69.04
BL X RDF_2	8.87	26.67	44.90	57.51	52.60
BL X RDF_3	7.80	19.75	19.94	36.58	34.09
GM X RDF_1	9.19	28.67	47.62	58.89	49.29
GM X RDF_2	8.26	12.35	26.55	36.61	44.28
GM X RDF_3	6.95	8.20	14.62	26.44	31.13
NO X RDF_1	8.65	25.89	44.87	50.86	50.18
NO X RDF_2	7.71	10.69	22.39	28.96	34.05
NO X RDF_3	7.07	7.14	13.95	19.15	23.96
SEm±	1.025	2.451	3.672	2.075	1.922
C D at 5%	2.839	6.789	10.171	5.748	5.323

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 9b. Nitrogen uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Nitrogen uptake [mg/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	13.46	21.12	27.49	36.92	40.07
FYM	10.84	17.67	29.58	38.48	40.79
VC	13.21	17.19	26.45	35.76	37.37
BL	15.48	31.48	42.27	55.58	56.14
GM	13.15	16.20	26.86	38.74	41.34
NO	11.29	14.69	23.51	30.66	33.37
SEm ±	0.067	1.106	1.152	3.109	2.225
C D at 5 %	0.199	3.284	3.421	9.233	6.608
B.Chemical fertilizers					
RDF_1	15.63	33.34	49.81	58.25	55.35
RDF_2	13.45	16.86	27.00	37.91	40.4
RDF_3	6.16	11.18	15.30	24.54	29.75
SEm±	0.722	1.108	1.321	1.33	1.321
C D at 5%	1.999	3.069	3.656	3.692	3.659
Interaction [AXB]					
TR X RDF_1	16.98	40.74	48.91	57.91	56.05
TR X RDF_2	13.68	16.27	22.42	35.94	38.46
TR X RDF_3	10.07	11.47	15.66	24.54	27.13
FYM X RDF_1	12.48	31.74	54.15	57.06	54.90
FYM X RDF_2	15.11	15.42	25.38	38.43	41.61
FYM X RDF_3	15.77	9.38	14.39	22.93	27.60
VC X RDF_1	15.96	28.85	11.01	51.63	50.07
VC X RDF_2	13.35	16.35	23.60	34.17	34.23
VC X RDF_3	10.34	9.14	17.16	23.52	28.78
BL X RDF_1	18.53	45.22	70.52	76.69	69.99
BL X RDF_2	14.39	29.30	45.56	57.59	61.59
BL X RDF_3	13.72	21.40	17.87	35.84	41.04
GM X RDF_1	15.63	28.69	45.96	58.22	54.54
GM X RDF_2	12.52	11.00	25.44	35.63	39.40
GM X RDF_3	7.58	8.94	13.64	25.44	30.67
NO X RDF_1	14.43	25.75	38.86	47.78	47.71
NO X RDF_2	11.57	12.32	21.27	28.61	31.82
NO X RDF_3	8.06	8.48	13.13	17.96	23.22
SEm±	0.822	2.242	3.411	1.990	2.217
C D at 5%	2.277	6.210	9.148	5.512	6.141

DAR = Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

The pooled data indicated that the interaction effects were significant. Application of BL X RDF_1, TR X RDF_1, FYM X RDF_1 and GM X RDF_1 showed on par results and were significantly superior over other treatments at 60 DAP/R. All the stages, exhibited significantly highest nitrogen uptake due to application of BL in conjunction with RDF_1 and further it was observed that application of TR X RDF_1, FYM X RDF_1, VC X RDF_1, BL X RDF_2 and GM X RDF_1 were at par in respect to N uptake but exerted significantly higher nitrogen uptake over low application of inorganic fertilizers and also over other treatment combinations at the advanced stages of crop growth expect that 60 DAP/R.

4.1.2.2 Phosphorus (mg/plant)

The phosphorus uptake of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.10, 10a and 10b.

The uptake of P_2O_5 by sugarcane at different growth stages as influenced by various organic and inorganic fertilizers showed significant difference. At 60 DAP/R (Days after planting/Ratoon initiation) significantly higher uptake of P_2O_5 was observed due to application of BL over application of VC and no organic were which inturn showed on par results. However at

latter stages except at 120 DAP/R significantly higher uptake of P_2O_5 was recorded with application of BL over rest of the treatments but at 120 DAP/R it was on par with application of GM. Further at all the stages of plant growth, application of GM did not influence significantly the uptake of P_2O_5 over no organic treatments. On the contrary, other organics registered significantly higher uptake of P_2O_5.

At 60 DAP/R application of RDF_1 (1.03) recorded significantly higher uptake of P_2O_5 compared to RDF_2 (0.74) and RDF_3 (0.44) but at 60 DAP, RDF_1 was on par with RDF_2. At 60 DAP/R onwards except at 240 DAP/R significantly higher P_2O_5 uptake was observed due to higher levels of inorganic fertilizers and as the levels of inorganic fertilizers were reduced, there was significant decrease in the uptake of P_2O_5. However at 240 DAP/R, both for plant and ratoon and also pooled data showed on par uptake with RDF_1 and RDF_2.

The interaction effects due to organic and inorganic fertilizers were found significant at all growth stages. Application of TR, VC, BL, GM along with RDF_1 exerted significantly higher uptake of P_2O_5 over all the treatment combinations except at 60

Table 10. Phosphorus uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Phosphorus uptake [mg/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	0.76	1.49	2.02	2.49	2.46
FYM	0.79	1.25	1.97	3.25	2.51
VC	0.72	1.24	1.85	3.15	2.31
BL	0.88	1.93	2.99	4.92	3.28
GM	0.73	1.41	2.26	3.94	3.05
NO	0.72	1.13	1.73	2.46	2.38
SEm ±	0.054	0.203	0.249	0.224	0.081
C D at 5 %	0.151	0.563	0.692	0.621	0.225
B.Chemical fertilizers					
RDF_1	1.03	2.04	3.65	4.93	4.11
RDF_2	0.74	1.29	1.77	4.18	2.58
RDF_3	0.44	0.82	1.11	3.41	1.74
SEm±	0.091	0.116	0.024	0.0327	0.040
C D at 5%	0.251	0.322	0.219	0.327	0.308
Interaction [AXB]					
TR X RDF_1	0.97	2.21	3.48	4.30	3.57
TR X RDF_2	0.77	1.29	1.66	3.07	2.29
TR X RDF_3	0.57	1.02	1.13	1.38	1.71
FYM X RDF_1	0.88	2.02	3.67	4.95	3.73
FYM X RDF_2	0.81	1.27	1.57	3.33	2.51
FYM X RDF_3	0.56	1.01	0.98	1.62	1.68
VC X RDF_1	1.01	1.87	3.03	4.65	3.32
VC X RDF_2	0.65	1.14	1.63	3.17	1.93
VC X RDF_3	0.57	0.74	1.31	1.62	1.65
BL X RDF_1	1.34	2.96	5.54	7.89	5.96
BL X RDF_2	1.03	1.88	3.34	5.99	3.74
BL X RDF_3	0.90	1.36	1.49	3.03	2.34
GM X RDF_1	1.08	1.75	2.95	5.05	4.48
GM X RDF_2	0.60	0.96	1.62	3.07	2.95
GM X RDF_3	0.45	0.92	0.95	1.74	2.39
NO X RDF_1	0.91	1.76	2.94	3.73	3.22
NO X RDF_2	0.61	0.95	1.34	2.28	2.11
NO X RDF_3	0.48	0.70	0.94	1.17	1.38
SEm±	0.157	0.146	0.125	0.505	0.334
C D at 5%	0.435	0.455	0.345	1.398	0.925

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 10a. Phosphorus uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Phosphorus uptake [mg/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	0.54	1.36	2.19	2.05	2.27
FYM	0.59	1.32	2.04	3.21	2.55
VC	0.57	1.26	1.97	3.14	2.67
BL	0.62	1.94	3.05	5.01	2.94
GM	0.71	1.38	2.24	3.90	2.76
NO	0.54	1.06	1.73	2.05	22.18
SEm ±	0.069	0.342	0.322	0.216	0.095
C D at 5 %	0.205	1.016	0.956	0.642	0.282
B.Chemical fertilizers					
RDF_1	0.76	1.94	3.77	4.80	3.90
RDF_2	0.56	1.26	1.83	4.12	2.43
RDF_3	0.44	0.72	1.17	3.36	1.62
SEm±	0.097	0.211	0.029	0.402	0.038
C D at 5%	0.269	0.584	0.080	1.114	0.105
Interaction [AXB]					
TR X RDF_1	0.65	1.85	3.75	3.52	3.46
TR X RDF_2	0.54	1.28	1.79	2.94	2.14
TR X RDF_3	0.47	0.96	1.18	1.30	1.61
FYM X RDF_1	0.79	1.90	3.88	4.89	3.76
FYM X RDF_2	0.55	1.25	1.56	3.28	2.37
FYM X RDF_3	0.44	0.79	0.99	1.63	1.69
VC X RDF_1	0.77	1.91	3.17	4.82	3.29
VC X RDF_2	0.55	1.15	1.77	3.05	1.98
VC X RDF_3	0.45	0.89	1.30	1.66	1.69
BL X RDF_1	0.91	2.94	5.46	8.01	5.10
BL X RDF_2	0.75	1.77	3.28	5.89	3.43
BL X RDF_3	0.59	1.28	1.48	2.59	2.07
GM X RDF_1	0.72	1.73	2.89	5.14	2.78
GM X RDF_2	0.43	1.01	1.60	3.15	3.26
GM X RDF_3	0.36	1.00	0.94	1.75	2.22
NO X RDF_1	0.70	1.69	2.93	3.72	3.27
NO X RDF_2	0.46	0.97	1.48	2.24	2.16
NO X RDF_3	0.40	0.71	1.07	1.14	1.39
SEm±	0.188	0.132	0.221	0.605	0.432
C D at 5%	0.521	0.366	0.612	1.676	1.197

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 10b. Phosphorus uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Phosphorus uptake [mg/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	0.97	1.62	1.84	2.92	2.69
FYM	0.99	1.38	1.89	3.29	2.47
VC	0.86	1.21	1.73	3.15	2.25
BL	1.14	1.91	2.92	4.83	3.61
GM	0.74	1.44	2.27	3.97	2.74
NO	0.90	1.19	1.73	2.86	2.34
SEm ±	0.042	0.950	0.219	0.286	0.091
C D at 5 %	0.125	0.624	0.650	0.849	0.270
B.Chemical fertilizers					
RDF_1	1.29	2.13	3.52	5.05	4.32
RDF_2	0.91	1.31	1.70	4.24	2.72
RDF_3	0.43	0.91	1.05	3.45	1.86
SEm±	0.105	0.079	0.020	0.302	0.027
C D at 5%	0.291	0.219	0.055	0.837	0.074
Interaction [AXB]					
TR X RDF_1	1.28	2.57	3.20	5.08	3.67
TR X RDF_2	1.00	1.29	1.52	3.20	2.44
TR X RDF_3	0.67	1.07	1.07	1.45	1.81
FYM X RDF_1	0.96	2.14	3.45	5.01	3.70
FYM X RDF_2	1.06	1.29	1.57	3.38	2.65
FYM X RDF_3	0.68	1.82	0.97	1.60	1.67
VC X RDF_1	1.25	1.83	2.89	4.48	3.34
VC X RDF_2	0.75	1.12	1.49	3.29	1.88
VC X RDF_3	0.69	0.59	1.31	1.57	1.61
BL X RDF_1	1.76	2.98	5.61	7.76	6.81
BL X RDF_2	1.30	1.99	3.39	6.08	4.05
BL X RDF_3	1.05	1.43	1.49	3.46	2.61
GM X RDF_1	1.43	1.77	3.00	4.96	6.19
GM X RDF_2	0.76	0.91	1.64	2.99	2.63
GM X RDF_3	0.53	0.83	0.95	1.72	2.55
NO X RDF_1	1.11	1.83	2.94	3.74	3.16
NO X RDF_2	0.76	0.92	1.20	2.32	2.06
NO X RDF_3	0.46	0.68	0.81	1.19	1.37
SEm±	0.142	0.181	0.110	0.403	0.228
C D at 5%	0.393	0.501	0.304	1.116	0.631

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

DAP/R. However there onwards at all stages application of BL in conjunction with RDF_1 recorded significantly higher uptake of P_2O_5. Further it was recorded that application of TR X RDF_1, FYM X RDF_1, VC X RDF_1, BL X RDF_2 and GM X RDF_1 gave significantly higher uptake of P_2O_5 over other treatment combinations including RDF_1 alone.

4.1.2.3 Potassium (mg/plant)

The uptake of potassium by sugarcane at various growth stages is presented in Tables.11, 11a and 11b.

The uptake of potassium (mg/plant) at various growth stages as influenced by organic and inorganic fertilizers differed significantly. The significantly higher uptake of K_2O was observed at all the stages of crop growth due to application of BL. At 60 DAP/R (Days after planting/Ratoon initiation) application of BL had significantly higher uptake of K_2O (14.31) over other treatments which were inturn had on par uptake. However at advanced growth stages, except at harvest significantly lower K_2O uptake was recorded with no organic treatment compared to all other organic sources and at harvest application of VC showed on par uptake of K_2O with no organics. In general, all the

Table 11. Potassium uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Potassium uptake [mg/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	12.12	26.25	30.66	40.98	33.83
FYM	12.17	25.27	33.26	54.30	35.62
VC	12.56	74.07	31.27	45.92	33.06
BL	14.31	35.04	48.44	71.52	59.38
GM	12.52	24.09	31.00	50.17	35.72
NO	11.76	21.63	27.89	36.38	31.13
SEm ±	0.571	1.128	0.798	0.910	0.974
C D at 5 %	1.582	3.124	2.210	2.521	2.425
B.Chemical fertilizers					
RDF_1	15.29	38.34	51.83	70.43	60.88
RDF_2	12.83	23.61	29.53	49.21	35.55
RDF_3	7.83	18.03	21.92	33.49	25.23
SEm±	0.657	0.963	1.377	1.234	1.139
C D at 5%	1.821	2.668	3.815	3.418	3.157
Interaction [AXB]					
TR X RDF_1	15.46	33.80	50.05	62.84	45.96
TR X RDF_2	12.73	23.82	25.10	47.99	32.72
TR X RDF_3	9.79	19.45	21.96	20.31	23.22
FYM X RDF_1	13.31	36.76	53.57	72.41	50.26
FYM X RDF_2	12.37	23.71	27.09	51.95	34.89
FYM X RDF_3	9.91	16.59	20.71	31.89	24.26
VC X RDF_1	15.75	33.65	44.64	66.29	40.56
VC X RDF_2	12.63	21.52	26.42	40.99	31.41
VC X RDF_3	9.65	16.81	24.30	36.29	25.63
BL X RDF_1	17.16	50.51	75.77	92.98	56.25
BL X RDF_2	14.25	31.16	46.61	69.88	46.62
BL X RDF_3	1.71	24.37	26.27	47.50	32.47
GM X RDF_1	15.10	33.59	45.74	71.69	74.23
GM X RDF_2	12.05	21.78	28.79	45.70	35.87
GM X RDF_3	10.63	16.29	19.65	35.13	25.54
NO X RDF_1	14.89	32.14	48.57	63.51	43.62
NO X RDF_2	11.91	19.26	23.64	38.13	30.08
NO X RDF_3	8.77	14.70	18.70	25.08	20.90
SEm±	0.551	2.101	2.525	0.948	1.345
C D at 5%	1.527	5.821	6.995	2.625	3.725

DAP/R = Days after planting or Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 11a. Potassium uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Potassium uptake [mg/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	8.97	24.40	31.99	35.57	32.68
FYM	9.60	24.60	34.49	52.48	35.68
VC	9.93	123.50	33.25	47.31	33.23
BL	10.42	34.03	49.27	72.95	56.61
GM	9.32	23.05	31.90	51.17	34.95
NO	9.34	21.08	29.11	32.48	31.88
SEm ±	0.622	0.231	0.992	0.927	0.968
C D at 5 %	1.847	3.656	2.946	2.275	2.875
B.Chemical fertilizers					
RDF_1	11.21	35.87	53.34	68.47	60.12
RDF_2	9.67	23.08	30.63	50.40	35.26
RDF_3	8.21	17.68	23.06	34.48	24.72
SEm±	0.725	1.082	1.422	1.421	1.242
C D at 5%	2.008	2.997	3.939	3.936	3.440
Interaction [AXB]					
TR X RDF_1	10.77	34.20	51.91	53.54	45.74
TR X RDF_2	9.23	23.26	25.98	47.98	31.27
TR X RDF_3	8.01	19.21	23.14	29.41	22.10
FYM X RDF_1	11.18	35.78	54.56	73.75	51.85
FYM X RDF_2	9.58	23.20	28.31	53.01	33.53
FYM X RDF_3	8.18	16.17	22.04	33.03	24.07
VC X RDF_1	11.55	32.96	48.27	69.02	41.35
VC X RDF_2	10.29	20.90	27.48	42.26	32.51
VC X RDF_3	8.27	16.44	25.48	41.56	26.32
BL X RDF_1	11.98	48.45	76.46	88.06	54.67
BL X RDF_2	10.61	29.58	47.42	69.30	44.07
BL X RDF_3	8.78	24.02	27.32	48.77	29.70
GM X RDF_1	10.89	33.05	46.66	72.24	43.29
GM X RDF_2	9.16	21.42	29.75	47.04	37.76
GM X RDF_3	8.07	15.83	20.58	35.96	24.71
NO X RDF_1	10.97	31.07	43.97	65.12	44.36
NO X RDF_2	9.21	19.04	24.80	38.95	30.18
NO X RDF_3	7.93	14.22	19.69	26.00	21.39
SEm±	0.625	2.852	2.428	1.009	1.442
C D at 5%	1.731	7.900	6.726	2.795	3.994

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 11b. Potassium uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Potassium uptake [mg/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	15.27	29.10	29.33	46.39	34.98
FYM	14.74	25.93	32.03	56.12	36.16
VC	15.19	24.63	29.28	44.53	32.88
BL	18.19	36.04	47.61	76.08	62.15
GM	15.71	25.12	30.10	49.17	36.48
NO	14.17	22.17	26.68	40.27	30.38
SEm ±	0.422	1.082	0.711	0.892	0.911
C D at 5 %	1.253	3.214	2.112	2.649	2.706
B.Chemical fertilizers					
RDF_1	19.36	40.80	50.31	72.39	61.63
RDF_2	15.99	24.13	28.43	48.01	35.84
RDF_3	7.45	18.38	20.78	32.49	25.81
SEm±	0.598	0.905	1.311	1.221	1.118
C D at 5%	1.656	2.507	3.631	3.382	3.097
Interaction [AXB]					
TR X RDF_1	20.14	33.40	48.18	72.13	46.18
TR X RDF_2	16.22	24.38	24.22	48.01	34.16
TR X RDF_3	11.56	19.69	20.77	31.21	24.33
FYM X RDF_1	15.43	37.74	52.57	71.07	48.67
FYM X RDF_2	15.15	24.22	25.88	50.89	36.25
FYM X RDF_3	1.64	17.02	19.37	30.74	24.49
VC X RDF_1	19.94	34.33	41.01	63.56	39.77
VC X RDF_2	14.97	22.13	25.36	39.72	30.31
VC X RDF_3	11.03	17.18	23.12	31.02	24.93
BL X RDF_1	22.38	52.56	75.08	96.50	57.83
BL X RDF_2	17.89	32.73	45.80	70.46	49.16
BL X RDF_3	14.63	24.71	25.22	46.23	35.24
GM X RDF_1	19.31	34.13	44.81	71.13	51.06
GM X RDF_2	14.93	22.14	27.82	44.36	33.98
GM X RDF_3	13.18	16.74	18.71	34.29	26.36
NO X RDF_1	18.80	33.20	41.17	61.89	42.90
NO X RDF_2	14.61	19.48	22.48	37.31	29.34
NO X RDF_3	9.60	15.18	17.71	24.16	20.41
SEm±	0.565	2.225	2.608	0.985	1.521
C D at 5%	1.565	6.163	7.279	2.728	4.213

DAR = Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

organics were found significantly superior in terms of K_2O uptake than no organic treatment.

The highest K_2O uptake was observed due to application of RDF_1 (15.29) over RDF_2 (12.83) and RDF_3 (7.83) and further latter two also differed significantly at 60 DAP/R. In rest of the growth stages, significantly superiority of RDF_1 interms of maximum uptake of K_2O then followed by RDF_2 and then RDF_3 was observed.

The pooled analysis revealed that the effects of interaction due to organic and inorganic fertilizers were significant. The uptake of K_2O was found significantly the highest at all the growth stages due to application of BL along with RDF_1 and further application of RDF_1 in conjunction with TR, FYM and GM and also BL along with RDF_2 showed significantly superior uptake of K_2O over rest of the combinations at all the stages except 60 and 120 DAP/R.

4.1.3 YIELD COMPONENTS AND YIELD

4.1.3.1 Number of internodes

The number of internodes of sugarcane at various growth stages is presented in Tables.12, 12a and 12b.

The internodal formation in sugarcane averaged over two years differed significantly at various growth stages except at 60 DAP/R. The number of internodes increased progressively from 60 DAP/R (Days after plant/Ratoon initiation) (1.82) till harvest (19.29). Application of BL significantly enhanced the number of internodes (6.98) compared no organic however, it was on par with that of TR, FYM, VC and GM in production of number of internodes at 120 DAP/R. At 180 and 240 DAP/R, application of BL though recorded significantly higher number of internodes [15.06 and 18.64 respectively) but was on par with TR and at harvest application of BL recorded (20.48) on par number of internodes with that of GM (19.35).

The varied levels of inorganic fertilizers failed to produce significant results on the number of internodes at 60 DAP/R. However, at 120 and 240 DAP/R, application of RDF_1 revealed significantly higher number of internodes over RDF_1 and it was on par with RDF_2. On the contrary at 180 DAP/R and at harvest RDF_1 had significantly higher number of internodes compared to RDF_2 and RDF_1.

The interaction effects due to organic and inorganic fertilizers were significant except at 60 DAP/R. As the growth

Table 12. Number of internodes in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Number of internodes				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	1.83	6.52	14.56	17.89	19.52
FYM	1.77	6.66	14.18	17.77	18.86
VC	1.80	6.59	13.99	17.71	19.00
BL	1.91	6.98	15.06	18.64	20.48
GM	1.81	6.63	13.68	17.08	19.35
NO	1.81	6.46	13.49	17.01	18.55
SEm ±	0.052	0.187	0.324	0.302	0.355
C D at 5 %	NS	0.518	0.898	0.837	0.984
B.Chemical fertilizers					
RDF_1	1.87	7.01	15.42	18.61	20.04
RDF_2	1.82	6.63	14.00	17.63	19.33
RDF_3	1.77	6.26	13.12	16.80	18.51
SEm±	0.031	0.151	0.227	0.225	0.229
C D at 5%	NS	0.419	0.229	0.624	0.635
Interaction [AXB]					
TR X RDF_1	1.89	6.82	15.68	18.98	20.27
TR X RDF_2	1.81	6.53	14.50	18.09	19.47
TR X RDF_3	1.78	6.22	13.51	16.59	18.88
FYM X RDF_1	1.86	7.02	15.56	18.57	19.52
FYM X RDF_2	1.77	6.68	13.99	17.82	18.99
FYM X RDF_3	1.68	6.27	12.98	16.91	18.07
VC X RDF_1	1.80	6.93	15.44	18.45	19.47
VC X RDF_2	1.83	6.62	13.85	17.63	19.14
VC X RDF_3	1.78	6.23	12.70	17.04	18.41
BL X RDF_1	1.96	7.43	15.85	19.82	21.59
BL X RDF_2	1.91	6.93	15.16	18.39	20.28
BL X RDF_3	1.86	6.38	14.16	17.69	19.56
GM X RDF_1	1.86	7.01	15.00	18.08	20.27
GM X RDF_2	1.79	6.63	13.43	16.93	19.49
GM X RDF_3	1.77	6.23	12.92	16.24	18.28
NO X RDF_1	1.87	6.88	14.96	17.77	19.14
NO X RDF_2	1.88	6.42	13.08	16.93	18.67
NO X RDF_3	1.77	6.07	12.45	16.34	17.85
SEm±	0.076	0.371	0.556	0.779	0.561
C D at 5%	NS	1.028	1.541	2.159	1.155

DAP/R = Days after planting or Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 12a. Number of internodes in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Number of internodes				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	1.78	6.15	13.02	16.78	19.96
FYM	1.74	6.47	13.32	16.86	19.25
VC	1.74	6.37	13.21	16.82	19.13
BL	1.83	6.82	13.78	17.66	20.26
GM	1.72	6.43	12.93	16.81	19.01
NO	1.77	6.16	13.02	16.66	18.90
SEm ±	0.097	0.324	0.550	0.457	0.565
C D at 5 %	NS	0.963	1.634	1.357	1.679
B.Chemical fertilizers					
RDF_1	1.83	6.80	14.17	17.60	19.92
RDF_2	1.75	6.31	13.05	16.72	19.51
RDF_3	1.71	6.10	12.43	16.48	18.83
SEm±	0.047	0.247	0.304	0.348	0.362
C D at 5%	NS	0.684	0.843	0.965	1.003
Interaction [AXB]					
TR X RDF_1	1.86	6.44	13.74	17.49	20.30
TR X RDF_2	1.72	6.10	13.15	16.44	19.85
TR X RDF_3	1.75	5.92	12.17	16.41	19.73
FYM X RDF_1	1.83	6.75	14.22	17.44	20.03
FYM X RDF_2	1.74	6.45	13.18	16.79	19.52
FYM X RDF_3	1.65	6.22	12.55	16.33	18.20
VC X RDF_1	1.72	6.63	14.23	12.30	19.55
VC X RDF_2	1.78	6.34	13.09	16.70	19.03
VC X RDF_3	1.72	6.15	12.32	16.46	18.80
BL X RDF_1	1.91	1.56	14.54	18.42	21.00
BL X RDF_2	1.83	6.67	13.91	17.41	19.98
BL X RDF_3	1.76	6.23	12.91	17.14	19.80
GM X RDF_1	1.82	6.84	13.85	17.75	19.30
GM X RDF_2	1.71	6.34	12.66	16.44	19.75
GM X RDF_3	1.63	6.12	12.29	16.24	17.98
NO X RDF_1	1.84	6.59	14.43	17.19	19.34
NO X RDF_2	1.94	6.00	12.28	16.54	18.96
NO X RDF_3	1.72	5.89	12.36	16.26	18.45
SEm±	0.114	0.610	0.743	0.852	0.887
C D at 5%	NS	1.691	2.059	2.362	2.459

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure@ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 12b. Number of internodes in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Number of internodes				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	1.87	6.89	16.11	18.99	19.09
FYM	1.80	6.84	15.03	18.68	18.47
VC	1.87	6.81	14.78	18.59	18.88
BL	1.98	7.13	16.33	19.61	20.69
GM	1.89	6.82	14.64	17.36	19.69
NO	1.86	6.75	13.97	17.36	18.20
SEm ±	0.038	0.145	0.385	0.338	0.435
C D at 5 %	NS	0.431	1.144	1.004	1.292
B.Chemical fertilizers					
RDF_1	1.92	7.23	16.66	19.60	20.17
RDF_2	1.88	6.95	14.96	18.55	19.16
RDF_3	1.84	6.45	13.81	17.13	18.19
SEm±	0.041	0.175	0.337	0.284	0.281
C D at 5%	NS	0.485	0.934	0.789	0.779
Interaction [AXB]					
TR X RDF_1	1.91	7.19	17.62	20.47	20.24
TR X RDF_2	1.89	6.98	15.85	19.75	18.99
TR X RDF_3	1.81	6.52	14.85	16.77	18.03
FYM X RDF_1	1.89	7.28	16.19	19.71	19.01
FYM X RDF_2	1.81	6.91	14.78	18.85	18.46
FYM X RDF_3	1.72	6.33	13.41	17.48	17.94
VC X RDF_1	1.88	7.72	16.64	19.59	19.38
VC X RDF_2	1.88	6.89	14.60	18.50	19.25
VC X RDF_3	1.84	6.31	13.09	17.62	18.01
BL X RDF_1	2.02	6.30	17.17	21.22	22.18
BL X RDF_2	1.98	7.18	16.42	19.38	20.58
BL X RDF_3	1.95	6.92	15.41	18.25	19.32
GM X RDF_1	1.90	7.18	16.16	18.41	21.25
GM X RDF_2	1.87	6.92	14.21	17.43	19.24
GM X RDF_3	1.90	6.35	13.55	16.24	18.58
NO X RDF_1	1.90	7.18	15.49	18.34	18.94
NO X RDF_2	1.87	6.83	13.88	17.32	18.42
NO X RDF_3	1.81	6.25	12.55	16.41	17.25
SEm±	0.009	0.428	0.826	0.699	0.689
C D at 5%	NS	1.186	2.269	1.938	1.909

DAR = Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure@ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

advanced, application of BL X RDF_1 recorded maximum number of internodes and was on par with TR X RDF_1 (20.27), BL X RDF_2 (20.28) and GM (20.27) but it was significantly superior over other treatments at harvest. Similarly, at other growth stages also the highest number of internodes owing to application of BL in conjunction with RDF_1 was observed.

4.1.3.2 Length of internode (cm)

The length of internode as influenced by organic and inorganic fertilizers is presented in Tables.13, 13a and 13b.

The length of internode averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The length of internode increased progressively from 60 DAP/R (Days after planting/Ratoon initiation) (2.83) till harvest (10.94). Application of BL exerted significantly higher internodal length at all the latter stages compared to application of other organics. However, at 120 DAP and 120 DAR did not differ significantly whereas pooled analysis did differ significantly. In all the latter growth stages, application of TR, FYM and VC gave significantly higher internodal length compared to no organics. Except at 240 DAP/R, application of GM produced on par internodal length with no organic treatment.

Table 13. Length of internode in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Length of internode (cm)				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	2.72	8.30	10.39	10.77	11.07
FYM	2.78	8.09	10.22	10.54	10.85
VC	2.85	7.90	10.12	10.52	10.93
BL	2.98	8.70	10.71	11.05	11.43
GM	2.87	7.93	9.94	10.39	10.87
NO	2.75	7.32	9.62	10.02	10.45
SEm ±	0.322	0.421	0.105	0.079	0.069
C D at 5 %	NS	1.172	0.292	0.221	0.193
B.Chemical fertilizers					
RDF_1	2.86	8.39	10.51	10.88	11.28
RDF_2	2.83	8.00	10.20	10.59	11.02
RDF_3	2.79	7.74	9.79	10.18	10.56
SEm±	0.308	0.272	0.221	0.110	0.113
C D at 5%	NS	NS	0.621	0.302	0.312
Interaction [AXB]					
TR X RDF_1	2.70	8.60	10.70	11.05	11.35
TR X RDF_2	2.80	8.40	10.50	10.85	11.15
TR X RDF_3	2.65	7.90	9.95	10.40	10.70
FYM X RDF_1	2.95	8.40	10.55	10.90	11.25
FYM X RDF_2	2.85	8.00	10.25	10.55	11.00
FYM X RDF_3	2.70	7.85	9.85	10.15	10.60
VC X RDF_1	2.75	8.40	10.55	10.90	11.30
VC X RDF_2	2.90	7.90	10.25	10.70	11.10
VC X RDF_3	2.90	7.40	9.55	9.95	10.40
BL X RDF_1	3.10	9.00	10.90	11.25	11.70
BL X RDF_2	2.85	8.60	10.70	11.05	11.50
BL X RDF_3	3.00	8.50	10.50	10.85	11.10
GM X RDF_1	2.90	8.50	10.25	10.70	11.35
GM X RDF_2	2.90	8.00	10.00	10.50	11.000
GM X RDF_3	2.80	7.60	9.55	9.95	10.35
NO X RDF_1	2.80	7.70	10.05	10.45	10.80
NO X RDF_2	2.75	7.10	9.50	9.85	10.35
NO X RDF_3	2.70	7.15	9.30	9.75	10.20
SEm±	0.347	0.421	0.221	0.218	0.297
C D at 5%	NS	NS	0.617	0.603	0.821

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 13a. Length of internode in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Length of internode (cm)				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	2.93	8.40	10.50	10.90	11.20
FYM	2.93	8.20	10.37	10.67	11.07
VC	2.90	8.07	10.27	10.63	11.03
BL	3.03	8.80	70.87	11.20	11.53
GM	2.93	8.03	10.10	10.50	10.93
NO	2.90	7.50	9.77	10.13	10.50
SEm ±	0.472	0.572	0.159	0.097	0.093
C D at 5 %	NS	NS	0.473	0.293	0.280
B.Chemical fertilizers					
RDF_1	2.98	8.52	10.65	10.98	11.38
RDF_2	2.93	8.12	10.33	10.72	11.12
RDF_3	2.92	7.87	9.95	10.32	10.63
SEm±	0.421	0.422	0.282	0.117	0.181
C D at 5%	NS	NS	0.782	0.321	0.504
Interaction [AXB]					
TR X RDF_1	2.9	8.70	10.80	11.20	11.50
TR X RDF_2	3.0	8.50	10.60	11.50	11.30
TR X RDF_3	2.9	8.00	10.10	10.50	10.80
FYM X RDF_1	3.10	8.50	10.70	11.00	11.40
FYM X RDF_2	2.90	8.10	10.47	10.70	11.10
FYM X RDF_3	3.00	8.00	10.00	10.30	10.70
VC X RDF_1	2.80	8.50	10.70	11.00	11.4
VC X RDF_2	3.00	8.10	10.40	10.80	11.20
VC X RDF_3	2.90	7.60	9.70	10.1	10.50
BL X RDF_1	3.20	9.10	11.10	11.40	11.9
BL X RDF_2	2.90	8.70	10.80	11.20	11.60
BL X RDF_3	3.0	8.60	10.70	11.00	11.20
GM X RDF_1	3.0	8.30	10.40	10.9	11.30
GM X RDF_2	2.90	8.10	10.20	10.60	11.10
GM X RDF_3	2.90	7.70	9.7	10.10	10.40
NO X RDF_1	2.90	8.00	10.20	10.50	10.90
NO X RDF_2	3.00	7.20	9.60	10.00	10.40
NO X RDF_3	2.80	7.30	9.50	9.90	10.2
SEm±	0.527	0.522	0.321	0.322	0.358
C D at 5%	NS	NS	0.890	0.893	0.993

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 13b. Length of internode in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter production (g/plant)				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	2.50	8.20	10.27	10.63	10.93
FYM	2.63	7.97	10.07	10.40	10.83
VC	2.80	7.73	9.97	10.40	10.83
BL	2.92	8.60	70.53	10.90	11.33
GM	2.80	7.83	9.77	10.27	10.80
NO	2.60	7.13	9.47	9.90	10.40
SEm ±	0.327	0.521	0.215	0.086	0.077
C D at 5 %	NS	NS	0.918	0.263	0.232
B.Chemical fertilizers					
RDF_1	2.73	8.25	10.37	10.77	11.17
RDF_2	2.73	7.88	10.07	10.45	10.92
RDF_3	2.67	7.60	9.62	10.03	10.48
SEm±	0.321	0.345	0.327	0.120	0.187
C D at 5%	NS	NS	0.918	0.332	0.521
Interaction [AXB]					
TR X RDF_1	2.5	8.50	10.60	10.90	11.20
TR X RDF_2	2.6	8.20	10.47	10.70	11.00
TR X RDF_3	2.4	7.80	9.80	10.30	10.60
FYM X RDF_1	2.7	8.30	10.40	10.50	11.10
FYM X RDF_2	2.8	7.90	10.10	10.40	11.90
FYM X RDF_3	2.4	7.70	9.70	10.00	10.50
VC X RDF_1	2.7	8.30	10.40	10.80	11.20
VC X RDF_2	2.8	7.70	10.1	10.60	11.00
VC X RDF_3	2.9	7.20	9.40	9.80	10.30
BL X RDF_1	3.00	8.90	10.70	11.10	11.6
BL X RDF_2	2.80	8.50	10.6	10.90	11.40
BL X RDF_3	3.0	8.40	10.30	10.70	11.00
GM X RDF_1	2.80	8.10	10.10	10.60	11.20
GM X RDF_2	2.90	7.90	9.80	10.40	10.90
GM X RDF_3	2.70	7.50	9.40	9.80	10.30
NO X RDF_1	2.70	7.40	9.90	10.40	10.70
NO X RDF_2	2.50	7.00	9.40	9.70	10.30
NO X RDF_3	2.60	7.0	9.10	9.60	10.2
SEm±	0.433	0.712	0.215	0.421	0.422
C D at 5%	NS	NS	0.605	1.173	1.172

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

The application of inorganic fertilizers failed to exert significant influence on internodal length of sugarcane at 60, 120 DAP/R. As growth advanced, significantly higher internodal length was observed due to application of RDF_1 compared to RDF_3. In all the latter stages of growth RDF_1 and RDF_2 recorded on par internodal length with each other.

The pooled analysis data revealed that the interaction effects were significant only at advanced growth stages (except at 60 and 120 DAP/R). The significantly higher internodal length was exhibited due to application of BL X RDF_1, BL X RDF_2, BL X RDF_3, TR X RDF_2, and VC X RDF_1 over other treatment combinations including application of various levels of inorganic fertilizers.

4.1.3.3 Cane diameter (cm)

The diameter of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.14, 14a and 14b.

The diameter of sugarcane averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The diameter of sugarcane increased positively as the growth stage advanced from 60 DAP/R (Days after planting/Ratoon initiation) till harvest (2.58). As the growth

advanced there was significant influence on the diameter of sugarcane. However, at 60 DAP/R and 120 DAP (Days after planting) diameter of cane did not differ significantly. In all the growth stages application of BL exerted significantly higher cane diameter over rest of the treatments except at harvest where it was on par with TR (2.58), VC (2.55) and GM (2.61). The other treatments at all stages except at harvest exhibited on par results even with no organic treatment..

Application of various levels of chemical fertilizers showed significant results on cane diameter. However, it was not significant at 60 DAP/R and also at 120 DAP/R though 120 DAP recorded significant variation of cane diameter. At 180 DAP/R significantly higher cane diameter was observed due to application of RDF_1 (1.87) over RDF_2 and RDF_3. Similar trend continued even at harvest also. At latter growth stages reduction in application of chemical fertilizers significantly decreased the cane diameter.

The pooled analysis indicated that the interaction effects due to organic and inorganic fertilizers were significant at all the stages except 60 and 120 DAP/R. Further it was revealed that application of BL X RDF_1 and BL X RDF_2 exerted significantly

Table 14. Diameter of sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Diameter [cm]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	0.98	1.05	1.72	2.32	2.58
FYM	0.80	1.00	1.69	2.31	2.54
VC	0.79	1.02	1.68	2.26	2.55
BL	0.81	1.24	1.92	2.44	2.79
GM	0.77	1.03	1.68	2.25	2.61
NO	0.79	0.98	1.60	2.28	2.43
SEm ±	0.022	0.028	0.063	0.057	0.079
C D at 5 %	NS	0.082	0.172	0.116	0.220
B.Chemical fertilizers					
RDF_1	0.88	1.06	1.87	2.46	2.89
RDF_2	0.85	1.08	1.76	2.30	2.57
RDF_3	0.74	1.02	1.52	2.17	2.29
SEm±	0.019	0.025	0.024	0.026	0.049
C D at 5%	NS	0.072	0.072	0.072	0.172
Interaction [AXB]					
TR X RDF_1	0.89	1.18	1.81	2.46	2.81
TR X RDF_2	1.29	1.02	1.88	2.33	2.54
TR X RDF_3	0.75	0.94	1.48	2.17	2.33
FYM X RDF_1	0.88	0.96	1.84	2.52	2.84
FYM X RDF_2	0.78	1.06	1.70	2.25	2.54
FYM X RDF_3	0.74	0.97	1.54	2.15	2.25
VC X RDF_1	0.77	0.97	1.84	2.45	2.81
VC X RDF_2	0.73	1.11	1.72	2.23	2.56
VC X RDF_3	0.91	0.99	1.48	2.11	2.27
BL X RDF_1	0.77	1.01	2.09	2.58	3.13
BL X RDF_2	0.77	1.23	1.93	2.45	2.72
BL X RDF_3	0.86	1.46	1.74	2.29	2.53
GM X RDF_1	0.75	1.09	1.87	2.42	2.90
GM X RDF_2	0.71	1.07	1.69	2.30	2.65
GM X RDF_3	0.71	0.93	1.49	2.07	2.28
NO X RDF_1	0.86	1.13	1.80	2.36	2.27
NO X RDF_2	0.76	0.98	1.63	2.23	2.40
NO X RDF_3	0.75	0.82	1.39	2.24	2.10
SEm±	0.038	0.241	0.072	0.079	0.132
C D at 5%	NS	NS	0.201	0.217	0.310

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 14a. Girh of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Diameter [cm]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	0.79	1.07	1.72	2.35	2.59
FYM	0.78	1.02	1.75	2.31	2.56
VC	0.79	1.10	1.77	2.55	2.63
BL	0.80	1.21	1.97	2.45	2.91
GM	0.74	1.15	1.77	2.31	2.68
NO	0.76	1.04	1.70	2.28	2.42
SEm ±	0.024	0.033	0.068	0.065	0.082
C D at 5 %	NS	NS	0.201	0.193	0.241
B.Chemical fertilizers					
RDF_1	0.82	1.19	1.86	2.45	2.30
RDF_2	0.78	1.10	1.82	2.34	2.67
RDF_3	0.76	1.01	1.66	2.72	2.35
SEm±	0.014	0.027	0.044	0.036	0.075
C D at 5%	NS	0.110	0.122	0.105	0.220
Interaction [AXB]					
TR X RDF_1	0.84	1.17	1.66	2.43	2.89
TR X RDF_2	0.77	1.06	1.89	2.37	2.53
TR X RDF_3	0.76	0.98	1.62	2.25	2.34
FYM X RDF_1	0.83	1.10	1.80	2.23	2.78
FYM X RDF_2	0.76	0.96	1.75	2.29	2.64
FYM X RDF_3	0.74	0.99	1.70	2.21	2.26
VC X RDF_1	0.82	1.17	1.86	2.48	2.62
VC X RDF_2	0.78	1.07	1.82	2.28	2.73
VC X RDF_3	0.67	1.06	1.64	2.25	2.33
BL X RDF_1	0.82	1.27	2.11	2.59	3.14
BL X RDF_2	0.80	1.21	1.99	2.44	2.88
BL X RDF_3	0.78	1.15	1.79	2.31	2.72
GM X RDF_1	0.77	1.26	1.88	2.42	2.94
GM X RDF_2	0.75	1.17	1.74	2.31	2.75
GM X RDF_3	0.70	1.02	1.69	2.18	2.34
NO X RDF_1	0.81	1.14	1.85	2.36	2.82
NO X RDF_2	0.77	1.11	1.73	2.33	2.42
NO X RDF_3	0.78	0.86	1.53	2.14	2.13
SEm±	0.035	0.066	0.108	0.088	0.183
C D at 5%	NS	NS	0.295	0.243	0.521

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 14b. Diameter of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Diameter [cm]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	1.16	1.02	1.72	2.29	2.52
FYM	0.82	0.97	1.63	2.30	2.52
VC	0.79	0.94	1.59	2.19	2.47
BL	0.82	1.26	1.87	2.42	2.66
GM	0.80	0.91	1.59	2.10	2.54
NO	0.79	0.91	1.590	2.27	2.39
SEm ±	0.032	0.054	0.033	0.041	0.090
C D at 5 %	NS	0.016	0.101	0.122	0.220
B.Chemical fertilizers					
RDF_1	0.93	0.93	1.88	2.47	2.87
RDF_2	0.73	1.06	1.69	2.25	2.47
RDF_3	0.72	1.02	1.37	2.11	2.23
SEm±	0.029	0.055	0.044	0.036	0.053
C D at 5%	NS	NS	0.122	0.101	0.152
Interaction [AXB]					
TR X RDF_1	0.94	1.19	1.95	2.49	2.84
TR X RDF_2	0.81	0.98	1.87	2.29	2.55
TR X RDF_3	0.73	0.89	1.34	2.09	2.32
FYM X RDF_1	0.93	0.81	1.87	2.61	2.90
FYM X RDF_2	0.79	1.16	1.64	2.21	2.48
FYM X RDF_3	0.73	0.95	1.38	2.08	2.23
VC X RDF_1	0.91	0.76	1.82	2.41	2.80
VC X RDF_2	0.76	1.15	1.62	2.18	2.39
VC X RDF_3	0.70	0.91	1.32	1.96	2.20
BL X RDF_1	0.98	0.75	2.06	2.56	3.10
BL X RDF_2	0.73	1.25	1.87	2.45	2.55
BL X RDF_3	0.75	1.77	1.68	2.26	2.34
GM X RDF_1	0.95	0.92	1.86	2.40	2.85
GM X RDF_2	0.73	0.97	1.63	2.25	2.55
GM X RDF_3	0.72	0.84	1.28	1.95	2.22
NO X RDF_1	0.91	1.12	1.75	2.36	2.71
NO X RDF_2	0.75	0.85	1.53	2.13	2.37
NO X RDF_3	0.72	0.77	1.24	2.33	2.06
SEm±	0.074	0.281	0.108	0.087	0.129
C D at 5%	NS	NS	0.308	0.238	0.362

DAR = Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

higher (2.09 and 1.93] respectively cane diameter over all the combinations at 180 DAP/R. Even at latter growth stages application of BL X RDF_1, BL X RDF_2, TR X RDF_1, VC X RDF_1, GM X RDF_1 recorded on par cane diameter with sole application of RDF_1 and were significantly superior over other treatment combinations.

4.1.3.4 Plant height (cm)

The plant height (cm) of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.15, 15a and 15b.

The plant height of sugarcane increased progressively from 60 DAP /R (Days after planting/ Ratoon initiation) till harvest.

Among the sources of organic manures, application of BL recorded significantly the highest plant height at 120 DAP/R (99.44), 180 (154.01), 240 DAP/R (185.53) and at harvest (213.05) compared to other sources of organics, except FYM at 180 and 240 DAP / R. Plant height did not differ significantly at 60 DAP / R due to different organics.

But at 120 D A P / R, except application of BL other sources of chemical fertilizers showed on par results with

respect to plant height. At harvest plant height was significantly higher with TR (201.55), FYM (198.12), GM (196.59) and VC (192.98) compared to no organics (188.49).

Application of various levels of chemical fertilizers did not produce significant results with respect to plant height at 60 DAP/R. However, at latter stages i.e. 120 DAP/R and onwards, significantly higher plant height was observed due to application of RDF_1 compared to RDF_2 and RDF_3. Significantly the highest plant height of 221.23 was registered in RDF_1 and lowest of 182.84 in RDF_3 at harvest. Significant reduction in plant height was observed due to reduced levels of chemical fertilizers.

The interaction effects of organic and chemical fertilizers on plant height was significant except at 60 DAP/R. Application of BL X RDF_1 significantly increased the plant height (105.84) over other treatments at 120 DAP/R but it was on par with TR X RDF_1, FYM X RDF_1 and GM X RDF_1. However at 180, 240 and at harvest significantly higher plant height was observed due to application of BL X RDF_1 compared to other treatments except the application of TR X RDF_1, FYM X RDF_1, VC X RDF_1, BL X RDF_2 and NO X RDF_1.

Table 15. Plant height in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Plant height (cm)				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
TR	36.94	92.44	145.47	171.34	201.55
FYM	37.57	91.19	146.84	179.75	198.12
VC	36.95	90.71	142.62	175.02	192.98
BL	39.87	99.44	154.01	185.53	213.05
GM	37.28	92.56	143.06	172.00	196.59
NO	35.79	88.98	137.49	166.69	188.49
SEm ±	1.122	1.359	2.844	3.322	3.421
C D at 5 %	NS	3.764	7.883	9.208	9.483
B.Chemical fertilizers					
RDF_1	40.68	99.32	154.12	183.36	221.28
RDF_2	36.72	92.43	147.30	175.26	200.32
RDF_3	34.79	85.79	133.34	166.54	182.84
SEm±	0.811	1.227	2.425	2.558	2.425
C D at 5%	NS	3.401	6.721	7.090	6.722
Interaction [AXB]					
TR X RDF_1	41.87	98.47	156.04	187.65	215.11
TR X RDF_2	34.72	92.77	147.04	179.88	202.44
TR X RDF_3	34.73	86.09	133.34	146.48	187.09
FYM X RDF_1	40.33	97.90	153.26	185.65	211.13
FYM X RDF_2	37.08	91.30	149.51	181.39	197.31
FYM X RDF_3	35.33	83.96	134.74	172.30	183.35
VC X RDF_1	39.06	98.49	147.68	177.30	208.71
VC X RDF_2	36.66	88.49	148.84	163.82	193.89
VC X RDF_3	34.93	85.17	131.32	184.94	176.33
BL X RDF_1	44.39	105.84	162.08	191.68	221.84
BL X RDF_2	39.50	99.46	155.72	184.51	216.67
BL X RDF_3	35.72	39.02	154.25	180.37	200.68
GM X RDF_1	40.23	99.75	156.13	180.74	208.46
GM X RDF_2	37.22	94.12	143.48	173.78	200.83
GM X RDF_3	34.30	83.83	129.39	161.49	180.47
NO X RDF_1	38.23	95.48	149.32	178.14	205.43
NO X RDF_2	35.39	88.48	139.20	168.19	190.88
NO X RDF_3	33.75	82.27	123.96	153.74	169.15
SEm±	1.891	2.958	6.215	6.226	5.952
C D at 5%	NS	8.199	17.227	17.258	16.498

DAP/R = Days after planting or ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 15a. Plant height in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Plant height (cm)				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
TR	34.07	92.43	148.70	177.88	215.27
FYM	34.33	92.82	152.99	176.74	210.49
VC	34.14	92.34	151.23	177.73	208.01
BL	34.94	102.80	156.88	189.53	223.78
GM	33.03	97.79	150.71	176.84	214.47
NO	33.84	91.77	147.52	174.58	203.25
SEm ±	1.127	1.890	3.946	4.223	4.526
C D at 5 %	NS	5.612	11.725	12.580	13.448
B.Chemical fertilizers					
RDF_1	35.70	99.48	159.62	184.57	218.82
RDF_2	33.94	94.51	151.56	179.39	214.55
RDF_3	32.42	90.98	142.84	172.78	204.26
SEm±	0.826	1.604	2.602	2.939	3.244
C D at 5%	NS	4.446	7.215	8.146	8.991
Interaction [AXB]					
TR X RDF_1	35.13	96.25	157.28	184.35	221.53
TR X RDF_2	34.58	91.60	149.30	177.35	219.53
TR X RDF_3	32.33	89.43	139.53	171.93	204.75
FYM X RDF_1	36.28	98.23	160.95	183.70	213.35
FYM X RDF_2	34.35	91.30	153.58	182.68	209.97
FYM X RDF_3	32.40	88.13	144.45	163.85	202.97
VC X RDF_1	34.75	97.38	159.48	181.35	213.65
VC X RDF_2	34.25	90.18	151.48	177.40	206.70
VC X RDF_3	33.43	89.48	142.73	175.45	203.67
BL X RDF_1	36.43	108.30	166.18	198.20	224.85
BL X RDF_2	34.68	101.58	153.03	188.68	229.55
BL X RDF_3	33.63	98.59	151.45	181.43	216.92
GM X RDF_1	35.45	101.20	158.45	181.57	218.57
GM X RDF_2	32.38	100.90	152.38	175.45	216.37
GM X RDF_3	31.75	91.28	141.30	173.50	208.45
NO X RDF_1	35.19	95.55	155.38	177.93	215.75
NO X RDF_2	33.45	91.53	149.60	175.33	205.20
NO X RDF_3	32.18	88.23	137.58	170.50	188.80
SEm±	2.024	3.928	6.386	7.201	7.947
C D at 5%	NS	10.887	17.701	19.960	22.028

DAP = Days after planting

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 15b. Plant height in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Plant height (cm)				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
TR	39.80	92.45	142.24	164.79	187.82
FYM	40.81	89.55	140.68	182.75	185.74
VC	39.75	89.08	134.01	172.30	177.94
BL	44.79	96.07	151.13	181.52	202.31
GM	41.53	87.33	135.40	167.16	178.70
NO	37.73	85.71	127.46	158.79	173.72
SEm ±	1.669	1.539	3.072	3.810	3.968
C D at 5 %	NS	4.573	9.128	11.321	11.793
B.Chemical fertilizers					
RDF_1	45.66	99.19	148.61	182.15	205.63
RDF_2	39.49	90.35	143.03	171.21	186.08
RDF_3	37.04	80.59	123.83	160.29	161.41
SEm±	0.992	1.287	3.416	3.366	2.600
C D at 5%	NS	3.567	8.720	9.330	7.206
Interaction [AXB]					
TR X RDF_1	48.43	100.68	154.80	190.95	208.68
TR X RDF_2	33.85	93.93	144.77	182.40	185.35
TR X RDF_3	37.13	82.75	127.15	121.03	169.43
FYM X RDF_1	44.38	97.57	145.57	187.60	209.05
FYM X RDF_2	39.80	91.30	145.43	180.10	184.45
FYM X RDF_3	38.25	79.78	131.03	180.55	163.73
VC X RDF_1	43.36	99.60	135.88	171.25	203.77
VC X RDF_2	39.46	86.80	146.20	151.23	181.08
VC X RDF_3	36.42	80.85	119.95	194.43	148.98
BL X RDF_1	52.25	103.38	157.98	184.85	218.80
BL X RDF_2	44.31	97.33	158.40	180.40	203.78
BL X RDF_3	37.81	87.50	137.03	179.30	184.35
GM X RDF_1	45.00	98.30	154.15	179.90	198.35
GM X RDF_2	42.25	87.33	134.58	172.10	185.28
GM X RDF_3	37.35	76.38	117.48	149.48	152.48
NO X RDF_1	40.55	95.40	143.25	178.35	195.10
NO X RDF_2	37.32	85.43	128.80	161.05	176.55
NO X RDF_3	35.31	76.30	110.33	136.98	149.50
SEm±	2.431	3.153	8.366	8.690	6.369
C D at 5%	NS	8.739	23.189	24.087	17.654

DAR = Days after ratoon initiation

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

4.1.3.5 Single cane weight (kg)

The single cane weight of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.16, 16a and 16b.

The single cane weight (kg) of sugarcane averaged over two years as influenced by organic and inorganic fertilizers differed significantly. Among organics, application of BL exerted significantly the highet single cane weight (1.23) over other organic manures. However, application of TR (1.12), FYM (1.09) and VC (1.09) were found on par with each other and they too registered significantly higher single cane weight over GM (1.05) and NO (0.99). Similar trend was observed in case of single cane weight of ratoon cane however, single cane weight of plant though it was the highest due to application of BL (1.29) but was on par with TR (1.15), FYM (1.18) and VC (1.19) and had significantly higher single cane weight over no organic treatment (1.06).

The application of chemical fertilizers exerted significant results. The reduction in the levels of inorganic fertilizers

significantly decreased the single cane weight exhibiting the highest single cane weight with RDF_1 (1.22) and the lowest with RDF_3 (0.96). The interaction effects on single cane weight due to organic and inorganic fertilizers showed significant result. Application of BL X RDF_1 registered significantly the highest single cane weight of 1.34 compared to all other treatments. But in case of VC X RDF_1 (1.24), BL X RDF_2 (1.29), TR X RDF_1 (1.21), FYM X RDF_1 (1.19) GM X RDF_1 (1.17) and RDF_1 alone (1.15) the single cane weight was found on par with each other.

4.1.3.6 Number of millable cane ('000/ha)

The number of malleable canes as influenced by organic and inorganic fertilizers is presented in Tables.16, 16a and 16b.

The number of millable cane (NMC) averaged over the plant and ratoon cane as influenced by organic and inorganic fertilizers had significant difference. The NMC were significantly superior due to application of BL (85.69) over other treatments and further application of VC had significantly higher NMC (81.58) over GM (76.49) and NO (77.94). However, application of VC produced on par NMC with that of application of TR, (80.67)

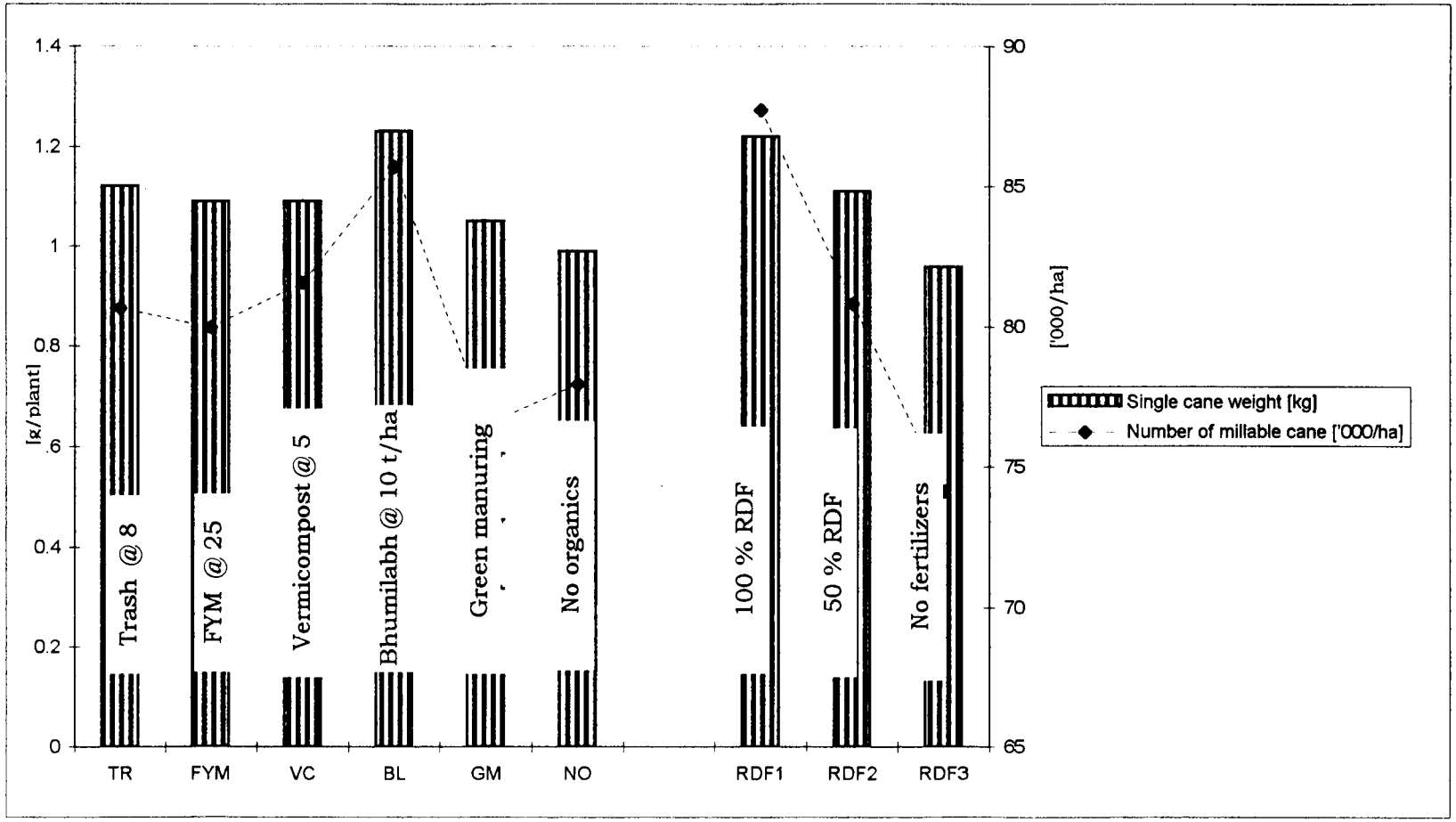

Fig . 5. Single cane weight [kg] and number of millable canes ['000/ha] in sugarcane as influenced by organic and inorganic fertilizers

and FYM (79.97). Similar trend was noticed in case of ratoon crop. The NMC of plant cane surpassed significantly due to application of BL (88.19) over no organic treatment (81.22) and it was on par with the application TR, FYM, VC and GM which recorded NMC of 85.11, 82.86, 86.59 and 88.19 respectively.

The significantly lower NMC were registered as the application of chemical fertilizers levels decreased i.e., RDF_3. The maximum NMC were observed with RDF_1 (87.73) and that of minimum was with RDF_3 (74.13).

The interaction effects were significant due to application of organic and inorganic fertilizers on NMC of cane. It was observed that the highest NMC due to application of BL X RDF_1 (91.56) which was significantly superior over other treatments. However, the former treatment was on par with FYM X RDF_1 (87.21), VC X RDF_1 (88.64), BL X RDF_2 (87.45) and RDF_1 alone (86.67).

4.1.3.7 Cane yield (t/ha)

The cane yield as influenced by organic and inorganic fertilizers is presented in Tables.16, 16a and 16b.

The cane yield (t/ha) averaged over plant and ratoon crop as influenced by various organic and inorganic fertilizers differed

significantly. Application of BL significantly surpassed the cane yield (97.06) over other treatments. Further application of FYM exerted significantly higher cane yield [84.39] over application of TR (77.91),VC[77.12] and NO (71.49). However, FYM exhibited on par cane yield with and GM (84.25). No organic treatment registered significantly lower cane yield when compared to all other organic manures. Cane yield of ratoon exhibited similar trends. However, the cane yield of planted cane was significantly higher due to application of BL (99.76) over all the organic manures. FYM and GM recorded on par cane yield i.e. 87.14 and 87.10 respectively and exerted significantly higher cane yield over TR (76.33), VC (79.41) and NO (74.13) and again even in plant cane also significantly inferior cane yield was obtained in case of treatment with no organics.

The different levels of chemical fertilizers had significant effect on cane yield. The reduced levels of inorganic fertilizers from RDF_1 to RDF_3 significantly decreased the cane yield. The maximum cane yield was obtained with RDF_1 (104.53) and that of minimum was with RDF_3 (61.23).

The interaction effects due to application of organic and inorganic fertilizers showed significant results. Among all the

treatments application of BL X RDF_1 (117.23) exerted significantly the highest cane yield. Application of TR, FYM, GM in combination with RDF_1 and BL along with RDF_2 gave significantly higher cane yield (102.38, 105.96, 108.01 and 100.55, respectively) over only application of RDF_1 (95.10). In case of both plant and ratoon crops significantly the highest cane yield was recorded due to application of BL X RDF_1 over rest of the treatments. However application of TR, FYM and GM along with RDF_1 in case ratoon and TR, FYM, VC, GM in conjunction with RDF_1 and BL along with RDF_2 in plant cane produced on par results and all these treatments exerted significantly higher cane yield over sole application of RDF_1 and its reduced levels also [Fig.6]

4.1.3.8 C.C.S. Yield (t/ha)

The C.C.S yield as influenced by organic and inorganic fertilizers is presented in Tables.16, 16a and 16b.

The C.C.S. yield (t/ha) averaged over two years as influenced by organic and inorganic fertilizers had significant effect. The C.C.S. yield was significantly highest due to application of BL (13.67) over other treatments. Application of FYM produced significantly higher C.C.S. yield (11.39) over no

organic treatment. However, it showed on par results with TR (10.43), VC (10.17) and GM (10.56). The behaviour of C.C.S yield in plant and ratoon cane was different. In case of plant cane significantly higher C.C.S. yield was exerted due to application of BL (14.74) over other treatments. There onwards application of FYM (12.39), GM (11.65), VC (10.97) and TR (10.71) showed significantly differing C.C.S. yield over their succeeding treatments (in descending order) and last treatment (TR) was on par with no organics. The ratoon C.C.S yield was significantly higher with application of BL (12.60) and application of TR (10.16) and FYM (10.40) and also VC [9.38] and GM [9.46] produced on par results with each other. However, all these organics recorded significantly higher C.C.S. yield over inorganic treatment (8.53) [Fig.6].

The decreased rate in the application of inorganic fertilizers exerted significant reduction in the C.C.S yield. The maximum C.C.S. yield was recorded due to RDF_1 (14.23) and minimum due to RDF_3 (7.87).

The interaction effects were significant due to application of organic and inorganic fertilizers on C.C.S. yield. The C.C.S yield was significantly the highest due to application of BL $XRDF_1$

Table 16. Single cane weight,Number of millable canes, Cane and C.C.S yield of sugarcane as influenced by organic and inorganic fertilizers [Pooled]

Single cane weight[Kg}

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	1.21	1.19	1.24	1.34	1.17	1.15	1.22
RDF_2	1.09	1.12	1.08	1.29	1.08	1.03	1.11
RDF_3	1.05	0.96	0.95	1.11	0.91	0.79	0.96
Mean	1.12	1.09	1.09	1.23	1.05	0.99	-

Number of millable canes ['000/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	86.99	87.21	88.64	91.56	85.28	86.67	87.73
RDF_2	80.65	80.39	81.11	87.45	78.05	77.28	80.82
RDF_3	74.38	72.31	74.99	78.05	75.15	69.86	74.13
Mean	80.67	79.67	81.58	85.69	76.49	77.94	-

Cane yield [t/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	102.38	105.96	98.65	117.23	108.01	95.10	104.55
RDF_2	74.97	85.43	71.35	100.55	81.10	68.46	80.31
RDF_3	58.38	61.68	61.35	73.41	63.63	50.94	61.23
Mean	77.91	84.39	77.12	97.06	84.25	71.45	-

C.C.S yield [t/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF_1	14.11	14.76	13.53	16.52	13.79	12.66	14.23
RDF_2	10.11	11.27	9.27	14.21	10.29	8.95	10.68
RDF_3	7.08	8.16	7.72	10.28	7.59	6.40	7.87
Mean	10.43	11.39	10.17	13.67	10.56	9.34	-

Source of variation	Single cane weight	Number of millable canes	Cane yield	C.C.S yield
SEm+ for chemical fertiliser	0.013	0.997	1.238	0.183
CD at 5% for chemical fertiliser	0.042	2.763	3.435	0.514
SEm+ for Organic manures	0.019	1.067	1.939	0.208
CD at 5% for Organic manures	0.052	2.965	5.329	0.582
SEm+ for interaction	0.033	1.953	3.033	0.382
CD at 5% for interaction	0.091	5.413	8.405	1.062

RDF_1=100%RDF
RDF_2= 50%RDF
RDF_3=No fertiliser

TR = Trash incorporation@8 t/ha
FYM=Farmyard manure @25 t/ha
VC= Vermicompost @ 5t/ha

BL=*Bhumilabh* @10 t/ha
GM=Green manure grown *in situ*
NO=No organics

Table 16a. Single cane weight,Number of millable canes, Cane and C.C.S yield of plant cane as influenced by organic and inorganic fertilizers

Single cane weight[Kg}

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	1.27	1.23	1.30	1.40	1.19	1.20	1.27
RDF2	1.19	1.17	1.16	1.31	1.11	1.13	1.18
RDF3	1.19	1.06	1.11	1.16	0.97	0.86	1.04
Mean	1.18	1.15	1.19	1.29	1.09	1.06	-

Number of millable canes ['000/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	91.43	80.26	93.62	92.61	87.54	89.53	90.67
RDF2	85.59	83.60	87.51	89.57	80.51	81.60	84.73
RDF3	70.33	75.272	78.65	82.39	80.44	72.51	78.01
Mean	85.11	82.86	86.59	88.19	82.83	81.22	-

Cane yield [t/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	100.22	108.54	99.44	124.29	110.31	98.39	106.36
RDF2	73.39	88.44	73.35	102.46	82.25	70.47	81.73
RDF3	55.39	64.46	65.43	7553	68.74	53.54	63.85
Mean	76.33	87.14	79.41	99.76	87.10	74.13	-

C.C.S yield [t/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	14.44	15.74	14.21	17.98	15.01	13.76	15.19
RDF2	10.39	12.55	9.96	15.15	11.17	9.64	11.48
RDF3	7.29	8.91	8.73	11.10	8.78	7.05	8.64
Mean	10.71	12.39	10.97	14.74	11.65	10.15	-

Source of variation	Single cane weight	Number of millable canes	Cane yield	C.C.S yield
SEm+ for chemical fertiliser	0.026	1.506	1.941	0.201
CD at 5% for chemical fertiliser	0.071	4.172	5.384	0.561
SEm+ for Organic manures	0.049	2.137	2.043	0.219
CD at 5% for Organic manures	0.152	6.350	6.102	0.652
SEm+ for interaction	0.064	2.691	3.924	0.402
CD at 5% for interaction	0.180	10.223	10.872	1.114

RDF_1=100%RDF
RDF_2= 50%RDF
RDF_3=No fertiliser

TR = Trash incorporation@8 t/ha
FYM=Farmyard manure @25 t/ha
VC= Vermicompost @ 5t/ha

BL=*Bhumilabh* @10 t/ha
GM=Green manure grown *in situ*
NO=No organics

Table 16b. Single cane weight,Number of millable canes, Cane and C.C.S yield of ratoon cane as influenced by organic and inorganic fertilizers

Single cane weight[Kg}

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	1.16	1.14	1.17	1.28	1.16	1.10	1.17
RDF2	1.02	1.07	1.01	1.18	1.05	0.93	1.04
RDF3	0.99	0.86	0.79	1.06	0.85	0.72	0.88
Mean	1.05	1.03	0.99	1.17	1.02	0.92	-

Number of millable canes ['000/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	82.55	85.16	83.65	90.51	83.02	83.81	84.78
RDF2	75.71	77.19	74.22	85.33	75.59	72.96	76.92
RDF3	70.44	68.91	71.33	73.71	69.86	67.19	70.25
Mean	76.23	77.09	76.57	83.18	70.16	74.66	-

Cane yield [t/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	104.55	103.38	97.87	113.16	105.72	91.74	102.73
RDF2	76.55	82.43	69.35	98.63	79.95	66.45	78.89
RDF3	57.37	58.91	57.27	71.28	58.52	48.34	58.61
Mean	79.49	81.57	74.83	94.36	81.39	68.64	-

C.C.S yield [t/ha]

Treatment	Organic manures						Mean
	TR	FYM	VC	BL	GM	NO	
Chemical fertilisers							
RDF1	13.78	13.79	12.84	15.06	12.58	11.55	13.27
RDF2	9.84	9.99	8.58	13.27	9.41	8.27	9.89
RDF3	6.86	7.42	6.76	9.48	6.39	5.75	7.10
Mean	10.16	10.40	9.38	12.60	9.46	8.53	-

Source of variation	Single cane weight	Number of millable canes	Cane yield	C.C.S yield
SEm± for chemical fertiliser	0.021	1.323	0.592	0.129
CD at 5% for chemical fertiliser	0.062	3.662	1.643	0.374
SEm± for Organic manures	0.018	1.471	0.729	0.246
CD at 5% for Organic manures	0.052	4.373	2.118	0.733
SEm± for interaction	0.033	2.281	1.449	0.318
CD at 5% for interaction	0.092	6.323	4.057	0.885

RDF_1=100%RDF
RDF_2= 50%RDF
RDF_3=No fertiliser

TR = Trash incorporation@8 t/ha
FYM=Farmyard manure @25 t/ha
VC= Vermicompost @ 5t/ha

BL=*Bhumilabh* @10 t/ha
GM=Green manure grown *in situ*
NO=No organics

LEGEND

TR	X	RDF_1	= Trash @ 8 t/ha + 100 % RDF
TR	X	RDF_2	= Trash @ 8 t/ha + 50 % RDF
TR	X	RDF_3	= Trash @ 8 t/ha + No fertilizer
FYM	X	RDF_1	= Farm yard manure @ 25 t/ha + 100 % RDF
FYM	X	RDF_2	= Farm yard manure @ 25 t/ha + 50 % RDF
FYM	X	RDF_3	= Farm yard manure @ 25 t/ha + No fertilizer
VC	X	RDF_1	= Vermicompost @ 5 t/ha + 100 % RDF
VC	X	RDF_2	= Vermicompost @ 5 t/ha + 50 % RDF
VC	X	RDF_3	= Vermicompost @ 5 t/ha + No fertilizer
BL	X	RDF_1	= *Bhumilabh* @ 10 t/ha + 100 % RDF
BL	X	RDF_2	= *Bhumilabh* @ 10 t/ha + 50 RDF
BL	X	RDF_3	= *Bhumilabh* @ 10 t/ha + No fertilizer
GM	X	RDF_1	= Green manure [Sunnhemp] + 100 % RDF
GM	X	RDF_2	= Green manure [Sunnhemp] + 50 RDF
GM	X	RDF_3	= Green manure [Sunnhemp] No fertilizer
NO	X	RDF_1	= No organics + 100 % RDF
NO	X	RDF_2	= No organics + 50 RDF
NO	X	RDF_3	= No organics + No fertilizer

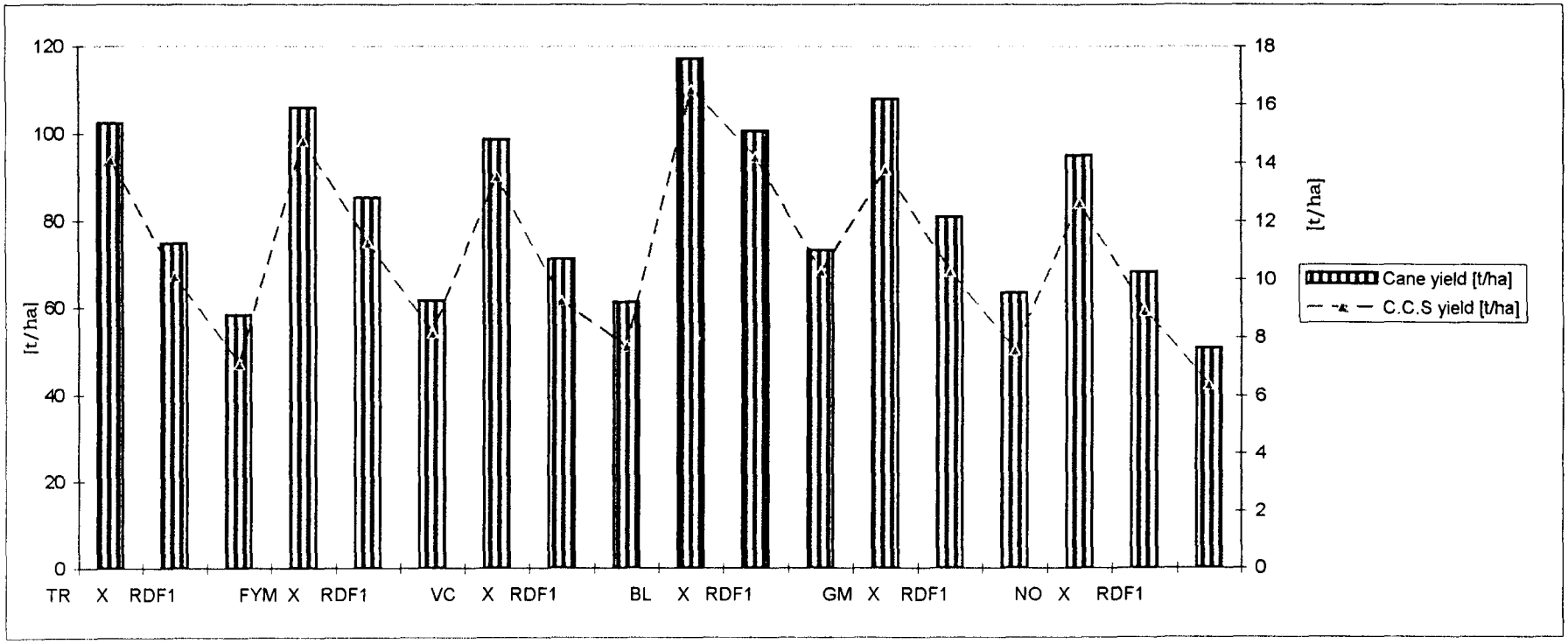

Fig. 6. Sugar cane and sugar yield [t/ha] as influenced by organic and inorganic fertilizers

organic treatment. However, it showed on par results with TR (10.43), VC (10.17) and GM (10.56). The behaviour of C.C.S yield in plant and ratoon cane was different. In case of plant cane significantly higher C.C.S. yield was exerted due to application of BL (14.74) over other treatments. There onwards application of FYM (12.39), GM (11.65), VC (10.97) and TR (10.71) showed significantly differing C.C.S. yield over their succeeding treatments (in descending order) and last treatment (TR) was on par with no organics. The ratoon C.C.S yield was significantly higher with application of BL (12.60) and application of TR (10.16) and FYM (10.40) and also VC [9.38] and GM [9.46] produced on par results with each other. However, all these organics recorded significantly higher C.C.S. yield over inorganic treatment (8.53).

The decreased rate in the application of inorganic fertilizers exerted significant reduction in the C.C.S yield. The maximum C.C.S. yield was recorded due to RDF_1 (14.23) and minimum due to RDF_3 (7.87).

The interaction effects were significant due to application of organic and inorganic fertilizers on C.C.S. yield. The C.C.S yield was significantly the highest due to application of BL $XRDF_1$

organic treatment recording maximum with the application of BL (20.65). Significantly lower brix percentage was exhibited due to application of GM (19.21). Only in case of plant cane, the brix percentage in juice was significantly higher with BL (21.51) over only GM (20.23). However it was not differed significantly due to application of BL over other rest of the treatments.

The application RDF_1 exerted significantly higher brix percentage (20.22) over RDF_3 (19.91). However, it was on par with RDF_2. The pooled analysis indicated that there were no significant interaction effects due to application of organic and inorganic fertilizers.

4.1.4.2 Pol (%)

The pol percentage in juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.17, 17a and 17b.

The pol per cent in juice of plant and ratoon crops averaged over as influenced by organic and inorganic fertilizers differed significantly. Among organics application of BL exhibited significantly higher pol per cent (18.74) over all other treatments. Further it was noticed that application of TR (17.75) recorded significantly higher pol per cent over application of GM (16.53).

However, it produced on par results with FYM, VC and even with no organic treatment.

Each levels of reduction in the application of inorganic fertilizers significantly reduced the pol per cent in juice. The maximum pol per cent was recorded with RDF_1 (18.12) and minimum with RDF_3 (17.05). But in case of plant cane the pol per cent in juice was on par with RDF_1 and RDF_2.

The interaction effects were found significant. Application of BL X RDF_1, BL X RDF_2, BL X RDF_3, TR X RDF_1, TR X RDF_2, FYM X RDF_1, FYM X RDF_2, FYM X RDF_3, VC X RDF_1, GM X RDF_1 and only RDF_1 produced on par pol per cent and had significantly higher pol per cent over other treatments.

4.1.4.3 Commercial Cane Sugar [C.C.S] (%)

The C.C.S per cent in juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.17, 17a and 17b.

The C.C.S. per cent in sugarcane juice averaged over two years as influenced by organic and inorganic fertilizer differd significantly. Application of BL exerted significantly the higher C.C.S per cent (14.06) over other treatments. However,

application of FYM, TR, VC and no organic showed significantly higher C.C.S percentage over application of GM (12.39) which recorded significantly lower C.C.S. percentage over other treatments but only in case of plant cane application of GM gave on par pol per cent compared with other organics except BL.

C.C.S per cent was significantly higher due to application of RDF_1 (13.59) over RDF_2 (13.25) and RDF_3 (12.78), which also differed significantly. However, in case of plant cane the C.C.S per cent in the juice was on par with RDF_1 and RDF_2.

The pooled analysis indicated that the interaction effects due to organic and inorganic fertilizers differed significantly on the pol content in the juice. Application of BL X RDF_1, BL X RDF_2, BL X RDF_3, TR X RDF_1, TR X RDF_2, FYM X RDF_1 and VC X RDF_1 were found significantly higher over other treatment combinations.

4.1.4.4 Purity (%)

The purity percentage in the juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.17, 17a and 17b.

Table 17. Brix, pol, C.C.S and purity in cane juice as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Brix [%]	Pol [%]	C.C.S [%]	Purity [%]
A.Organic manures				
TR	20.34	17.75	13.31	87.30
FYM	20.52	17.92	13.44	87.40
VC	19.67	17.44	13.08	88.60
BL	20.65	18.74	14.06	90.80
GM	19.21	16.53	12.39	86.20
NO	19.19	17.29	12.97	87.00
SEm ±	0.230	0.225	0.192	0.013
C D at 5 %	0.638	0.707	0.572	0.042
B.Chemical fertilizers				
RDF_1	20.22	18.21	13.59	89.70
RDF_2	20.02	17.66	13.25	88.40
RDF_3	19.19	17.05	12.78	85.60
SEm±	0.159	0.135	0.101	0.008
C D at 5%	0.447	0.374	0.282	0.025
Interaction [AXB]				
TR X RDF_1	20.62	18.44	13.83	89.50
TR X RDF_2	20.84	17.99	13.49	86.50
TR X RDF_3	19.56	16.79	12.59	85.90
FYM X RDF_1	20.84	18.56	13.92	89.20
FYM X RDF_2	20.14	17.55	13.16	86.20
FYM X RDF_3	20.32	17.65	13.23	86.80
VC X RDF_1	20.19	18.27	13.69	90.60
VC X RDF_2	19.29	17.33	12.99	89.80
VC X RDF_3	19.54	16.71	12.54	86.00
BL X RDF_1	20.64	18.75	14.06	91.00
BL X RDF_2	20.50	18.82	14.12	91.60
BL X RDF_3	20.75	18.64	13.98	89.80
GM X RDF_1	19.39	16.99	12.75	87.60
GM X RDF_2	18.98	16.84	12.63	89.40
GM X RDF_3	19.26	15.74	11.81	88.90
NO X RDF_1	19.68	17.68	13.26	90.05
NO X RDF_2	20.06	117.44	13.08	87.10
NO X RDF_3	2001	16.73	12.55	83.80
SEm±	0.725	0.468	0.248	0.022
C D at 5%	NS	1.297	0.692	0.061

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 17a.Brix,pol, C.C.S and purity in plant cane juice as influenced by organic and inorganic fertilizers

Treatment	Brix [%]	Pol [%]	C.C.S [%]	Purity [%]
A.Organic manures				
TR	21.21	18.61	13.96	87.80
FYM	21.38	18.92	14.19	88.80
VC	20.53	18.36	13.77	89.50
BL	21.51	19.66	14.75	91.50
GM	20.23	17.68	13.26	87.40
NO	20.91	18.16	13.62	86.90
SEm ±	0.396	0.387	0.290	0.018
C D at 5 %	1.182	1.152	0.860	0.052
B.Chemical fertilizers				
RDF_1	21.16	19.02	14.26	90.00
RDF_2	21.01	18.66	13.99	89.10
RDF_3	20.73	18.02	13.51	86.90
SEm±	0.142	0.192	0.148	0.011
C D at 5%	10.378	0.546	0.412	0.032
Interaction [AXB]				
TR X RDF_1	21.50	19.31	14.48	89.80
TR X RDF_2	21.50	18.86	14.15	87.10
TR X RDF_3	20.42	17.66	13.25	86.50
FYM X RDF_1	21.70	19.24	14.50	89.30
FYM X RDF_2	21.28	18.91	14.18	89.80
FYM X RDF_3	21.18	18.50	13.88	87.50
VC X RDF_1	21.05	19.04	14.25	90.50
VC X RDF_2	20.15	18.19	13.04	90.20
VC X RDF_3	20.40	17.85	13.39	87.80
BL X RDF_1	21.50	19.75	14.81	92.00
BL X RDF_2	21.44	19.69	14.77	92.00
BL X RDF_3	21.00	19.55	14.66	90.50
GM X RDF_1	20.25	18.09	13.57	89.30
GM X RDF_2	20.50	17.99	13.49	88.10
GM X RDF_3	19.99	16.94	12.70	89.50
NO X RDF_1	20.93	18.57	13.93	88.90
NO X RDF_2	20.84	18.31	13.73	87.50
NO X RDF_3	20.65	17.59	13.19	84.40
SEm±	0.622	0.483	0.362	0.028
C D at 5%	NS	1.338	1.001	0.082

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 17b. Brix,pol, C.C.S and purity in ratoon cane juice as influenced by organic and inorganic fertilizers

Treatment	Brix [%]	Pol [%]	C.C.S [%]	Purity [%]
A.Organic manures				
TR	19.47	16.88	12.66	86.80
FYM	19.66	16.91	12.69	86.00
VC	18.80	16.51	12.38	88.10
BL	19.79	17.81	13.36	90.10
GM	18.18	15.38	11.53	84.90
NO	18.92	16.42	12.31	87.10
SEm ±	0.284	0.382	0.286	0.021
C D at 5 %	0.842	1.142	0.832	0.062
B.Chemical fertilizers				
RDF_1	19.29	17.21	12.91	89.30
RDF_2	19.04	16.67	12.49	87.80
RDF_3	19.08	16.07	12.06	84.40
SEm±	0.071	0.185	0.139	0.014
C D at 5%	0.532	0.513	0.392	0.042
Interaction [AXB]				
TR X RDF_1	19.74	17.58	13.68	89.20
TR X RDF_2	19997	17.13	12.85	85.90
TR X RDF_3	18.69	15.94	11.95	85.20
FYM X RDF_1	19.97	17.78	13.33	89.00
FYM X RDF_2	19.55	16.91	12.14	82.70
FYM X RDF_3	1947	16.78	12.59	86.20
VC X RDF_1	19.32	17.49	13.12	90.70
VC X RDF_2	18.42	16.46	12.35	89.30
VC X RDF_3	18.67	15.58	11.69	84.10
BL X RDF_1	1972	17.75	13.31	90.00
BL X RDF_2	19.71	17.95	13.46	91.20
BL X RDF_3	19.89	17.73	13.29	89.10
GM X RDF_1	18.52	15.89	11.92	85.80
GM X RDF_2	1743	15.68	11.76	90.70
GM X RDF_3	18.59	14.55	10.91	88.30
NO X RDF_1	18.42	16.79	12.59	91.20
NO X RDF_2	19.19	16.58	12.44	86.70
NO X RDF_3	19.13	15.87	11.90	83.30
SEm±	0.962	0.452	0.339	0.034
C D at 5%	NS	1.267	0.942	0.092

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

The purity percentage in juice of sugarcane averaged over two years as influenced by organic and inorganic fertilizers had significant effect. All the organic treatments differed significantly in affecting purity of juice. Significantly the highest purity per centage was recorded with BL (90.80) followed by VC (88.60), FYM (87.40), TR (87.30] NO (87.00) and GM (86.20). Application of GM recorded significantly lower purity percentage of juice. The reduction in the levels of inorganic fertilizers significantly decreased the purity per cent of juice. The maximum purity was obtained against RDF_1 (89.20) and minimum against RDF_3 (85.60).

The pooled data indicated significant interaction effects. The combination of BL X RDF_1, BL X RDF_2, VC X RDF_2 and only RDF_1 exerted significantly higher purity per cent of juice in sugarcane.

4.1.4.5 Reducing sugars (%)

The reducing sugars percentage in the juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.18, 18a and 18b.

The reducing sugars in the juice averaged over plant and ratoon crop differed significantly. Significantly lower reducing

sugars were observed due to application of BL (0.593) over other organics. Further application of FYM, VC and GM recorded significantly lesser reducing sugars over inorganics and TR.

Application of RDF_1 and RDF_2 exhibited significantly lower reducing sugars over RDF_3 and in case of plant cane, reducing sugars were not varied due to various levels of inorganic fertilizers.

The interaction effects due to organic and inorganic fertilizers were significant. Application of different organic in conjunction with varied levels of chemical fertilizers except TR X RDF_3 recorded significantly lower reducing sugars over other treatments and were on par with sole RDF_1.

4.1.4.6 Fibre (%)

The fibre percentage in sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.18, 18a and 18b.

The fibre per cent in sugarcane averaged over two years did not differ significantly. Similarly the interaction effects were also not significant due to application of organic and inorganic fertilizers.

Table 18. Reducing sugars in cane juice, fibre and moisture in cane as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Reducing sugars [%]	Fibre [%]	Moisture [%]
A.Organic manures			
TR	0.810	13.41	70.87
FYM	0.783	13.39	71.28
VC	0.742	13.53	70.97
BL	0.593	13.66	70.89
GM	0.706	13.39	71.39
NO	0.856	13.38	71.39
SEm ±	0.019	0.149	0.602
C D at 5 %	0.054	NS	NS
B.Chemical fertilizers			
RDF_1	0.733	13.50	70.95
RDF_2	0.748	13.46	70.86
RDF_3	0.868	13.42	71.79
SEm±	0.009	0.109	0.417
C D at 5%	0.024	NS	NS
Interaction [AXB]			
TR X RDF_1	0.791	13.34	70.82
TR X RDF_2	0.770	13.45	70.85
TR X RDF_3	0.869	13.43	70.95
FYM X RDF_1	0.376	13.52	71.20
FYM X RDF_2	0.790	13.21	69.99
FYM X RDF_3	0.782	13.47	72.64
VC X RDF_1	0.716	13.57	70.38
VC X RDF_2	0.745	13.53	71.04
VC X RDF_3	0.766	13.50	71.48
BL X RDF_1	0.585	13.71	70.74
BL X RDF_2	0.531	13.64	70.85
BL X RDF_3	0.665	13.61	71.00
GM X RDF_1	0.743	13.47	71.05
GM X RDF_2	0.793	13.49	71.11
GM X RDF_3	0.852	13.21	70.93
NO X RDF_1	0.793	13.39	71.50
NO X RDF_2	0.859	13.44	71.38
NO X RDF_3	0.916	13.32	71.29
SEm±	0.021	0.269	1.445
C D at 5%	0.058	NS	NS

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 18a. Reducing sugars in plant cane juice, fibre and moisture in plant cane as influenced by organic and inorganic fertilizers

Treatment	Reducing sugars [%]	Fibre [%]	Moisture [%]
A.Organic manures			
TR	0.890	13.33	70.70
FYM	0.860	13.29	71.44
VC	0.789	13.46	70.70
BL	0.621	13.59	70.93
GM	0.924	13.31	70.86
NO	0.955	13.38	71.55
SEm ±	0.029	0.331	1.089
C D at 5 %	0.093	NS	NS
B.Chemical fertilizers			
RDF_1	0.830	13.43	70.84
RDF_2	0.812	13.31	70.69
RDF_3	0.873	13.44	71.59
SEm±	0.017	0.219	0.831
C D at 5%	NS	NS	NS
Interaction [AXB]			
TR X RDF_1	0.923	13.28	70.60
TR X RDF_2	0.785	13.38	70.25
TR X RDF_3	0.962	13.33	70.75
FYM X RDF_1	0.863	13.38	71.63
FYM X RDF_2	0.864	12.85	68.83
FYM X RDF_3	0.842	13.65	73.88
VC X RDF_1	0.779	13.58	71.11
VC X RDF_2	0.805	13.40	71.00
VC X RDF_3	0.782	13.40	71.23
BL X RDF_1	0.642	13.68	70.60
BL X RDF_2	0.523	13.43	70.28
BL X RDF_3	0.681	13.69	71.28
GM X RDF_1	0.862	13.30	70.95
GM X RDF_2	0.933	13.45	71.08
GM X RDF_3	0.978	13.18	70.55
NO X RDF_1	0.910	13.38	71.70
NO X RDF_2	0.964	13.38	71.58
NO X RDF_3	0.991	13.38	71.38
SEm±	0.042	0.535	2.034
C D at 5%	0.116	NS	NS

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 18b. Reducing sugars in ratoon cane juice, fibre and moisture in ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Reducing sugars [%]	Fibre [%]	Moisture [%]
A.Organic manures			
TR	0.730	13.49	71.04
FYM	0.709	13.50	71.11
VC	0.696	13.61	71.44
BL	0.570	13.71	70.85
GM	0.607	13.48	71.21
NO	0.757	13.39	71.23
SEm ±	0.022	0.268	1.025
C D at 5 %	0.073	NS	NS
B.Chemical fertilizers			
RDF_1	0.637	13.57	71.05
RDF_2	0.683	13.61	71.04
RDF_3	0.744	13.41	71.19
SEm±	0.003	0.121	0.679
C D at 5%	0.008	NS	NS
Interaction [AXB]			
TR X RDF_1	0.659	13.41	71.04
TR X RDF_2	0.754	13.53	70.94
TR X RDF_3	0.777	13.54	71.14
FYM X RDF_1	0.688	13.66	70.78
FYM X RDF_2	0.716	13.56	71.16
FYM X RDF_3	0.722	13.29	71.30
VC X RDF_1	0.652	13.56	70.38
VC X RDF_2	0.685	13.67	71.07
VC X RDF_3	0.751	13.60	71.24
BL X RDF_1	0.522	13.75	70.87
BL X RDF_2	0.539	13.86	70.79
BL X RDF_3	0.649	13.53	70.90
GM X RDF_1	0.023	13.63	71.16
GM X RDF_2	0.653	13.55	71.15
GM X RDF_3	0.725	13.25	71.70
NO X RDF_1	0.676	13.41	71.25
NO X RDF_2	0.753	13.49	71.13
NO X RDF_3	0.842	13.26	71.21
SEm±	0.002	0.252	0.951
C D at 5%	0.019	NS	NS

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

4.1.4.7 Moisture (%)

Moisture percentage of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.18, 18a and18b.

The moisture percentage in sugarcane averaged over plant and ratoon crop did not differ significantly. The interaction effects due to application of organic and inorganic fertilizers also did not exhibit significant influence on moisture content of sugarcane.

4.1.5 ECONOMICS

4.1.5.1 Gross income (Rs '000/ha)

The gross income of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.19, 19a and 19b.

The gross income (Rs '000/ha) of sugarcane averaged over plant and ratoon crop had significant effect. Among the organics application of BL, recorded significantly higher gross income of 87.34 over other sources of organics, followed by application of FYM (75.42), GM (75.52) and TR (70.24) but all latter treatments were on par with each other. Further application of VC produced significantly higher gross income of 69.41 compared to without

organic treatment (64.31). The gross income behaved differently for plant and ratoon crops due to application of organics. Plant cane gave significantly higher gross income (89.79) due to application of BL over other treatments. However, other organics also recorded significantly higher gross income over no organic treatment except TR. In case of ratoon cane significantly the highest gross income was obtained due to application of BL [84.89] over other organics. However, rest of all organics including TR produced significantly higher gross income over no organic treatment (61.88).

The maximum gross income was obtained due to RDF_1 (93.89) and minimum with RDF_3 (55.19). Reduced levels of chemical fertilizers exerted significantly lesser gross income for all the reduced grades.

The interaction effects were found significant due to organic and inorganic fertilizers. Application of BL X RDF_1 exhibited significantly the highest gross income (105.48) over all other treatment combinations. The data further revealed that application of TR, FYM, VC and GM inconjunction with RDF_1 and BL along with RDF_2 gave significantly higher gross income compared to application of only chemical fertilizers (85.45).

4.1.5.2 Net return (Rs '000/ha)

The net returns of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.19, 19a and 19b.

The net return (Rs '000/ha) of sugarcane averaged over two years showed significant results. The pooled data and on individual crop basis it was revealed that application of BL (58.94) exerted significantly higher net returns compared to other organics. In case of pooled analysis application of BL and GM (54.58). exhibited on par results and showed significantly higher net income over VC (40.03), TR [46.75] and no organics (44.95). It was also observed that application of VC recorded significantly lower net return (40.03) compared to no organic treatment (44.95). In case of plant cane, application of BL, GM and FYM were found on par with each other and were significantly superior over VC, TR and no organic treatments and latter all these treatments were on par with each other. However, ratoon crop produced significantly higher returns due to application of TR and FYM compared to no organic and VC, further, application of VC recorded significantly lower net returns even compared to without organic treatment [Fig.7]

Lower levels of chemical fertilizers significantly reduced the net returns recording the lowest with RDF_3 (33.12).

The interaction effects were significant. Application of FYM X RDF_1, BL X RDF_1 and GM X RDF_1 exerted significantly higher net returns over other treatment combinations. It was further revealed that application of BL X RDF_2, TR X RDF_1, FYM X RDF_1, GM X RDF_1 gave on par net returns compared to the application of RDF_1 alone and its reduced levels.

4.1.5.3 Benefit: Cost ratio (B: C ratio)

The benefit cost ratio of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.19, 19a and 19b.

The benefit cost ratio (B: C ratio) of sugarcane averaged over plant and ratoon crops was significant. The pooled data revealed that application of GM significantly recorded the highest B: C ratio (3.64) over other treatments. However, the B: C ratio showed on par results due to application of BL, FYM and no organics and significantly the lowest B: C ratio (2.26) was obtained due to application of VC. In case of plant cane, application of GM, TR, FYM and BL recorded on par B: C ratio and that of ratoon recorded on par results due to application of

Table 19. Economics in sugarcane as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Gross income [Rs.'000 /ha]	Net returns [Rs.'000 /ha]	B:C ratio	Rs.'000/ha Profit[+] or loss[-] over control
A.Organic manures				
TR	70.24	46.75	3.02	1.80
FYM	75.42	50.29	2.99	5.34
VC	69.41	40.03	2.26	-4.92
BL	87.34	58.94	3.08	13.63
GM	75.52	54.58	3.64	9.63
NO	64.31	44.95	3.29	-
SEm ±	1.753	1.746	0.069	-
C D at 5 %	4.859	4.839	0.191	-
B.Chemical fertilizers				
RDF_1	93.89	66.89	3.57	-
RDF_2	72.29	47.76	3.05	-19.13
RDF_3	55.19	33.12	2.57	-33.77
SEm±	1.113	1.113	0.045	-
C D at 5%	3.085	3.085	0.125	-
Interaction [AXB]				
TR X RDF_1	92.14	66.28	3.02	
TR X RDF_2	67.47	44.10	2.95	
TR X RDF_3	51.12	29.88	2.48	
FYM X RDF_1	95.36	67.24	3.42	
FYM X RDF_2	76.89	51.27	3.11	
FYM X RDF_3	55.52	32.39	2.43	
VC X RDF_1	88.79	56.91	2.81	
VC X RDF_2	64.22	34.84	2.21	
VC X RDF_3	55.21	28.33	2.07	
BL X RDF_1	105.46	74.52	3.44	
BL X RDF_2	90.49	63.12	3.22	
BL X RDF_3	66.07	40.19	2.58	
GM X RDF_1	96.17	72.77	4.17	
GM X RDF_2	73.02	51.99	3.57	
GM X RDF_3	57.36	28.98	3.18	
NO X RDF_1	85.45	63.59	3.97	
NO X RDF_2	61.04	42.27	3.25	
NO X RDF_3	45.85	28.97	2.66	
SEm±	2.729	2.726	0.111	
C D at 5%	7.556	7.556	0.307	

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 19a. Economics in plant cane as influenced by organic and inorganic fertilizers

Treatment	Gross income [Rs.'000 /ha]	Net returns [Rs.'000 /ha]	B:C ratio
A.Organic manures			
TR	68.69	82.22	2.55
FYM	78.69	49.68	2.25
VC	71.47	38.97	2.19
BL	89.79	58.29	2.83
GM	79.39	54.31	3.24
NO	66.47	44.24	2.84
SEm ±	3.231	3.219	0.120
C D at 5 %	4.600	9.564	0.356
B.Chemical fertilizers			
RDF_1	95.23	65.61	3.21
RDF_2	03.56	45.90	2.71
RDF_3	51.47	32.34	2.26
SEm±	2.164	2.165	0.087
C D at 5%	5.998	6.001	0.241
Interaction [AXB]			
TR X RDF_1	90.19	81.22	3.11
TR X RDF_2	66.05	39.57	2.49
TR X RDF_3	49.85	25.86	2.05
FYM X RDF_1	97.69	66.44	3.13
FYM X RDF_2	79.69	50.85	2.92
FYM X RDF_3	58.02	31.77	2.20
VC X RDF_1	86.49	54.49	2.56
VC X RDF_2	66.02	33.52	2.03
VC X RDF_3	58.89	28.89	1.97
BL X RDF_1	109.17	75.17	3.21
BL X RDF_2	92.21	60.71	2.93
BL X RDF_3	67.98	38.98	3.35
GM X RDF_1	99.28	72.78	3.75
GM X RDF_2	74.03	49.78	3.09
GM X RDF_3	61.86	40.36	2.89
NO X RDF_1	88.55	63.55	3.54
NO X RDF_2	63.49	40.99	2.82
NO X RDF_3	48.49	28.19	2.16
SEm±	5.301	5.304	0.123
C D at 5%	14.94	14.702	0.590

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 19b. Economics in ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Gross income [Rs.'000 /ha]	Net returns [Rs.'000 /ha]	B:C ratio
A.Organic manures			
TR	71.89	51.29	3.48
FYM	73.41	50.91	3.22
VC	67.35	41.09	2.54
BL	84.89	59.59	3.33
GM	72.64	54.86	4.04
NO	61.88	45.65	3.75
SEm ±	0.746	0.733	0.041
C D at 5 %	2.216	2.178	0.121
B.Chemical fertilizers			
RDF_1	92.06	68.17	3.93
RDF_2	71.01	49.63	3.39
RDF_3	52.91	33.91	2.87
SEm±	0.519	0.514	0.026
C D at 5%	1.439	1.425	0.072
Interaction [AXB]			
TR X RDF_1	94.09	71.34	4.14
TR X RDF_2	68.89	48.64	3.40
TR X RDF_3	52.39	33.89	2.91
FYM X RDF_1	93.04	68.04	3.72
FYM X RDF_2	73.09	51.69	3.29
FYM X RDF_3	53.02	33.02	2.65
VC X RDF_1	88.08	59.33	3.07
VC X RDF_2	62.42	36.17	2.38
VC X RDF_3	51.54	27.78	2.17
BL X RDF_1	101.76	73.88	3.67
BL X RDF_2	88.77	63.52	3.52
BL X RDF_3	64.15	41.40	2.82
GM X RDF_1	93.07	72.77	4.59
GM X RDF_2	72.01	54.21	4.05
GM X RDF_3	52.85	37.39	3.47
NO X RDF_1	82.34	63.64	4.39
NO X RDF_2	59.80	43.55	3.68
NO X RDF_3	43.51	29.76	3.17
SEm±	1.273	1.259	0.063
C D at 5%	3.529	3.489	0.174

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

LEGEND

TR	X	RDF_1	= Trash @ 8 t/ha + 100 % RDF
TR	X	RDF_2	= Trash @ 8 t/ha + 50 % RDF
TR	X	RDF_3	= Trash @ 8 t/ha + No fertilizer
FYM	X	RDF_1	= Farm yard manure @ 25 t/ha + 100 % RDF
FYM	X	RDF_2	= Farm yard manure @ 25 t/ha + 50 % RDF
FYM	X	RDF_3	= Farm yard manure @ 25 t/ha + No fertilizer
VC	X	RDF_1	= Vermicompost @ 5 t/ha + 100 % RDF
VC	X	RDF_2	= Vermicompost @ 5 t/ha + 50 % RDF
VC	X	RDF_3	= Vermicompost @ 5 t/ha + No fertilizer
BL	X	RDF_1	= *Bhumilabh* @ 10 t/ha + 100 % RDF
BL	X	RDF_2	= *Bhumilabh* @ 10 t/ha + 50 RDF
BL	X	RDF_3	= *Bhumilabh* @ 10 t/ha + No fertilizer
GM	X	RDF_1	= Green manure [Sunnhemp] + 100 % RDF
GM	X	RDF_2	= Green manure [Sunnhemp] + 50 RDF
GM	X	RDF_3	= Green manure [Sunnhemp] No fertilizer
NO	X	RDF_1	= No organics + 100 % RDF
NO	X	RDF_2	= No organics + 50 RDF
NO	X	RDF_3	= No organics + No fertilizer

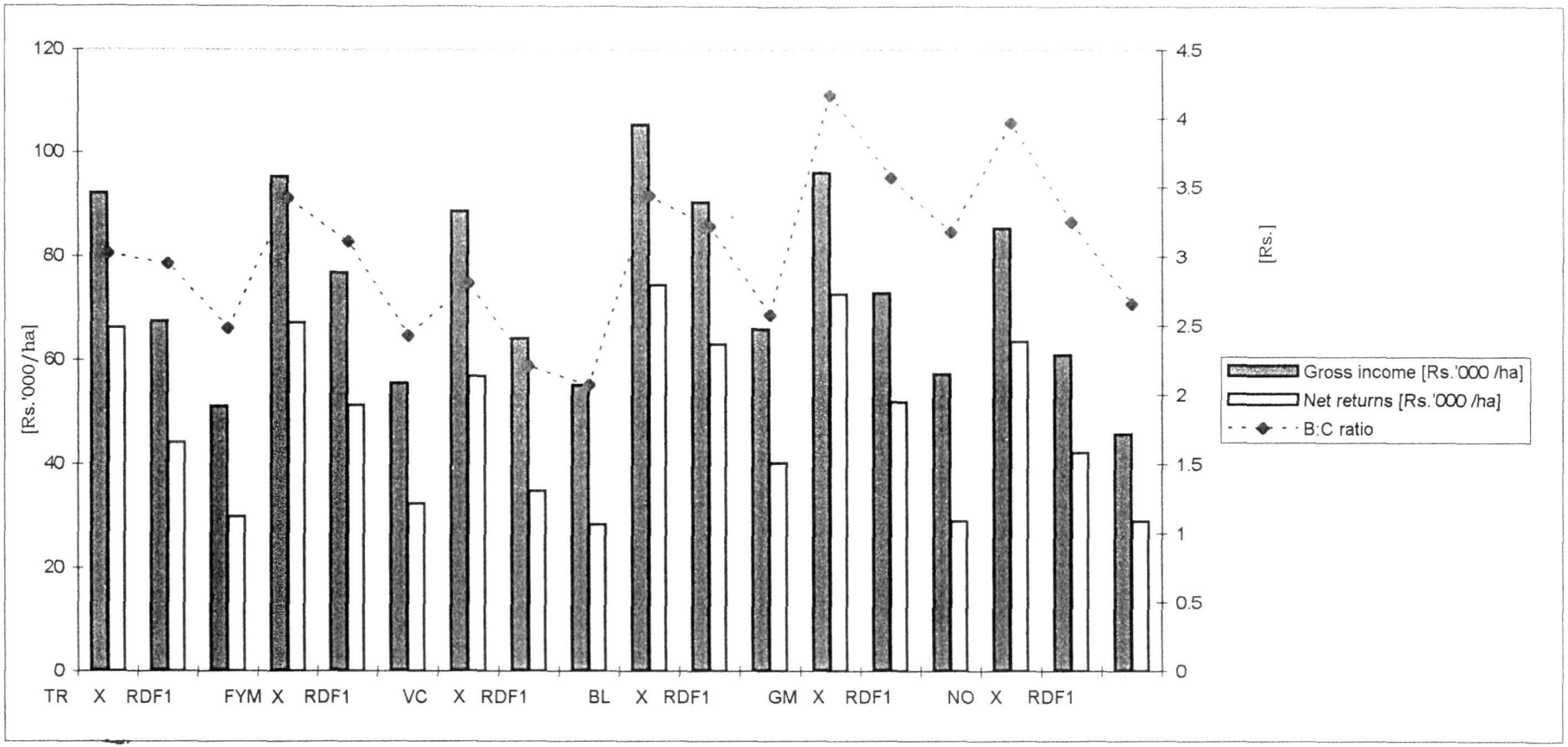

Fig. 7. Gross income, net income [Rs. '000/ha] and B:C ratio of sugar cane as influenced by organic and inorganic fertilizers.

BL, TR and FYM and recorded significantly lower B: C ratio than no organic treatment.

The significant reduction in B: C ratio was noticed due to reduced levels of chemical fertilizers from RDF_1 to RDF_3 recording maximum with RDF_1 (3.57) and minimum with RDF_4 (2.57).

The interaction effects were found significant due to application of organic and inorganic fertilizers. The significantly higher B: C ratio was recorded due to combinations of GM X RDF_1 (4.17) and RDF_1 alone (3.97) over other treatment combinations.

4.1.6 SOIL PROPERTIES

4.1.6.1 Soil reaction [pH]

The pH of soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables.20, 20a and 20b.

The soil pH after harvest of plant and ratoon crop due to application of organic and inorganic fertilizers did not differ significantly. The initial soil pH was 8.0. Use of different organics failed to influence on soil pH significantly. Similarly reduced

levels of chemical fertilizers did not exert any significant effect on soil pH. The interaction effects due to application of organic and inorganic fertilizers also followed the same trend.

4.1.6.2 Electrical conductivity [E.C] (dS/m)

The electrical conductivity of soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables. 20, 20a and 20b.

The electrical conductivity of initial soil was 0.33. The electrical conductivity of soil due to application of organic fertilizers had no significant effect over a period of two years. Similarly the varied levels of inorganic fertilizers application did not exert significant results on electrical conductivity of soil. Further pooled analysis data revealed that there was no significant difference in electrical conductivity of soils due to interaction effects of organic and inorganic fertilizers.

4.1.6.3 Bulk density (g/cc)

The bulk density of soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables.20, 20a and 20b.

The bulk density of soil averaged over two years due to application of organic and inorganic fertilizers produced significant results. The initial soil bulk density was 1.44.The bulk density was registered significantly lower due to application of BL (1.34) over VC (1.42) and NO (1.44) and it was on par with the application of TR (1.36), FYM (1.37) and GM (1.38). The similar trend was noticed in case of soils after harvest of ratoon crop. However, the soils after harvest of plant cane did not exhibit any significant difference of bulk density due to various organics.

The lower levels of inorganic fertilizers significantly increased the bulk density of soils. However, application of RDF_1 recorded on par bulk density with RDF_2 but it registered significantly lower bulk density over RDF_3.

The pooled analysis data indicated that significantly lower bulk density was recorded due to application of all organics along with different levels of inorganic fertilizers except TR X RDF_3 and BL X RDF_3 over application of various grades of chemical fertilizers. However the plant cane did not exert any significant results due to interaction effects.

4.1.6.4 Water holding capacity [W.H.C](%)

The water holding capacity of soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables. 20, 20a and 20b.

The water holding capacity of soils after harvest of plant and ratoon cane averaged over two years due to application of organic and inorganic fertilizers exerted significant results. The initial water holding capacity was 29.83. The application of BL exerted significantly higher water holding capacity (37.47) in soil over other treatments. Further application of TR and FYM recorded significantly higher water holding capacity over VC, GM and no organic treatment and they were on par with each other. Significantly less water holding capacity was noticed with no organic treatment (29.48). Similar trend was observed in case of soils after harvest of ratoon crop. However, after harvest of plant crop application of BL, TR and FYM showed on par water holding capacity values compared to other treatment and were significantly superior over other treatments.

The water holding capacity registered significant higher WHC due to RDF_1 and there onwards upto RDF_3.

Table 20.Soil reaction , electrical conductivity, bulk density and water holding capacity of soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Soil reaction[pH]	Electrical conductivity [dS/m]	Bulk density [g/cc]	Water holding capacity [%]
A.Organic manures				
TR	7.76	0.26	1.36	35.41
FYM	7.68	0.28	137	35.66
VC	7.77	0.28	1.42	31.63
BL	7.60	0.25	1.34	37.47
GM	7.77	0.28	1.38	30.50
NO	8.06	0.33	1.44	29.48
SEm ±	0.189	0.030	0.017	0.524
C D at 5 %	NS	NS	0.047	1.480
B.Chemical fertilizers				
RDF_1	7.63	0.27	1.36	34.24
RDF_2	7.79	0.28	1.37	33.77
RDF_3	0.89	0.25	1.43	32.05
SEm±	0.118	0.004	0.016	0.852
C D at 5%	NS	NS	0.044	2.364
Interaction [AXB]				
TR X RDF_1	7.67	0.26	1.32	37.70
TR X RDF_2	7.75	0.26	1.34	36.58
TR X RDF_3	7.87	0.25	1.40	32.45
FYM X RDF_1	7.52	0.27	1.33	36.95
FYM X RDF_2	7.68	0.28	1.37	33.25
FYM X RDF_3	7.85	0.28	1.37	33.85
VC X RDF_1	7.45	0.27	1.37	32.35
VC X RDF_2	7.79	0.28	1.39	31.63
VC X RDF_3	7.85	0.28	1.49	20.97
BL X RDF_1	7.52	0.24	1.30	38.40
BL X RDF_2	7.55	0.25	1.32	38.25
BL X RDF_3	7.75	0.27	1.35	31.19
GM X RDF_1	7.75	0.27	1.37	30.65
GM X RDF_2	7.95	0.30	1.41	29.59
GM X RDF_3	7.95	0.32	1.41	29.32
NO X RDF_1	7.95	0.32	1.41	29.37
NO X RDF_2	8.13	0.32	1.42	29.72
NO X RDF_3	8.09	0.34	1.47	29.65
SEm±	0.265	0.008	0.035	0.857
C D at 5%	NS	NS	0.097	2.375

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 20a. Soil reaction , electrical conductivity , bulk density and water holding capacity of soil after harvest of plant cane as influenced by organic and inorganic fertilizers

Treatment	Soil reaction[pH]	Electrical conductivity [dS/m]	Bulk density [g/cc]	Water holding capacity [%]
Initial value	8.0	0.33	1.44	29.83
A.Organic manures				
TR	7.81	0.26	1.38	34.30
FYM	7.76	0.28	1.39	34.83
VC	7.80	0.29	1.42	31.12
BL	7.50	0.26	1.37	36.53
GM	7.80	0.29	1.38	30.30
NO	8.08	0.32	1.42	29.54
SEm ±	0.189	0.041	0.025	0.812
C D at 5 %	NS	NS	NS	2.428
B.Chemical fertilizers				
RDF_1	7.64	0.28	1.26	34.01
RDF_2	7.80	0.28	1.38	23.39
RDF_3	7.93	0.29	1.44	30.95
SEm±	0.112	0.007	0.016	1.054
C D at 5%	NS	NS	0.044	3.122
Interaction [AXB]				
TR X RDF_1	7.73	0.27	1.35	37.20
TR X RDF_2	7.80	0.25	1.37	36.50
TR X RDF_3	7.90	0.24	1.41	29.20
FYM X RDF_1	7.63	0.28	1.35	36.80
FYM X RDF_2	7.75	0.29	1.36	35.28
FYM X RDF_3	7.90	7.28	1.45	32.40
VC X RDF_1	7.70	0.28	1.37	32.10
VC X RDF_2	7.80	0.29	1.39	30.75
VC X RDF_3	7.90	0.28	1.50	30.50
BL X RDF_1	7.30	0.25	1.33	37.50
BL X RDF_2	7.40	0.26	1.36	37.80
BL X RDF_3	7.80	0.28	1.35	34.30
GM X RDF_1	7.80	0.28	1.37	31.18
GM X RDF_2	8.00	0.31	1.41	30.50
GM X RDF_3	7.90	0.32	1.41	29.30
NO X RDF_1	7.90	0.32	1.41	29.50
NO X RDF_2	8.25	0.31	1.47	29.83
NO X RDF_3	8.10	0.33	1.42	29.60
SEm±	0.275	0.012	0.039	1.302
C D at 5%	NS	NS	NS	3.609

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 20b. Soil reaction , electrical conductivity , bulk density and water holding capacity of soil after harvest of ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Soil reaction[pH]	Electrical conductivity [dS/m]	Bulk density [g/cc]	Water holding capacity [%]
A.Organic manures				
TR	7.71	0.25	1.33	36.52
FYM	7.60	0.27	1.34	36.48
VC	7.73	0.27	1.41	32.13
BL	7.44	0.24	1.30	38.40
GM	7.64	0.27	1.38	30.60
NO	8.02	0.33	1.45	29.41
SEm ±	0.174	0.006	0.014	0.394
C D at 5 %	NS	0.017	0.042	1.179
B.Chemical fertilizers				
RDF_1	7.54	0.26	1.33	34.47
RDF_2	7.68	0.27	1.35	34.15
RDF_3	7.85	0.28	1.42	33.15
SEm±	0.131	0.004	0.008	0.948
C D at 5%	NS	NS	0.049	2.821
Interaction [AXB]				
TR X RDF_1	7.60	0.24	1.30	37.20
TR X RDF_2	7.70	0.25	1.31	36.65
TR X RDF_3	7.83	0.26	1.38	35.70
FYM X RDF_1	7.40	0.26	1.31	37.10
FYM X RDF_2	7.60	0.27	1.32	37.05
FYM X RDF_3	7.80	0.28	1.32	35.30
VC X RDF_1	7.60	0.26	1.32	32.60
VC X RDF_2	7.78	0.27	1.39	32.50
VC X RDF_3	7.80	0.28	1.42	31.30
BL X RDF_1	7.33	0.23	1.26	39.30
BL X RDF_2	7.30	0.24	1.28	38.70
BL X RDF_3	7.70	0.25	1.35	37.20
GM X RDF_1	7.70	0.26	1.36	31.20
GM X RDF_2	7.90	0.29	1.41	30.80
GM X RDF_3	8.00	0.31	1.41	29.88
NO X RDF_1	8.00	0.31	1.41	29.25
NO X RDF_2	8.00	0.33	1.42	29.60
NO X RDF_3	8.08	0.34	1.52	29.50
SEm±	0.319	0.009	0.045	0.878
C D at 5%	NS	NS	0.124	2.434

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

The interaction effects revealed that application of BL X RDF_1 (38.40) gave significantly the highest water holding capacity value over other treatments. However, it was on par with application of TR X RDF_1, TR X RDF_2, FYM X RDF_1, FYM X RDF_2 and BL X RDF_2 and all these combinations were also significantly superior over rest of the treatments. The other treatments viz., TR X RDF_3, FYM X RDF_3 and BL X RDF_3 exerted significantly higher WHC values compared to application of chemical fertilizers alone.

4.1.6.5 Organic carbon (%)

The organic carbon of soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables.21, 21a and 21b.

The organic carbon after harvest of plant and ratoon crops averaged over due to application of organic and inorganic fertilizers differed significantly. The initial soil organic carbon was 0.39. Significantly higher organic carbon was registered (0.58) due to application of BL over other treatments followed by application of TR (0.49) which also recorded significantly higher organic carbon over VC (0.44), NO (0.36). Application of TR was on par with FYM (0.49) and GM (0.45). Similar trend was

exhibited in case of soils after harvest of ratoon crop. However soils after harvest of plant cane showed significantly higher organic carbon (0.53) due to application of BL over other treatments but application of rest of the organics were on par.

Reduced levels of chemical fertilizers significantly decreased the organic carbon content of the soil. There was however, no significant difference between RDF_1 and RDF_2 while RDF_3 recorded significantly lower organic carbon content compared to RDF_1 and RDF_2.

The interaction effects due to application of organic and inorganic fertilizers differed significantly. Application of BL X RDF_1 (0.64) exerted significantly higher organic carbon over other treatment combinations. Further, it was revealed that application of all the organics in conjunction with fertilizers significantly exerted higher organic carbon content over the sole application of fertilizers.

4.1.6.6 Available nitrogen (kg/ha)

The available nitrogen content in the soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables. 21, 21a and 21b.

The available nitrogen (kg/ha) content averaged over two years differed significantly. The initial available nitrogen content in the soil was 210.40. Application of BL had the highest available nitrogen content (254.08) over other treatments followed by TR (240.65), which was also significantly higher than rest of the treatments. Applications of FYM, VC and GM did not exhibit significant difference but were significant over no organic treatment.

The application of different levels of fertilizers significantly influenced the available nitrogen content in the soil. The highest was observed with RDF_1 (273.42) and the lowest with RDF_3 (165.61).

The pooled analysis revealed that the interaction effects due to organic and inorganic fertilizers were significant. The highest available nitrogen was recorded due to application of BL X RDF_1 (350.12). Further it was observed that the available nitrogen content was significantly higher due to TR X RDF_1, TR X RDF_2, FYM X RDF_1, VC X RDF_1, BL X RDF_2 and GM X RDF_1 over all levels inorganic fertilizers alone Fig.8].

4.1.6.7 Available phosphorus (kg/ha)

The available phosphorus content in the soils after harvest

of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables. 21, 21a and 21b.

The available phosphorus content (kg/ha) averaged over two years as influenced by organic and inorganic fertilizers showed significant results. The initial soil P_2O_5 content was 19.80. Application of BL recorded significantly higher available P_2O_5 (45.15) over other treatments followed by application of TR (41.71) which inturn was significantly superior over FYM, GM and VC. While, latter three treatments were significantly higher available P_2O_5 compared to the soils without organic (20.83). The least P_2O_5 content was observed with no organic treatment.

Significant reduction in the available P_2O_5 content was observed due to decreased in the levels of application of fertilizers from RDF_1 to RDF_3.

The interaction effects were significant due to application of organic and inorganic fertilizers. The highest available P_2O_5 was found due to application of BL X RDF_1 (58.18) over other treatment combinations. It was also observed that application of TR X RDF_1, TR X RDF_2, TR X RDF_3, FYM X RDF_1, FYM X RDF_2, VC X RDF_1, BL X RDF_2 and GM X RDF_1 recorded significantly higher available P_2O_5 over application of sole inorganic fertilizers.

4.1.6.9 Available potassium (kg/ha)

The available potassium content in the soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables. 21, 21a and 21b.

The available potassium content (kg/ha) averaged over two years differed significantly. The initial content of potassium in the soil was 332.40. Among organics, BL recorded maximum (398.73) K_2O content in the soil over other treatments. Further it was revealed that application of TR and VC registered on par available K_2O content in the soil but significantly higher over application of FYM, GM and inturn these latter two treatments recorded higher available K_2O over no organic treatment (277.79).

The available K_2O content in the soil decreased significantly as the inorganic fertilizers levels were reduced from RDF_1 to RDF_3 [Fig.8].

The pooled analysis of the data indicated that the interaction effects were significant. Significantly the highest available K_2O was observed due to application of BL X RDF_1 and further it was noticed that application of TR X RDF_1, TR X RDF_2, TR X RDF_3, FYM X RDF_1, FYM X RDF_2, VC X RDF_1, VC X RDF_2,

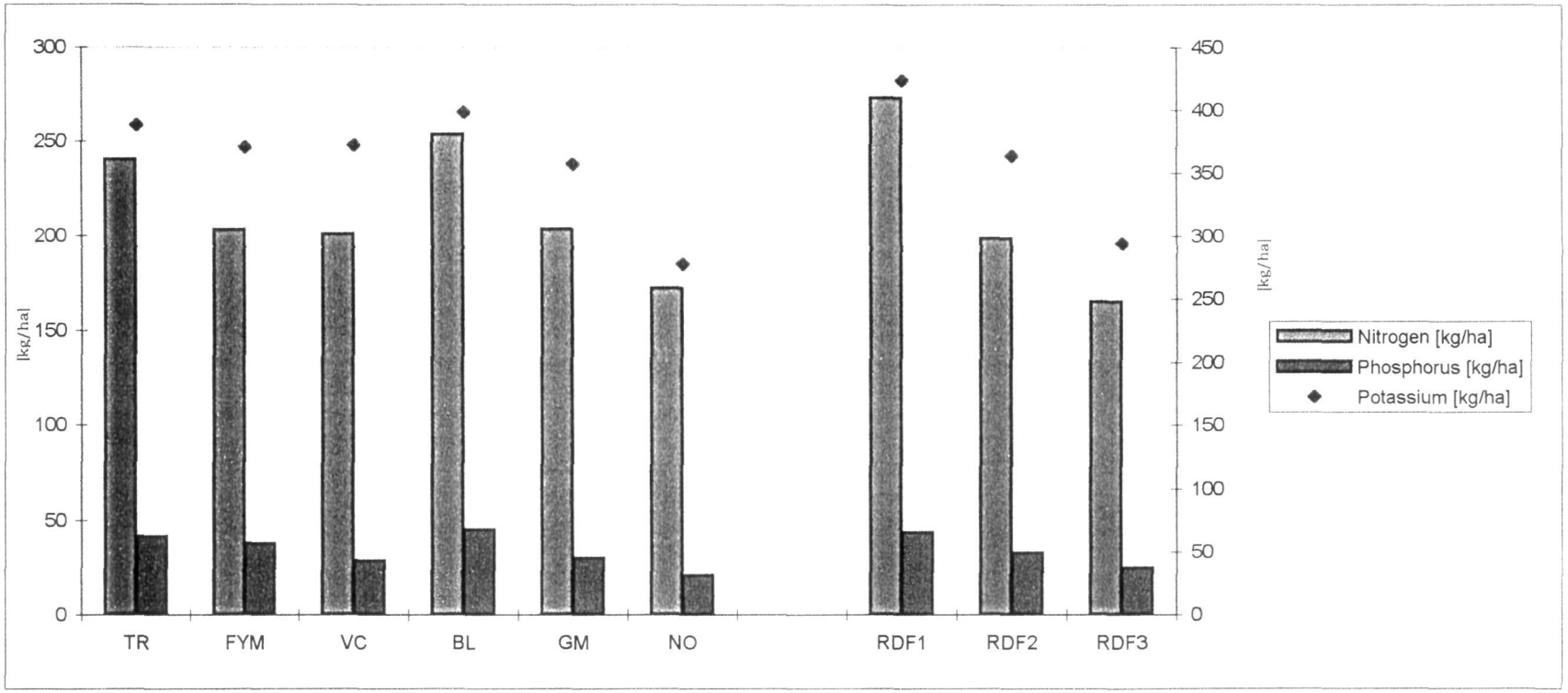

Fig. 8. Available nitrogen, phosphorus and potassium [kg/ha] in the soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers.

Table 21.Organic carbon,available nitrogen,phosphorus and potassium in the soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Organic carbon [%]	Nitrogen [kg/ha]	Phosphorus [kg/ha]	Potassium [kg/ha]
A.Organic manures				
TR	0.49	240.65	41.71	388.32
FYM	0.49	203.39	38.02	370.32
VC	0.44	201.28	28.57	372.22
BL	0.58	254.08	45.15	398.73
GM	0.45	203.90	30.32	357.56
NO	0.36	172.38	20.83	277.79
SEm ±	0.015	3.456	1.032	3.228
C D at 5 %	0.042	9.579	2.852	8.948
B.Chemical fertilizers				
RDF_1	0.48	273.42	43.59	424.12
RDF_2	0.48	198.82	33.07	364.21
RDF_3	0.44	165.41	24.97	294.15
SEm±	0.007	2.188	0.437	3.342
C D at 5%	0.019	6.064	1.211	9.264
Interaction [AXB]				
TR X RDF_1	0.48	313.73	49.08	452.59
TR X RDF_2	0.53	232.75	43.68	391.01
TR X RDF_3	0.46	175.48	32.64	313.42
FYM X RDF_1	0.51	250.92	52.99	443.30
FYM X RDF_2	0.50	190.73	33.44	365.65
FYM X RDF_3	0.47	168.52	26.14	302.00
VC X RDF_1	0.46	258.90	34.66	419.94
VC X RDF_2	0.44	183.42	27.47	394.53
VC X RDF_3	0.42	161.48	22.60	297.40
BL X RDF_1	0.64	350.12	58.18	482.18
BL X RDF_2	0.57	226.01	48.39	397.11
BL X RDF_3	0.47	186.13	28.88	316.92
GM X RDF_1	0.47	265.42	40.96	442.83
GM X RDF_2	0.42	186.81	26.81	348.97
GM X RDF_3	0.37	159.48	23.19	280.29
NO X RDF_1	0.37	201.36	25.67	298.90
NO X RDF_2	0.38	173.84	21.46	279.98
NO X RDF_3	0.34	142.55	25.25	254.50
SEm±	0.017	4.798	1.195	9.259
C D at 5%	0.047	13.299	3.312	22.893

Organics
TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 21a. Organic carbon,available nitrogen,phosphorus and potassium in the soil after harvest of plant cane as influenced by organic and inorganic fertilizers

Treatment	Organic carbon [%]	Nitrogen [kg/ha]	Phosphorus [kg/ha]	Potassium [kg/ha]
Initial value	0.39	210.40	19.80	332.40
A.Organic manures				
TR	0.46	237.64	38.62	368.19
FYM	0.46	194.63	36.33	345.49
VC	0.43	192.08	27.63	334.51
BL	0.52	245.62	41.93	372.63
GM	0.44	198.35	28.37	342.72
NO	0.36	181.95	22.23	290.23
SEm ±	0.018	4.132	1.232	3.529
C D at 5 %	0.053	12.277	3.646	10.486
B.Chemical fertilizers				
RDF_1	0.47	263.42	42.65	413.29
RDF_2	0.45	193.43	32.44	336.29
RDF_3	0.41	163.31	22.47	277.31
SEm±	0.010	2.277	0.492	3.565
C D at 5%	0.028	6.172	1.364	9.881
Interaction [AXB]				
TR X RDF_1	0.51	295.13	46.80	450.93
TR X RDF_2	0.46	243.40	42.50	369.25
TR X RDF_3	0.41	174.40	26.55	284.40
FYM X RDF_1	0.48	235.40	56.60	428.45
FYM X RDF_2	0.47	182.98	29.25	329.40
FYM X RDF_3	0.43	165.58	23.15	278.63
VC X RDF_1	0.44	238.43	34.53	413.43
VC X RDF_2	0.43	178.30	26.78	321.80
VC X RDF_3	0.42	162.50	21.60	268.30
BL X RDF_1	0.56	338.80	55.05	453.18
BL X RDF_2	0.49	215.38	45.68	271.23
BL X RDF_3	0.45	182.68	25.05	293.50
GM X RDF_1	0.45	260.38	36.89	421.33
GM X RDF_2	0.41	178.32	26.08	331.50
GM X RDF_3	0.35	156.35	22.15	272.30
NO X RDF_1	0.35	222.38	26.03	312.40
NO X RDF_2	0.40	175.23	24.35	291.58
NO X RDF_3	0.33	148.25	16.30	266.73
SEm±	0.025	5.576	1.205	8.733
C D at 5%	0.069	15.464	3.340	24.207

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 21b. Organic carbon,available nitrogen, phosphorus and potassium in the soil after harvest of ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Organic carbon [%]	Nitrogen [kg/ha]	Phosphorus [kg/ha]	Potassium [kg/ha]
A.Organic manures				
TR	0.51	253.66	44.74	408.47
FYM	0.52	212.15	39.21	395.14
VC	0.44	210.48	29.51	410.09
BL	0.62	262.54	48.37	424.83
GM	0.46	209.45	32.26	372.40
NO	0.36	162.81	19.43	265.35
SEm ±	0.011	3.782	0.811	7.122
C D at 5 %	0.034	11.237	2.409	21.161
B.Chemical fertilizers				
RDF_1	0.49	283.42	44.52	434.95
RDF_2	0.50	204.21	34.55	392.13
RDF_3	0.45	167.91	27.46	311.06
SEm±	0.008	2.673	0.590	4.011
C D at 5%	0.022	7.409	1.635	11.117
Interaction [AXB]				
TR X RDF_1	0.43	342.23	51.350	454.25
TR X RDF_2	0.59	232.10	44.30	428.77
TR X RDF_3	0.51	186.55	38.73	342.40
FYM X RDF_1	0.53	266.53	19.38	458.15
FYM X RDF_2	0.52	198.48	37.63	401.90
FYM X RDF_3	0.50	171.45	29.13	325.32
VC X RDF_1	0.46	279.45	34.78	426.45
VC X RDF_2	0.44	191.53	28.15	467.33
VC X RDF_3	0.42	160.45	25.60	326.50
BL X RDF_1	0.71	361.43	61.30	511.18
BL X RDF_2	0.64	236.63	51.10	422.98
BL X RDF_3	0.48	189.38	32.70	340.35
GM X RDF_1	0.49	270.45	45.03	464.30
GM X RDF_2	0.43	195.30	27.53	363.43
GM X RDF_3	0.37	162.60	24.23	289.48
NO X RDF_1	0.37	180.33	25.30	285.40
NO X RDF_2	0.36	171.25	18.57	268.38
NO X RDF_3	0.35	136.85	14.40	242.27
SEm±	0.018	6.548	1.446	9.826
C D at 5%	0.049	18.150	4.008	27.236

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

BL X RDF_2, GM x RDF_1 and GM X RDF_2 were significantly higher over sole application of inorganic fertilizers.

4.1.6.9 P-solubilisers count (10^4/g soil)

The P-solubilisers count in the soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables.22, 22a and 22b.

The P-solubilisers count averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The initial P-solubilisers count was 5.96. Application of BL significantly increased P-solubilisers (19.29) compared to other treatments followed by TR (16.75), which also exhibited significantly higher P-solubilisers over FYM, VC and GM. The latter three though recorded significantly higher P-solubilisers over no organic treatment (8.46) but were on par with each other.

The reduced levels of inorganic fertilizers significantly decreased the P-solubilisers count. The maximum P-solubilisers count was with RDF_1 (17.30) and minimum was with RDF_3 (11.59).

The pooled analysis data revealed that the interaction effects due to organic and inorganic fertilizers differed

significantly. The highest P-solubilisers count was observed due to application of BL along with RDF_1 (22.88).

4.1.7.0 Actinomycetes (10^4/g soil)

The actinomycetes in the soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables.22, 22a and 22b.

The actinomycetes in the soils averaged over two years as influenced by organic and inorganic fertilizers showed significant results. The initial actinomycetes count was 17.43. Application of BL exhibited significantly higher actinomycetes count (25.17) over other treatments and further it was observed that application of TR (22.88) registered significantly higher actinomycetes over VC, FYM, GM and latter three also registered significantly higher actinomycetes over no organics (17.75). Only in case of soils after harvest of plant cane the results were non-significant. There was significant reduction in actinomycete count due to reduced levels of inorganic fertilizers. Significantly the highest actinomycetes count was recorded with RDF_1 (22.92) and lowest with RDF_3 (19.65).

The interaction effects were significant due to organic and inorganic fertilizers on actinomycete count. The significantly highest actinomycetes count was recorded with application BL X

RDF_1 (28.00). The data further revealed that application of TR X RDF_1, TR X RDF_2, FYM X RDF_1, VC X RDF_1, BL X RDF_2, BL X RDF_3 and GM X RDF_1 exhibited significantly higher actinomycetes count over only application of inorganic fertilizers.

4.1.7.1 Fungi (10^4/g soil)

The fungal count in the soils after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables.22, 22a and 22b.

The fungal count averaged over two years as influenced by organic and inorganic fertilizers showed significant results. The initial fungal count was 19.81. Among the organics, application of BL exerted significantly higher fungal count (28.54) over other treatments. Further application of TR (25.88) also exhibited significantly higher fungal count over VC, FYM and GM that were on par and produced significantly higher fungal count than without organic treatment (16.84). Only in case of plant crop, application of BL showed significantly higher fungal count over other treatments except TR and VC.

The fungal count was significantly reduced as the levels of chemical fertilizers application reduced from RDF_1 to RDF_3 exhibiting maximum with RDF_1 and minimum with RDF_3.

The interaction effects were found significant due to organic and inorganic fertilizers. The pooled analysis data revealed that application of BL along with RDF_1 exerted significantly higher fungal count over other all treatment combinations and further it was noticed that except FYM X RDF_3 and GM X RDF_3 rest of all organics in combination with all levels of inorganic fertilizers gave significantly higher fungal count compared to application of only inorganic fertilizers.

4.1.7.2 Azotobacteria (10^4/g soil)

The azotobacteria count in soils after harvest of plant and ratoon crop as influenced by organic and inorganic fertilizers is presented in Tables.22,22a and22b.

The azotobacteria count averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The initial azotobacteria count was 7.46. Among the organics application of BL recorded significantly higher (19.92) azotobacteria count compared to all other treatments. The on par results were shown by TR and VC and were significantly superior over FYM and GM. These latter two treatments had significantly higher azotobacteria count over no organic treatment (6.79).

Table 22. Biological properties of soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers [Pooled]

Treatment	P-solubilizers [10^4/g soil]	Actinomycetes [10^4/g soil]	Fungi [10^4/g soil]	Azotobacteria [10^4/g soil]
A.Organic manures				
TR	16.75	22.88	25.88	16.21
FYM	13.96	19.75	21.71	13.71
VC	14.54	21.42	24.59	15.64
BL	19.29	25.17	28.54	19.92
GM	13.04	20.17	21.50	12.96
NO	8.46	17.75	16.84	6.79
SEm ±	0.325	0.347	0.374	0.348
C D at 5 %	0.908	0.962	1.042	0.962
B.Chemical fertilizers				
RDF_1	17.30	22.92	26.44	14.86
RDF_2	14.15	20.57	21.94	13.86
RDF_3	11.59	19.65	20.94	13.28
SEm±	0.341	0.233	0.245	0.328
C D at 5%	0.943	0.654	0.685	0.917
Interaction [AXB]				
TR X RDF_1	19.50	24.25	29.50	17.50
TR X RDF_2	16.88	22.63	24.63	15.88
TR X RDF_3	13.88	21.75	23.50	15.25
FYM X RDF_1	18.25	22.50	26.00	13.88
FYM X RDF_2	13.38	19.13	20.25	12.88
FYM X RDF_3	10.25	17.63	18.88	12.75
VC X RDF_1	19.13	22.25	28.13	16.00
VC X RDF_2	13.02	21.00	23.15	14.88
VC X RDF_3	11.50	21.00	22.25	13.88
BL X RDF_1	22.88	28.00	32.63	20.75
BL X RDF_2	19.25	23.00	26.88	20.00
BL X RDF_3	15.75	23.38	26.13	19.00
GM X RDF_1	15.25	22.00	24.75	14.00
GM X RDF_2	13.50	19.88	21.00	12.50
GM X RDF_3	10.38	20.13	18.75	12.38
NO X RDF_1	8.75	18.50	17.63	7.00
NO X RDF_2	8.88	17.75	16.05	7.00
NO X RDF_3	7.25	17.00	16.13	6.38
SEm±	0.816	0.692	0.688	0.785
C D at 5%	2.264	1.905	1.914	2.175

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 22a. *Biological properties of soil after harvest of plant cane as influenced by organic and inorganic fertilizers*

Treatment	P-solubilizers [10^4/g soil]	Actinomycetes [10^4/g soil]	Fungi [10^4/g soil]	Azotobacteria [10^4/g soil]
Initial value	5.96	17.43	19.81	7.46
A.Organic manures				
TR	4.33	17.42	23.25	13.83
FYM	11.53	17.00	21.00	12.00
VC	12.58	17.22	23.50	13.50
BL	15.75	18.17	24.75	16.50
GM	11.08	18.25	20.08	19.08
NO	7.83	19.00	17.17	7.08
SEm ±	0.398	0.682	0.573	0.218
C D at 5 %	1.180	NS	1.704	0.654
B.Chemical fertilizers				
RDF_1	15.17	17.88	24.58	13.21
RDF_2	11.83	17.25	20.50	12.17
RDF_3	10.21	17.08	19.79	11.38
SEm±	0.397	0.282	0.349	0.218
C D at 5%	1.105	0.784	0.975	0.605
Interaction [AXB]				
TR X RDF_1	16.25	16.25	26.25	15.25
TR X RDF_2	14.50	17.75	21.75	13.50
TR X RDF_3	12.25	18.25	21.75	12.75
FYM X RDF_1	16.25	18.75	25.50	13.50
FYM X RDF_2	10.50	16.50	19.25	12.25
FYM X RDF_3	8.25	15.75	18.25	11.75
VC X RDF_1	16.75	15.25	26.50	14.75
VC X RDF_2	11.25	17.25	21.75	13.50
VC X RDF_3	9.75	19.50	22.25	12.25
BL X RDF_1	19.25	19.25	28.50	17.25
BL X RDF_2	14.75	15.25	23.25	16.50
BL X RDF_3	13.25	17.25	22.50	15.75
GM X RDF_1	12.25	17.25	23.25	11.25
GM X RDF_2	11.50	17.50	19.75	9.50
GM X RDF_3	9.50	19.50	17.25	9.50
NO X RDF_1	9.75	19.50	17.50	7.25
NO X RDF_2	8.50	19.25	17.21	7.75
NO X RDF_3	8.25	18.25	16.75	6.25
SEm±	0.913	1.672	0.856	0.534
C D at 5%	2.704	NS	2.373	1.484

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

Table 22b. Biological properties of soil after harvest of ratoon canes as influenced by organic and inorganic fertilizers

Treatment	P-solubilizers [10^4/g soil]	Actinomycetes [10^4/g soil]	Fungi [10^4/g soil]	Azotobacteria [10^4/g soil]
A.Organic manures				
TR	19.17	28.33	28.50	18.58
FYM	16.08	22.50	22.42	13.83
VC	16.50	25.50	25.67	16.58
BL	22.83	32.17	22.33	23.33
GM	15.00	23.08	22.92	15.83
NO	8.08	15.50	16.50	6.50
SEm ±	0.453	0.382	0.382	0.455
C D at 5 %	1.352	1.142	1.145	1.356
B.Chemical fertilizers				
RDF_1	19.42	27.96	28.29	16.50
RDF_2	16.64	23.88	23.18	15.54
RDF_3	12.96	22.21	22.08	15.17
SEm±	0.345	0.365	0.365	0.436
C D at 5%	0.963	1.015	1.017	1.224
Interaction [AXB]				
TR X RDF_1	22.75	32.25	32.75	19.75
TR X RDF_2	19.25	27.50	27.50	18.25
TR X RDF_3	15.50	25.25	21.25	17.75
FYM X RDF_1	19.25	26.25	25.00	14.25
FYM X RDF_2	16.25	21.50	21.25	13.50
FYM X RDF_3	12.25	19.50	19.50	13.05
VC X RDF_1	21.50	29.25	29.25	17.25
VC X RDF_2	14.75	24.75	24.50	16.25
VC X RDF_3	13.25	22.50	22.25	15.50
BL X RDF_1	26.50	26.25	36.75	14.25
BL X RDF_2	23.75	20.75	30.50	23.50
BL X RDF_3	18.25	29.50	29.75	22.25
GM X RDF_1	18.25	26.75	26.25	16.25
GM X RDF_2	15.50	22.25	22.25	15.50
GM X RDF_3	11.25	20.75	20.28	15.25
NO X RDF_1	7.25	17.50	17.75	6.25
NO X RDF_2	9.25	14.25	16.25	6.25
NO X RDF_3	7.25	15.75	15.50	6.50
SEm±	0.844	0.894	0.894	1.068
C D at 5%	2.342	2.484	2.482	2.961

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure @ 25 t/ha
VC = Vermicompost @ 5 t/ha
BL = *Bhumilabh* @ 10 t/ha
GM = Green manuring [sunnhemp]
NO = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 50 % RDF
RDF_3 = No fertilizer

The reduced levels of chemical fertilizers significantly reduced the azotobacteria count and further RDF $_2$ and RDF$_3$ showed on par results.

The pooled analysis indicated that the interaction effects were significant. The combination of BL with all levels of RDF exerted significantly highest azotobacteria count over all other treatments. Further rest of all organic fertilizers in conjunction with various levels of chemical fertilizers registered significantly higher azotobacteria count over their sole application.

EXPERIMENT II

4.2.1 GROWTH PARAMETERS

4.2.1.1 GERMINATION (%)

The germination percentage in plant cane as influenced by organic and inorganic fertilizers is presented in Table.23.

The germination percentage failed to exhibit significant difference either due to application of organic or due to inorganic fertilizers. The interaction effects due to organic and inorganic fertilizers did not differ significantly with respect to germination percentage.

4.2.1.2 Tiller count (lakh/ha)

The tiller count in sugarcane at 120 DAP/R (Days after planting/ratoon initiation) as influenced by organic and inorganic fertilizers is presented in Table. 23

The tiller count (lakh/ha) at 120 DAP/R in sugarcane was not influenced significantly due to application of organic fertilizers. However, levels of fertilizers significantly affected the tiller count at 120 DAP/R. Significantly higher tiller count was observed due to application of RDF_1 (1.34) over RDF_3 (1.27) and RDF_4 (1.25) which showed on par tiller count with RDF_2 (1.30) and latter two levels also exhibited on par tillers. However, plant cane did not exhibit significant difference due to reduced levels of inorganic fertilizers where as ratoon cane showed similar trend as observed on pooled analysis.

The interaction effects due to organic and inorganic fertilizers failed to influence significantly the tiller count for both plant and ratoon cane individually and also on pooled analysis.

Table 23. Germination and tiller count in sugarcane as influenced by organic and inorganic fertilizers

Treatment	Germination [%]	Tiller count [Lakh/ha]		
		120 DAP	120 DAR	Pooled
A. Organic manures				
PM_1	84.91	1.29	1.24	1.27
PM_2	81.60	1.32	1.28	1.30
BL_1	86.09	1.29	1.26	1.28
BL_2	85.93	1.33	1.35	1.34
NO	84.08	1.29	1.23	1.26
SEm±	1.732	0.066	0.051	0.047
C D at 5%	NS	NS	NS	NS
B.Chemical fertilizers				
RDF_1	84.41	1.35	1.32	1.34
RDF_2	84.50	1.31	1.29	1.30
RDF_3	83.27	1.29	1.24	1.27
RDF_4	85.91	1.26	1.23	1.25
SEm±	1.308	0.033	0.053	0.025
C D at 5%	NS	NS	0.073	0.069
Interaction [AXB]				
SEm±	2.924	0.127	0.118	0.109
C D at 5 %	NS	NS	NS	NS

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

4.2.1.3 Total dry matter (TDM) production (g/plant)

The total dry matter (TDM) production at various growth stages as influenced by organic and inorganic fertilizer is presented in Tables.24, 24a and 24b.

The total dry matter production (g/plant) averaged over two years as influenced by various organic and inorganic fertilizers differed significantly at various growth stages. The TDM production increased progressively from 60 DAP/R (Days after planting/ratoon initiation) (50.47) till harvest (242.55). Among the various organic manures, the highest TDM (g/plant) at 60 DAP/R was observed in BL_2 (54.09) which was significantly superior over rest of the organic manures followed by PM_2 and BL_1 and PM_1 however, PM_2 and BL_1 did not differ significantly and the least was with no organic manures (47.08). Similarly, TDM due to PM_1 and NO also did not exhibit significant difference. Similar trend in the TDM production at advanced growth stages of 120, 180, 240 and at harvest was maintained. Application of *bhumilabh* @ 5.0 t/ha had the highest TDMproduction in allthe growth stages andit was found on par with

application of pressmud @ 25 t/ha only at 240 DAP/R.

Significant difference in the TDM production on pooled basis was observed due to application of chemical fertilizers at various levels in all the growth stages of the crop. Application of RDF_1 exhibited significantly highest TDM production in all the growth stages. The TDM production decreased in all the growth stages with decreased levels of fertilizers and reached the lowest with RDF_4. However, significant difference among the various fertilizer levels in all the stages was noticed.

The interaction effects between the organic manures and chemical fertilizers were found significant for all the growth stages. At 60 DAP/R the highest TDM was recorded in BL_2 X RDF_1 (61.65) and superiority of this treatment continued at other growth stages too. This was followed by PM_2 X RDF_1, BL1 X RDF_1 latter one was found on par with PM_1 X RDF_1 in all the growth stages. The data on the interaction between BL2 X RDF_3 and also BL_2 X RDF_4 showed lower TDM compared to RDF_1 alone, in all the stages except at harvest. Similarly no significant difference between BL_2 X RDF_1 and PM_2 X RDF_1 was observed but both the above treatments were superior over only RDF_1 [Fig.9].

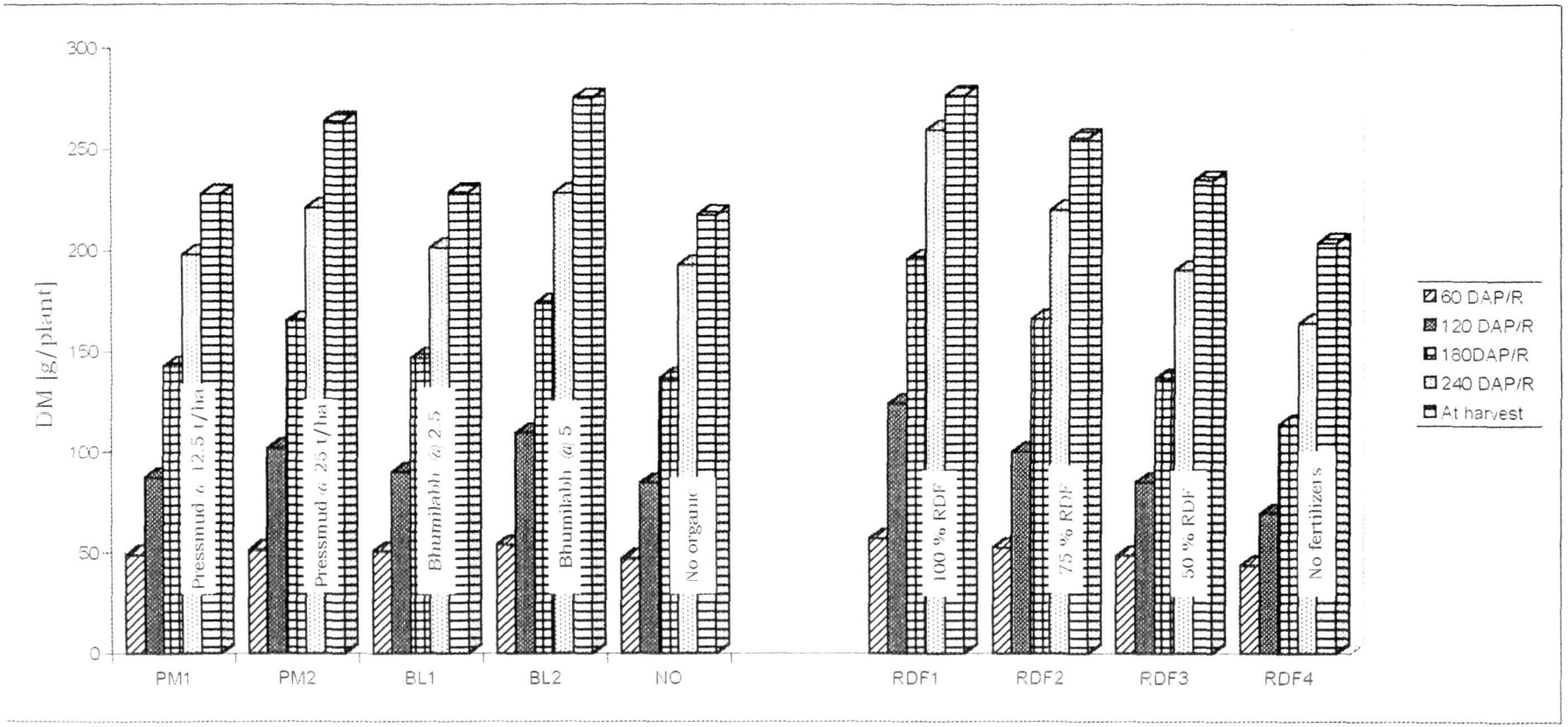

Fig. 9 Dry matter production [g/plant] in sugarcane at various growth stages as influenced by organic and inorganic fertilizers.

Table 24. Dry matter production in sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

60 DAP/R

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	54.97	58.67	56.80	61.65	53.08	57.03
RDF_2	51.29	52.85	53.20	57.00	48.75	52.62
RDF_3	47.13	49.50	49.00	51.40	45.75	48.56
RDF_4	43.37	44.85	44.15	46.30	40.75	43.68
Mean	48.94	51.47	50.09	54.09	47.08	-

120 DAP/R

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	108.50	130.33	112.40	149.79	111.65	124.14
RDF_2	89.30	105.98	95.38	117.08	91.55	100.64
RDF_3	83.10	88.62	85.15	93.33	75.97	85.23
RDF_4	65.41	75.32	67.70	78.30	60.77	69.49
Mean	87.55	102.06	90.15	109.63	84.97	-

180 DAP /R

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	181.02	213.15	183.88	225.73	173.84	195.53
RDF_2	153.12	181.03	159.10	189.20	149.15	166.32
RDF_3	125.60	150.55	129.33	157.28	120.70	136.69
RDF_4	111.40	116.70	114.43	123.50	103.62	113.93
Mean	142.78	165.36	146.69	173.93	136.83	-

240DAP/R

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	245.30	276.30	248.82	288.32	239.58	259.66
RDF_2	205.80	237.82	202.65	245.35	202.13	219.95
RDF_3	182.66	199.83	185.83	203.42	278.30	190.01
RDF_4	158.22	170.60	162.78	176.50	151.28	163.88
Mean	197.99	221.14	201.52	228.39	192.83	-

At harvest

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	246.75	318.01	247.97	330.51	240.27	276.70
RDF_2	237.52	275.44	240.99	288.78	233.34	255.61
RDF_3	225.52	244.53	225.01	260.34	212.69	234.62
RDF_4	199.36	218.24	200.19	216.96	183.65	203.68
Mean	227.78	264.05	228.54	275.39	217.49	-

Source of variation	60DAP/R	120DAP/R	180DAP/R	240DAP/R	At harvest
SEm± for chemical fertiliser	0.566	1.729	2.555	2.412	3.674
CD at 5% for chemical fertiliser	1.569	4.793	7.082	6.686	10.184
SEm± for Organic manures	0.633	1.930	2.856	2.677	3.379
CD at 5% for Organic manures	1.897	5.786	8.563	8.086	10.131
SEm± for interaction	1.266	3.861	5.713	5.393	8.216
CD at 5% for interaction	3.509	10.702	15.836	14.949	22.774

DAP=Days after planting/ratoon initiation

RDF_1=100%RDF PM_1 =Pressmud @12.5 t/ha BL_2=*Bhumilabh* @5 t/ha

RDF_2= 75%RDF PM_2=Pressmud @ 25.0 t/ha NO=No organics

RDF_3= 50%RDF BL_1 = *Bhumilabh* @ 2.5 t/ha

RDF_4= No fertiliser

Table 24a. Dry matter production in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

60 DAP

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	41.43	42.83	42.10	45.30	40.97	42.53
RDF_2	39.78	40.73	41.50	45.07	39.20	41.96
RDF_3	38.97	38.60	39.70	39.90	37.50	38.93
RDF_4	37.20	37.30	38.60	38.70	36.40	37.64
Mean	39.35	39.87	40.48	42.24	38.52	-

120 DAP

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	124.00	148.30	129.60	163.52	120.40	137.16
RDF_2	101.40	114.70	102.49	132.47	197.50	109.71
RDF_3	91.60	94.83	93.50	99.14	82.00	92.29
RDF_4	67.51	82.30	68.40	85.60	63.21	73.42
Mean	96.13	110.06	98.49	120.19	90.88	-

180 DAP

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	189.20	215.40	192.41	226.00	185.28	201.67
RDF_2	162.50	186.47	169.60	191.50	159.30	173.87
RDF_3	141.00	159.40	148.33	169.00	137.00	151.04
RDF_4	125.20	131.60	128.97	139.60	115.00	128.07
Mean	154.68	173.22	159.76	181.53	149.14	-

240DAP

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	259.10	289.00	263.33	294.23	256.00	272.33
RDF_2	220.00	257.93	222.00	262.00	215.87	235.62
RDF_3	192.33	215.07	196.27	219.00	185.53	201.71
RDF_4	155.53	175.63	162.67	184.00	150.67	165.76
Mean	206.74	234.40	211.07	240.04	202.02	-

At harvest

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	248.38	329.45	252.71	338.72	242.17	282.29
RDF_2	237.61	288.32	246.51	292.21	238.92	260.71
RDF_3	235.62	244.41	238.33	278.08	232.44	245.78
RDF_4	204.52	137.59	208.66	128.05	192.61	214.29
Mean	231.53	274.94	236.55	284.27	226.54	-

Source of variation	60DAP	120DAP	180DAP	240DAP	At harvest
SEm± for chemical fertiliser	0.819	3.416	4.021	3.930	5.863
CD at 5% for chemical fertiliser	2.270	9.469	11.147	10.893	16.251
SEm± for Organic manures	0.690	2.282	7.788	2.885	6.990
CD at 5% for Organic manures	2.174	7.190	22.964	9.090	22.025
SEm± for interaction	1.833	7.637	8.992	8.834	13.112
CD at 5% for interaction	5.081	21.169	22.924	24.486	36.345

DAP=Days after planting

RDF_1=100%RDF PM_1 =Pressmud @12.5 t/ha BL_2=*Bhumilabh* @5 t/ha

RDF_2= 75%RDF PM_2=Pressmud @ 25.0 t/ha NO=No organics

RDF_3= 50%RDF BL_1 = *Bhumilabh* @ 2.5 t/ha

RDF_4= No fertilizer

Table 24b. Dry matter production in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

60 DAR

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	68.50	74.50	71.50	78.00	65.20	71.4
RDF_2	62.80	64.97	64.90	68.93	58.30	63.98
RDF_3	55.30	60.40	58.30	62.90	54.00	58.18
RDF_4	47.53	52.40	49.70	53.90	45.10	49.73
Mean	58.83	63.07	61.10	65.93	55.65	-

120 DAR

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	93.00	128.37	95.20	136.07	102.90	111.11
RDF_2	85.00	97.27	88.27	101.70	85.60	91.57
RDF_3	74.60	82.40	76.80	87.50	69.53	78.17
RDF_4	63.30	68.23	67.00	71.00	58.20	65.55
Mean	78.98	94.07	81.82	99.07	79.06	-

180 DAR

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	172.83	210.90	175.30	225.50	162.40	189.37
RDF_2	143.73	175.60	148.60	186.90	139.00	158.77
RDF_3	109.40	141.70	110.67	145.57	104.40	122.35
RDF_4	97.60	101.80	99.90	107.40	92.23	99.79
Mean	130.89	157.50	133.62	166.34	134.51	-

240DAR

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	231.50	263.60	234.30	282.40	222.17	246.99
RDF_2	191.60	217.70	195.30	228.40	188.40	204.28
RDF_3	173.00	184.60	175.40	287.00	171.07	178.31
RDF_4	160.90	165.57	162.90	168.70	151.90	161.99
Mean	189.25	207.87	191.98	216.75	183.63	-

At harvest

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	245.13	306.57	243.24	322.29	238.37	271.12
RDF_2	241.43	262.56	235.48	285.35	227.75	250.51
RDF_3	215.41	244.65	211.69	252.60	192.96	232.46
RDF_4	194.49	198.88	191.71	205.88	174.68	193.07
Mean	224.04	253.16	220.53	266.53	208.44	-

Source of variation	60DAR	120DAR	180DAR	240DAR	At harvest
SEm± for chemical fertiliser	0.972	1.339	1.958	2.301	4.076
CD at 5% for chemical fertiliser	2.694	3.712	5.427	6.378	11.198
SEm± for Organic manures	0.945	1.324	2.217	2.081	4.401
CD at 5% for Organic manures	2.977	4.172	6.985	6.557	13.866
SEm± for interaction	1.772	2.995	4.380	5.146	9.114
CD at 5% for interaction	4.912	8.302	12.141	14.264	19.719

DAR=Days after ratoon initiation

RDF_1=100%RDF PM_1 =Pressmud @12.5 t/ha BL_2=*Bhumilabh* @5 t/ha

RDF_2= 75%RDF PM_2=Pressmud @ 25.0 t/ha NO=No organics

RDF_3= 50%RDF BL_1 = *Bhumilabh* @ 2.5 t/ha

RDF_4= No fertilizer

4.2.1.4 Dry matter production in stem (g/plant)

The dry matter production in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables. 25, 25a and 25b.

The dry matter production in stem (g/plant) averaged over two years differed significantly at various growth stages. The dry matter production in stem increased progressively from 60 DAP/R (Days after planting/ratoon initiation) (24.84) till harvest (188.66).

The dry matter production in stem was significantly highest at 60 DAP/Rdue to application ofBL_2 [26.57)over rest of the treatments. However, it was on par with PM_2 (25.44). BL_1 and PM_1 did not differ significantly in dry matter production of stem andleast dry matter of stem was observed with no organics (23.18). The plant cane did not show any significant difference due to application of various organics at 60 DAP on the contrary, ratoon crop showed significantly higher dry matter in stem due to application of BL_2 (35.46) over rest of the treatments. As the growth advanced from 60 DAP/R to harvest, there was significantly higher dry matter in stem due to application of BL_2 which was found on par with PM_2. Further BL_1 and PM_1

produced on par dry matter production in stem but did exert significantly higher stem dry matter compared to no organic treatment..

Application of chemical fertilizers influenced stem dry matter production significantly. At 60 DAP/R significantly higher dry matter in stem (28.28) was registered with RDF_1 over other levels of chemical fertilizers and the lowest stem dry matter production was registered with RDF_4 (21.36). Advanced stages viz., 120, 180, 240 and at harvest also exhibited similar trends in terms of production of dry matter of stem. In all the cases, reduced levels of fertilizers significantly affected the stem dry matter production recording the highest with RDF_1 and lowest with RDF_4.

The interaction effects were significant at all growth stages of crop except at 60 DAP. Pooled data indicated significantly higher stem dry matter production with BL_2 X RDF_1 (30.59) over other treatments except PM_2 X RDF_1 (29.13). Application of chemical fertilizers including BL_1 and PM_1 in conjunction with chemical fertilizers exerted significantly higher stem dry matter production over application of fertilizers alone.

Table 25. Dry matter accumulation in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Dry matter accumulation in stem (g/plant)				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	24.05	44.05	80.37	136.38	178.85
PM_2	25.44	51.55	92.99	150.19	207.44
BL_1	24.99	46.02	82.78	136.97	179.54
BL_2	26.57	55.58	97.75	154.96	217.98
NO	23.18	38.60	70.22	122.83	159.47
SEm±	0.413	0.429	1.393	3.786	3.882
C D at 5%	1.239	1.286	4.176	11.351	11.639
B.Chemical fertilizers					
RDF_1	28.28	61.64	108.54	175.57	215.57
RDF_2	25.89	49.96	92.23	147.39	197.05
RDF_3	23.84	42.58	75.08	127.17	182.73
RDF_4	21.36	38.47	63.44	110.96	159.27
SEm±	0.369	0.384	1.246	3.386	3.472
C D at 5%	1.023	1.064	3.454	9.385	9.618
Interaction [AXB]					
PM_1 X RDF_1	27.13	55.14	101.77	171.35	193.33
PM_1 X RDF_2	25.33	47.07	86.16	139.95	188.33
PM_1 X RDF_3	23.02	40.99	70.69	124.38	177.14
PM_1 X RDF_4	20.71	33.01	62.86	109.82	156.59
PM_2 X RDF_1	29.13	69.87	119.97	287.96	250.59
PM_2 X RDF_2	26.21	53.47	101.67	161.02	216.34
PM_2 X RDF_3	24.40	44.70	84.65	135.46	192.09
PM_2 X RDF_4	22.02	39.16	65.67	116.31	170.77
BL_1 X RDF_1	28.17	56.84	103.34	169.33	194.79
BL_1 X RDF_2	26.28	48.50	89.41	141.29	189.33
BL_1 X RDF_3	23.95	44.66	73.69	125.91	176.76
BL_1 X RDF_4	21.56	34.09	64.69	111.36	157.26
BL_2 X RDF_1	30.59	75.71	126.84	196.59	259.61
BL_2 X RDF_2	27.59	59.19	106.19	166.26	226.84
BL_2 X RDF_3	25.35	42.91	88.26	136.99	208.38
BL_2 X RDF_4	22.72	39.53	69.71	120.04	177.10
NO X RDF_1	26.34	50.56	90.76	152.63	179.56
NO X RDF_2	24.02	41.59	77.72	128.38	164.44
NO X RDF_3	22.49	34.62	58.09	113.05	159.26
NO X RDF_4	19.86	27.54	54.31	97.27	134.63
SEm±	0.826	1.859	2.787	7.571	7.764
C D at 5 %	2.289	2.381	7.725	20.985	21.521

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 25a. Dry matter accumulation in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in stem(g/plant)				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	16.60	49.89	87.94	123.86	181.73
PM_2	16.93	56.99	98.39	137.43	215.76
BL_1	17.12	51.87	91.26	132.64	185.94
BL_2	17.69	62.18	103.04	140.20	226.74
NO	16.40	43.61	78.21	112.59	164.22
SEm±	0.533	0.550	2.419	4.714	3.586
C D at 5%	1.981	1.733	7.622	14.853	11.299
B.Chemical fertilizers					
RDF_1	18.06	70.15	112.98	160.32	220.05
RDF_2	17.32	56.11	97.22	136.85	199.33
RDF_3	16.40	47.82	84.88	116.89	191.64
RDF_4	16.00	37.56	72.01	96.12	168.49
SEm±	0.185	0.621	2.233	4.782	4.281
C D at 5%	1.344	1.721	6.189	13.255	11.866
Interaction [AXB]					
PM_1 X RDF_1	17.41	64.49	107.47	161.88	194.23
PM_1 X RDF_2	16.87	52.52	92.31	129.93	186.76
PM_1 X RDF_3	16.28	47.50	80.34	113.30	185.19
PM_1 X RDF_4	15.85	35.07	71.44	90.33	160.75
PM_2 X RDF_1	18.19	76.82	123.68	169.53	258.92
PM_2 X RDF_2	17.29	59.41	105.70	151.00	226.57
PM_2 X RDF_3	16.41	40.11	90.00	126.40	192.11
PM_2 X RDF_4	15.85	42.63	74.70	102.77	185.43
BL_1 X RDF_1	17.88	67.13	109.20	155.20	198.63
BL_1 X RDF_2	17.64	13.19	96.30	121.67	193.76
BL_1 X RDF_3	16.54	51.36	85.73	114.47	187.33
BL_1 X RDF_4	16.41	35.93	73.80	95.24	164.04
BL_2 X RDF_1	19.25	84.70	128.30	172.00	266.23
BL_2 X RDF_2	18.13	68.65	108.47	153.67	229.68
BL_2 X RDF_3	16.85	51.02	95.70	127.17	218.46
BL_2 X RDF_4	16.45	44.34	79.70	108.00	192.58
NO X RDF_1	17.55	57.60	97.23	142.99	182.24
NO X RDF_2	16.66	46.80	83.30	119.98	159.89
NO X RDF_3	15.94	29.70	71.90	103.12	175.09
NO X RDF_4	15.45	30.34	60.40	84.27	139.65
SEm±	1.084	1.389	4.193	10.691	9.534
C D at 5 %	3.005	3.850	11.622	29.63	26.427

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 25b. Dry matter accumulation in stem of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in stem (g/plant)				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	31.49	38.21	72.79	148.90	175.96
PM_2	33.95	46.11	87.58	162.95	199.14
BL_1	32.88	40.17	74.27	150.30	173.13
BL_2	35.46	48.99	92.46	169.70	209.22
NO	29.95	33.59	62.24	133.08	154.73
SEm±	0.538	0.598	1.234	5.768	5.159
C D at 5%	1.695	1.569	3.888	18.174	16.255
B.Chemical fertilizers					
RDF_1	38.49	53.14	104.09	190.82	211.10
RDF_2	34.46	43.82	87.24	157.29	194.77
RDF_3	31.28	87.33	65.28	137.42	173.21
RDF_4	26.75	31.37	54.88	125.80	150.05
SEm±	0.554	0.492	1.160	4.661	5.726
C D at 5%	1.536	1.361	3.215	12.919	15.871
Interaction [AXB]					
PM_1 X RDF_1	36.85	45.78	96.08	180.32	192.43
PM_1 X RDF_2	33.39	41.63	80.01	150.02	189.89
PM_1 X RDF_3	29.75	34.48	60.83	135.46	169.09
PM_1 X RDF_4	25.56	35.95	54.28	129.31	152.44
PM_2 X RDF_1	40.08	62.93	117.26	206.37	242.23
PM_2 X RDF_2	30.13	47.53	97.63	171.05	206.11
PM_2 X RDF_3	32.39	40.29	78.79	144.51	192.08
PM_2 X RDF_4	28.19	33.69	56.63	129.85	156.12
BL_1 X RDF_1	38.47	46.55	97.47	183.46	190.93
BL_1 X RDF_2	34.92	43.81	82.52	152.92	184.89
BL_1 X RDF_3	31.37	37.56	61.65	137.39	166.18
BL_1 X RDF_4	26.74	32.76	55.54	129.48	150.28
BL_2 X RDF_1	41.94	66.71	123.38	221.18	252.99
BL_2 X RDF_2	37.07	49.73	103.92	178.85	223.99
BL_2 X RDF_3	33.86	44.79	80.81	146.81	198.29
BL_2 X RDF_4	28.99	34.72	59.71	132.07	161.62
NO X RDF_1	35.13	43.73	84.29	162.26	176.89
NO X RDF_2	31.37	36.38	72.14	136.28	168.91
NO X RDF_3	29.05	29.54	44.29	122.98	145.42
NO X RDF_4	24.26	24.74	48.22	110.27	129.61
SEm±	1.238	1.100	2.598	10.422	10.804
C D at 5 %	3.432	3.049	7.201	28.884	29.973

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

4.2.1.5 Dry matter production in leaves (g/plant)

The dry matter production in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables. 26, 26a and 26b.

The dry matter production in leaves (g/plant) averaged over two years differed significantly at various growth stages. The progressively increased trend in dry matter production of leaves was increased from 60 DAP/R (Days after planting/ratoon initiation) (25.81) to 240 DAP/R (68.52) and then declined at harvest (54.25).

The dry matter production in leaves was significantly higher due to application of BL_2 (27.18) over other organics except application of PM_2 and BL_1. No organic registered significantly lower dry matter of leaves (23.71) at 60 DAP/R. However at 60 DAP there was no significant difference due to any of the organics on dry matter production of leaves, whereas at 60 DAP/R results were significant.

As the age advanced from 60 DAP/R, application of BL_2 enhanced significantly the dry matter of leaves upto 240 DAP/R

and it was on par with application of PM_2.The lower doses of pressmud and *bhumilabh* (PM_1 and BL_1) failed to exert significant difference in dry matter production over no organics. At harvest the dry matter in leaves found significantly higher (59.05) due to BL_2 but it was on par with PM_2 and also with no organic treatments.

Application of fertilizers influenced significantly on dry matter of leaves at various growth phases of sugarcane. Pooled analysis data indicated that application of RDF_1 produced significantly higher dry matter accumulation in leaves (28.78) over other levels of chemical fertilizers. The lowest dry matter was recorded with RDF_4 (22.10) at 60 DAP/R. Similar trend was also observed at 120, 180, 240 and at harvest.

It was observed that reduced levels of chemical fertilizers registered significantly lower dry matter production in leaves during all the growth stages of crop, recording the highest with RDF_1 and the lowest with RDF_4 Pooled analysis revealed that application of BL_2 X RDF_1 significantly increased dry matter production (31.05) over other treatment combinations at 60 DAP/R, but at 60 DAP, the results were non-significant.

Table 26. Dry matter accumulation in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Dry matter accumulation in leaves [g/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	24.82	45.92	63.82	63.15	48.86
PM_2	26.02	50.28	71.51	71.11	56.63
BL_1	25.75	44.74	64.03	65.56	49.01
BL_2	27.18	53.52	76.87	72.69	59.05
NO	23.71	46.45	64.38	70.14	57.67
SEm±	0.679	0.968	1.690	1.488	1.629
C D at 5%	1.136	2.902	5.066	4.461	4.884
B.Chemical fertilizers					
RDF_1	28.78	64.67	85.57	84.89	61.61
RDF_2	26.54	50.28	73.84	73.45	57.26
RDF_3	24.56	42.95	61.10	62.55	52.57
RDF_4	22.10	35.31	45.05	36.22	43.02
SEm±	0.438	0.865	1.512	1.241	1.457
C D at 5%	1.309	2.397	4.191	3.439	4.039
AXB					
PM_1 X RDF_1	27.74	63.78	80.19	78.79	52.92
PM_1 X RDF_2	26.09	46.36	67.08	65.82	51.43
PM_1 X RDF_3	23.79	41.16	55.95	58.22	48.36
PM_1 X RDF_4	21.65	32.39	52.04	49.71	42.73
PM_2 X RDF_1	29.52	68.63	89.99	88.40	68.42
PM_2 X RDF_2	26.79	50.98	79.12	76.98	59.08
PM_2 X RDF_3	24.95	43.90	65.90	64.75	52.46
PM_2 X RDF_4	22.83	37.67	51.02	54.32	46.58
BL_1 X RDF_1	28.64	55.56	80.52	79.80	53.19
BL_1 X RDF_2	26.92	47.65	69.09	71.69	51.67
BL_1 X RDF_3	24.88	42.60	56.76	59.33	48.26
BL_1 X RDF_4	22.58	33.61	49.75	51.32	42.93
BL_2 X RDF_1	31.05	74.41	98.89	89.86	70.85
BL_2 X RDF_2	28.16	56.46	82.54	78.85	61.93
BL_2 X RDF_3	25.95	46.10	68.73	65.59	56.91
BL_2 X RDF_4	23.58	37.10	57.33	56.34	46.53
NO X RDF_1	26.96	60.99	78.24	87.54	62.66
NO X RDF_2	24.74	49.96	71.36	73.81	62.18
NO X RDF_3	23.26	41.41	57.95	64.78	56.86
NO X RDF_4	19.89	38.12	49.96	54.43	48.99
SEm±	0.928	1.935	3.381	2.776	3.257
C D at 5 %	2.690	5.364	9.372	7.695	9.028

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 26a. Dry matter accumulation in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Dry matter accumulation in leaves [g/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	22.51	46.38	69.49	85.46	49.53
PM_2	22.91	53.12	73.08	97.11	58.73
BL_1	23.27	47.50	68.71	86.96	50.59
BL_2	23.91	57.13	80.02	98.31	60.72
NO	21.69	47.78	68.76	90.05	61.54
SEm±	0.961	1.383	2.433	0.862	2.931
C D at 5%	NS	4.358	7.666	2.716	9.361
B.Chemical fertilizers					
RDF_1	24.49	67.19	85.85	113.59	62.73
RDF_2	23.42	53.66	70.27	98.63	58.67
RDF_3	22.29	45.06	66.95	84.54	55.41
RDF_4	21.23	37.02	35.77	52.02	52.22
SEm±	0.746	1.323	2.521	1.387	2.405
C D at 5%	2.213	3.667	6.988	4.385	6.666
Interaction[AXB]					
PM_1 X RDF_1	23.83	60.04	83.67	107.27	53.15
PM_1 X RDF_2	22.83	48.87	70.27	91.03	50.87
PM_1 X RDF_3	22.02	44.18	63.26	79.00	50.40
PM_1 X RDF_4	21.35	32.43	60.76	64.50	43.70
PM_2 X RDF_1	24.61	71.48	86.33	119.60	70.50
PM_2 X RDF_2	23.40	55.99	80.27	106.73	61.70
PM_2 X RDF_3	22.19	45.69	68.83	89.45	32.30
PM_2 X RDF_4	21.45	40.02	56.85	72.67	50.40
BL_1 X RDF_1	24.21	62.47	83.20	108.53	54.08
BL_1 X RDF_2	23.46	49.50	72.25	91.00	52.70
BL_1 X RDF_3	22.83	45.07	64.25	80.60	51.00
BL_1 X RDF_4	22.19	32.17	55.14	67.29	44.60
BL_2 X RDF_1	26.06	79.15	97.67	118.33	72.07
BL_2 X RDF_2	24.49	63.95	82.64	108.33	62.50
BL_2 X RDF_3	22.83	47.48	72.76	70.00	59.00
BL_2 X RDF_4	22.25	37.93	66.98	76.07	48.80
NO X RDF_1	23.75	62.80	78.36	113.83	63.83
NO X RDF_2	22.54	50.70	75.86	96.00	65.60
NO X RDF_3	21.56	42.85	65.59	83.13	63.84
NO X RDF_4	18.93	42.76	55.23	67.23	52.50
SEm±	2.733	2.950	5.638	3.536	5.377
C D at 5 %	NS	8.196	15.28	9.801	14.904

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 26b. Dry matter accumulation in leaves of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Dry matter accumulation in leaves [g/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	27.12	45.46	58.14	40.84	40.19
PM_2	29.12	47.44	69.93	45.11	54.54
BL_1	28.03	41.98	79.35	44.16	47.42
BL_2	30.46	49.90	73.23	47.06	57.39
NO	25.73	45.45	59.99	50.22	53.79
SEm±	0.842	1.666	2.747	1.522	0.791
C D at 5%	2.515	5.249	8.655	4.799	2.492
B.Chemical fertilizers					
RDF_1	33.09	62.15	85.28	56.19	60.49
RDF_2	29.65	46.89	71.41	48.27	55.84
RDF_3	26.84	40.83	55.17	40.55	49.72
RDF_4	22.97	34.31	45.05	36.89	48.08
SEm±	0.629	1.612	1.669	1.614	1.626
C D at 5%	1.889	4.468	4.626	4.473	4.507
Interaction [AXB]					
PM_1 X RDF_1	31.65	67.52	76.72	50.80	52.70
PM_1 X RDF_2	29.34	43.84	63.89	40.58	52.01
PM_1 X RDF_3	25.55	58.15	48.63	37.54	46.31
PM_1 X RDF_4	21.95	32.35	43.33	34.92	41.75
PM_2 X RDF_1	34.32	65.77	93.62	53.20	66.34
PM_2 X RDF_2	30.17	46.69	77.97	43.22	56.45
PM_2 X RDF_3	27.70	42.11	62.93	40.05	52.61
PM_2 X RDF_4	24.22	35.21	45.19	35.98	42.76
BL_1 X RDF_1	33.06	48.65	77.83	60.84	52.29
BL_1 X RDF_2	29.99	45.79	65.93	52.38	50.64
BL_1 X RDF_3	26.93	39.25	49.28	38.06	45.51
BL_1 X RDF_4	22.96	34.24	44.36	35.35	41.26
BL_2 X RDF_1	36.04	69.66	98.17	61.39	69.62
BL_2 X RDF_2	31.83	48.97	82.39	49.56	61.35
BL_2 X RDF_3	29.06	44.91	64.70	40.69	54.31
BL_2 X RDF_4	24.90	36.28	47.69	36.61	44.26
NO X RDF_1	30.17	59.17	78.11	61.22	51.49
NO X RDF_2	26.94	49.22	60.85	51.62	58.76
NO X RDF_3	24.95	39.96	50.31	46.42	47.87
NO X RDF_4	20.80	33.47	44.68	41.62	45.07
SEm±	0.960	2.597	3.729	3.608	3.635
C D at 5 %	2.061	7.199	9.089	10.000	10.076

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Advanced growth stages also produced significantly higher dry matter accumulation in leaves due to combinations of BL_2 X RDF_1 and PM_2 X RDF_1 over other treatments. Further it was noticed that significantly inferior dry matter production of leaves due to application of only chemical fertilizers. The combinations of chemical fertilizers in conjunction with organics significantly enhanced the dry matter of leaves over their sole application.

4.2.1.6 Leaf area (LA) (dm^2/plant)

The leaf area in sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.27, 27 and 27b.

The leaf area in sugarcane (dm^2/plant) averaged over two years differed significantly at various growth stages except at 60 DAP/R (Days after planting/Ratoon initiation). The leaf area increased progressively from 60 DAP/R (16.02) till harvest (72.45). The leaf area was significantly higher due to application of BL_2 (49.71) over BL_1 (48.47) and no organics (48.01] and BL_2 showed on par leaf area with PM_1 and PM_2 at 120 DAP/R. However, at advanced stages of growth, BL_2 exerted significantly higher leaf area compared to rest of the treatments. Similarly application of PM_2 though shown on par results of leaf area with

PM_1 and BL_1 but tended to produce significantly the highest leaf area over no organics.

The effect of different levels of inorganic fertilizers on leaf area was non-significant at 60 DAP/R. The pooled analysis indicated that application of RDF_1 enhanced the leaf area significantly (51.13 and 54.54 respectively) over RDF_3 and RDF_4 at 120 and 180 DAP/R, however, it was on par with RDF_2. In contrast application of RDF_1 exhibited significantly the highest leaf area at 240 DAP/R and at harvest (71.68 and 76.95, respectively) over even RDF_2, RDF_3 and RDF_4 and at both these latter stages application of inorganic fertilizers significantly minimized the leaf area.

The interaction effects were found significant after 60 DAP/R with combinations of BL_2X RDF_1 registered significantly higher leaf area compared to other treatments except PM_2 X RDF_1 at all advanced stages of growth except at 120 DAP/R. The higher leaf area was observed due to application of various inorganic fertilizers along with organics compared with their sole application at all growth stages of crop.

Table 27. Leaf area in sugarcane at various growth stages as influenced by organic and inorganics fertilizers [Pooled]

Treatment	Leaf area [dm²/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	16.22	48.90	52.48	67.48	71.66
PM_2	16.31	49.62	53.08	68.66	73.08
BL_1	16.09	48.47	52.42	68.05	71.96
BL_2	16.13	49.71	54.18	70.31	74.35
NO	16.10	48.01	51.28	67.08	71.19
SEm±	0.112	0.321	0.292	0.292	0.282
C D at 5%	NS	0.952	0.855	0.879	0.799
B.Chemical fertilizers					
RDF_1	16.35	51.13	54.54	71.68	76.95
RDF_2	16.23	50.39	53.62	70.25	74.08
RDF_3	16.03	48.13	51.99	67.15	70.67
RDF_4	16.08	46.19	50.59	64.17	68.09
SEm±	0.162	0.422	0.225	0.255	0.279
C D at 5%	NS	1.204	0.609	0.757	0.799
Interaction [AXB]					
PM_1 X RDF_1	16.43	52.08	53.97	71.21	74.91
PM_1 X RDF_2	16.24	50.29	53.43	69.13	72.83
PM_1 X RDF_3	16.07	47.29	52.08	65.70	70.58
PM_1 X RDF_4	16.16	45.94	50.46	63.87	68.32
PM_2 X RDF_1	16.29	51.98	55.50	73.19	77.98
PM_2 X RDF_2	16.31	50.75	53.79	70.94	74.73
PM_2 X RDF_3	16.34	49.16	52.17	66.03	70.85
PM_2 X RDF_4	16.31	46.57	50.4	64.47	68.77
BL_1 X RDF_1	16.13	52.44	54.15	71.75	77.04
BL_1 X RDF_2	16.43	48.60	52.98	67.42	73.83
BL_1 X RDF_3	16.07	47.08	52.10	68.77	71.12
BL_1 X RDF_4	15.73	45.79	50.45	64.26	65.85
BL_2 X RDF_1	16.49	48.68	56.95	75.09	80.23
BL_2 X RDF_2	16.09	52.62	55.26	71.29	75.99
BL_2 X RDF_3	15.82	50.39	52.53	69.40	71.03
BL_2 X RDF_4	16.09	47.14	51.98	65.43	70.12
NO X RDF_1	16.39	50.48	52.14	67.15	74.58
NO X RDF_2	16.06	49.67	52.62	72.47	73.01
NO X RDF_3	15.85	46.75	51.11	65.85	69.76
NO X RDF_4	16.09	45.16	49.23	62.84	67.42
SEm±	0.342	1.283	0.529	0.572	0.605
C D at 5 %	NS	3.808	1.497	1.694	1.787

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 27a. Leaf area in sugarcane at various growth stages as influenced by organic and fertilizers

Treatment	Leaf area [dm²/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	16.28	46.72	51.76	68.44	72.34
PM_2	16.07	47.43	53.43	70.17	73.78
BL_1	16.07	45.83	51.99	69.04	72.44
BL_2	16.02	47.11	54.30	71.16	74.75
NO	16.08	45.68	50.36	67.75	72.49
SEm±	0.142	0.385	0.350	0.082	0.385
C D at 5%	NS	1.134	1.050	0.224	1.132
B.Chemical fertilizers					
RDF_1	16.34.	48.58	55.13	73.54	77.36
RDF_2	16.28	48.08	53.84	70.58	75.16
RDF_3	15.92	45.96	51.38	67.92	71.26
RDF_4	15.86	43.59	49.13	65.22	68.84
SEm±	0.172	0.310	0.267	0.082	0.392
C D at 5%	NS	0.938	0.762	0.245	1.162
Interaction [AXB]					
PM_1 X RDF_1	16.55	50.54	53.97	72.02	74.91
PM_1 X RDF_2	16.43	48.25	53.07	69.85	73.83
PM_1 X RDF_3	16.07	44.58	51.08	66.79	70.94
PM_1 X RDF_4	16.07	43.50	48.92	65.10	69.67
PM_2 X RDF_1	16.12	50.18	56.86	74.37	77.98
PM_2 X RDF_2	16.19	48.98	55.05	71.29	75.45
PM_2 X RDF_3	16.25	47.05	52.17	69.49	71.30
PM_2 X RDF_4	15.70	43.50	49.64	65.52	70.39
BL_1 X RDF_1	16.01	51.26	54.33	73.64	78.28
BL_1 X RDF_2	16.79	44.31	52.53	70.03	75.45
BL_1 X RDF_3	16.07	44.76	51.50	66.97	72.02
BL_1 X RDF_4	15.40	42.96	49.64	65.52	64.02
BL_2 X RDF_1	16.55	42.96	57.94	76.17	80.86
BL_2 X RDF_2	15.95	51.50	56.56	71.84	76.16
BL_2 X RDF_3	15.58	48.98	52.53	70.03	71.30
BL_2 X RDF_4	16.01	45.01	50.18	66.61	70.64
NO X RDF_1	16.49	47.95	52.53	71.48	74.79
NO X RDF_2	16.06	47.35	51.98	69.85	74.91
NO X RDF_3	15.64	44.40	49.64	66.30	70.76
NO X RDF_4	16.13	43.02	47.29	63.36	69.84
SEm±	0.392	0.701	0.592	0.192	0.902
C D at 5 %	NS	2.097	1.704	0.548	2.599

DAP= Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 27b. Leaf area in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Leaf area [dm²/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	16.17	51.08	52.00	66.5	70.98
PM_2	16.55	51.80	52.72	67.45	72.38
BL_1	16.11	51.13	52.54	67.06	71.48
BL_2	16.23	52.30	54.06	69.45	73.95
NO	16.13	50.34	52.19	66.41	69.95
SEm±	0.124	0.572	0.782	0.681	0.392
C D at 5%	NS	1.706	NS	2.035	1.169
B.Chemical fertilizers					
RDF_1	16.35	53.68	53.96	69.82	76.53
RDF_2	16.17	52.69	53.92	69.93	72.99
RDF_3	16.14	50.31	52.62	66.39	70.02
RDF_4	16.29	48.64	52.06	63.13	67.35
SEm±	0.251	0.772	0.372	0.521	0.371
C D at 5%	NS	2.218	1.101	1.495	1.097
Interaction [AXB]					
PM_1 X RDF_1	16.31	53.61	53.97	70.39	74.91
PM_1 X RDF_2	16.06	52.35	53.79	68.41	71.84
PM_1 X RDF_3	16.07	49.99	53.07	64.62	70.22
PM_1 X RDF_4	16.25	48.37	51.98	62.63	66.97
PM_2 X RDF_1	16.47	58.79	54.16	72.02	77.98
PM_2 X RDF_2	16.43	52.53	52.53	70.58	74.04
PM_2 X RDF_3	16.43	51.26	52.17	62.57	70.39
PM_2 X RDF_4	16.71	49.64	52.05	63.42	67.15
BL_1 X RDF_1	16.25	53.61	53.97	69.85	75.81
BL_1 X RDF_2	16.06	52.89	53.43	64.80	72.20
BL_1 X RDF_3	16.07	49.39	52.71	70.57	70.22
BL_1 X RDF_4	16.07	48.62	51.26	62.99	67.69
BL_2 X RDF_1	16.43	54.39	55.96	74.01	79.81
BL_2 X RDF_2	16.25	53.73	55.96	70.76	75.81
BL_2 X RDF_3	16.07	51.80	52.53	68.77	70.76
BL_2 X RDF_4	16.19	49.18	53.79	64.26	69.61
NO X RDF_1	16.31	53.00	51.74	62.81	74.37
NO X RDF_2	16.07	51.98	53.25	75.09	71.12
NO X RDF_3	16.07	49.09	52.59	65.40	68.77
NO X RDF_4	16.07	47.29	51.20	62.33	65.34
SEm±	0.583	0.701	0.853	1.132	0.821
C D at 5 %	NS	2.097	2.462	3.343	2.453

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

4.2.1.7 Leaf area index (LAI)

The leaf area index in sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables. 28, 28a and 28b.

The leaf area index in sugarcane averaged over two years differed significantly at all the growth stages except at 60 DAP/R and 120 DAP/R (Days after planting/Ratoon initiation). The leaf area index increased progressively from 60 DAP/R (0.905) to harvest (4.017). Application of various organic manures failed to influence the leaf area index at 60, 120 DAP/R. However, organics significantly increased leaf area index over no organics at 180 DAP/R. Similar trend was also noticed at harvest. The leaf area index did not differ significantly only in case of plant cane at 180 DAP.

The inorganic fertilizers influenced significantly the leaf area index at all the growth stages except 60 DAP/R. The leaf area index was significantly higher (2.833) due to application of RDF_1 over RDF_4 at 120 DAP/R. However, at 180, 240, application RDF_1 exerted higher leaf area index over RDF_3 and RDF_4. Further at harvest it was observed that RDF_1 caused

Table 28. Leaf area index in sugarcane at various growth stages as influenced by organic and inorganics fertilizers [Pooled]

Treatment	Leaf area index				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	0.901	2.709	2.908	3.613	3.970
PM_2	0.909	2.749	2.940	3.804	4.049
BL_1	0.891	2.656	2.904	3.770	3.982
BL_2	0.892	2.754	3.002	3.895	4.119
NO	0.892	2.660	2.841	3.716	3.944
SEm±	0.026	0.071	0.042	0.734	0.048
C D at 5%	NS	NS	0.1282	0.220	0.145
B.Chemical fertilizers					
RDF_1	0.914	2.833	3.022	3.871	4.263
RDF_2	0.893	2.792	2.970	3.892	4.104
RDF_3	0.892	2.667	2.881	3.720	3.915
RDF_4	0.891	2555	2.803	3.555	3.773
SEm±	0.0234	0.0631	0.038	0.657	0.433
C D at 5%	NS	0.175	0.105	0.182	0.120
Interaction [AXB]					
PM_1 X RDF_1	0.912	2.885	2.990	3.445	4.150
PM_1 X RDF_2	0.901	2.787	2.960	3.830	4.035
PM_1 X RDF_3	0.892	2.620	2.885	3.640	3.910
PM_1 X RDF_4	0.891	2.545	2.795	3.538	3.785
PM_2 X RDF_1	0.901	2.880	3.075	4.055	4.320
PM_2 X RDF_2	0.903	2.812	2.980	3.930	4.140
PM_2 X RDF_3	0.935	2.723	2.890	3.658	3.925
PM_2 X RDF_4	0.903	2.580	2.717	3.572	3.810
BL_1 X RDF_1	0.893	2.905	3.000	3.975	4.268
BL_1 X RDF_2	0.891	2.693	2.935	3.735	4.090
BL_1 X RDF_3	0.872	2.608	2.887	3.810	3.940
BL_1 X RDF_4	0.913	2.537	2.795	3.560	3.648
BL_2 X RDF_1	0.892	2.697	3.155	4.160	4.445
BL_2 X RDF_2	0.877	2.915	3.062	3.950	4.210
BL_2 X RDF_3	0.892	2.792	2.910	3.845	3.935
BL_2 X RDF_4	0.908	2.612	2.880	3.625	3.885
NO X RDF_1	0.890	2.797	2.888	3.720	1.132
NO X RDF_2	0.889	2.752	2.915	4.015	4.045
NO X RDF_3	0.878	2.590	2.832	3.648	3.865
NO X RDF_4	0.892	2.502	2.728	3.482	3.735
SEm±	0.052	0.141	0.081	0.147	0.097
C D at 5 %	NS	0.391	0.237	0.407	0.269

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 28 a. Leaf area index in sugarcane at various growth stages as influenced by organic and inorganics fertilizers

Treatment	Leaf area index				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	0.902	2.588	2.868	3.542	4.008
PM_2	0.890	2.628	2.960	3.887	4.083
BL_1	0.890	2.539	2.881	3.825	4.013
BL_2	0.887	2.610	3.008	3.942	4.141
NO	0.891	2.531	2.790	3.753	4.016
SEm±	0.023	0.063	0.058	0.111	0.063
C D at 5%	NS	NS	0.183	0.349	NS
B.Chemical fertilizers					
RDF_1	0.905	2.691	3.054	3.874	4.286
RDF_2	0.902	2.664	2.984	3.910	4.164
RDF_3	0.882	2.546	2.847	3.763	3.948
RDF_4	0.879	2.415	2.722	3.613	3.814
SEm±	0.029	0.052	0.0420	0.102	0.064
C D at 5%	NS	0.144	0.116	0.283	0.177
Interaction [AXB]					
PM_1 X RDF_1	0.917	2.800	2.990	3.990	4.150
PM_1 X RDF_2	0.910	2.673	2.940	3.870	4.090
PM_1 X RDF_3	0.890	2.470	2.830	3.700	3.930
PM_1 X RDF_4	0.890	2.410	2.710	3.607	3.860
PM_2 X RDF_1	0.893	2.180	3.150	4.120	4.320
PM_2 X RDF_2	0.897	2.713	3.050	3.950	4.180
PM_2 X RDF_3	0.900	2.607	2.870	3.850	3.950
PM_2 X RDF_4	0.870	2.410	2.750	3.630	3.900
BL_1 X RDF_1	0.887	2.840	3.010	4.080	4.337
BL_1 X RDF_2	0.930	2.445	2.910	3.880	4.180
BL_1 X RDF_3	0.890	2.480	2.853	3.710	3.990
BL_1 X RDF_4	0.853	2.480	2.750	3.630	3.547
BL_2 X RDF_1	0.917	2.380	2.210	4.220	4.480
BL_2 X RDF_2	0.883	2.853	3.133	3.980	4.221
BL_2 X RDF_3	0.863	2.713	2.910	3.880	3.950
BL_2 X RDF_4	0.887	2.493	2.780	3.690	3.913
NO X RDF_1	0.913	2.657	2.910	3.870	4.143
NO X RDF_2	0.890	2.623	2.880	3.870	4.150
NO X RDF_3	0.867	2.460	2.750	3.673	3.920
NO X RDF_4	0.893	2.383	2.620	3.510	3.800
SEm±	0.064	0.116	0.094	0.228	0.144
C D at 5 %	NS	0.322	0.261	0.632	0.399

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 28b. Leaf area index in sugarcane at various growth stages as influenced by organic and inorganics fertilizers

Treatment	Leaf area index				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	0.896	2.830	2.948	3.683	3.933
PM_2	0.917	2.870	2.921	3.720	4.010
BL_1	0.892	2.833	2.928	3.715	3.960
BL_2	0.899	2.898	2.995	3.847	4.097
NO	0.893	2.789	2.892	3.679	3.872
SEm±	0.020	0.095	0.071	0.113	0.065
C D at 5%	NS	NS	NS	NS	0.205
B.Chemical fertilizers					
RDF_1	0.906	2.974	2.989	3.868	4.240
RDF_2	0.896	2.919	2.958	3.874	4.044
RDF_3	0.894	2.787	2.915	3.674	3.882
RDF_4	0.903	2.605	2.884	3.491	3.731
SEm±	0.042	0.123	0.0612	0.083	0.061
C D at 5%	NS	0.341	NS	0.230	0.169
Interaction [AXB]					
PM_1 X RDF_1	0.903	2.970	2.990	3.900	4.150
PM_1 X RDF_2	0.890	2.900	2.980	3.790	3.980
PM_1 X RDF_3	0.890	2.770	2.940	3.580	3.890
PM_1 X RDF_4	0.900	2.680	2.880	3.470	3.710
PM_2 X RDF_1	0.913	2.580	2.000	3.990	4.320
PM_2 X RDF_2	0.910	2.910	2.910	3.910	4.100
PM_2 X RDF_3	0.910	2.540	2.890	3.467	3.900
PM_2 X RDF_4	0.937	2.750	2.883	3.513	3.720
BL_1 X RDF_1	0.900	2.970	2.990	3.810	4.200
BL_1 X RDF_2	0.890	2.930	2.960	3.590	3.400
BL_1 X RDF_3	0.890	2.737	2.920	3.910	3.890
BL_1 X RDF_4	0.890	2.693	2.840	3.490	3.750
BL_2 X RDF_1	0.910	3.013	3.100	4.100	4.410
BL_2 X RDF_2	0.900	2.977	2.980	3.920	4.200
BL_2 X RDF_3	0.890	2.810	2.910	3.810	3.920
BL_2 X RDF_4	0.897	2.730	2.930	3.560	3.857
NO X RDF_1	0.903	2.937	2.867	3.480	4.120
NO X RDF_2	0.890	2.880	2.950	4.160	3.940
NO X RDF_3	0.890	2.720	2.913	2.623	3.810
NO X RDF_4	0.890	2.620	2.937	3.453	3.620
SEm±	0.093	0.275	0.136	0.185	0.136
C D at 5 %	NS	0.762	0.977	0.513	0.377

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

significantly higher leaf area index (4.263) over RDF_2 (4.104), RDF_3 (3.915) and RDF_4 (3.773).The interaction effects did not differ significantly due to application of organic and inorganic fertilizers on leaf area index only at 60, 120 DAP/R and also at 180 DAP. The pooled analysis data revealed that significantly higher leaf area index due to application of BL_2 X RDF_1 at 180, 240and at harvest,over others except PM_2XRDF_1, BL_1XRDF_2, BL_2 X RDF_2 at180day,BL_1XRDF_1,BL_2XRDF_2,$BL_2XRDF_3$and PM_1XRDF_2 at 240th day and PM_2XRDF_1,BL_1XRDF_1 at harvest, Further, higher values of leaf area index was noticed due application of inorganic fertilizers in conjunction with organics rather than their sole application.

4.2.2 NUTRIENT UPTAKE

4.2.2.1 Nitrogen (mg/plant)

The nitrogen uptake of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.29, 29a and 29b.The nitrogen uptake by sugarcane averaged over two years at various growth stages differed significantly. The nitrogen uptake exhibited significantly higher values (11.85) due to application of BL_2 over other organics and further rest of the treatments showed on par results at 60 DAP/R

planting/Ratoon initiation) however only at 60 DAP nitrogen uptake not showed significant results due to various organics. As the growth advanced, application of BL_2 exerted significantly higher nitrogen uptake and it performed on par with that of PM_2 in all latter stages except at 240 DAP/R as application of BL_2 was also on par with the application of BL_1 at 240 DAR. The observations further revealed that no organic treatment recorded significantly lower uptake of nitrogen at the advanced growth stages of crop and application of BL_1 and PM_1 were found on par with each other.

The chemical fertilizer levels produced significant influence on nitrogen uptake of sugarcane at all growth stages. At 60 DAP/R, significantly higher nitrogen uptake (12.94) was noticed due to application of RDF_1 compared to RDF_3 and RDF_4. However, only at 60 DAP/R it showed on par results with RDF_2. Further advanced growth exhibited significantly lower uptake of nitrogen due to every reduced level of inorganic fertilizers recording maximum with RDF_1 and minimum with RDF_4.

The interaction effects at all the stages due to organic and inorganic fertilizers on nitrogen uptake of sugarcane did show significant results. Application of BL_2 in conjunction with RDF_1

Table 29. Nitrogen uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Nitrogen uptake [mg/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	10.42	15.67	23.99	31.68	25.97
PM_2	10.91	18.27	26.29	34.06	28.52
BL_1	10.97	16.68	24.64	32.24	25.60
BL_2	11.85	21.05	30.26	37.68	31.95
NO	9.70	14.53	21.76	30.28	23.71
SEm±	0.705	0.952	1.352	1.245	1.183
C D at 5%	2.105	2.851	4.051	3.721	3.527
B.Chemical fertilizers					
RDF_1	12.94	27.43	37.15	46.48	33.76
RDF_2	11.42	18.72	29.11	36.15	29.40
RDF_3	10.20	13.98	21.46	29.26	25.81
RDF_4	8.69	10.63	16.29	22.62	20.37
SEm±	0.692	0.778	1.123	1.256	0.981
C D at 5%	1.921	2.127	3.111	3.472	2.721
Interaction [AXB]					
PM_1 X RDF_1	12.26	23.87	34.21	45.14	30.55
PM_1 X RDF_2	11.13	16.70	27.10	34.37	27.31
PM_1 X RDF_3	9.99	13.63	20.10	28.31	25.26
PM_1 X RDF_4	8.47	9.75	16.26	22.31	20.73
PM_2 X RDF_1	13.26	28.15	39.22	48.08	38.16
PM_2 X RDF_2	11.36	19.39	29.69	38.05	31.09
PM_2 X RDF_3	10.40	14.36	22.73	29.57	26.07
PM_2 X RDF_4	8.88	11.83	15.87	22.52	20.41
BL_1 X RDF_1	13.12	25.40	34.94	44.54	30.50
BL_1 X RDF_2	11.76	18.22	28.32	35.05	26.99
BL_1 X RDF_3	1025	14.30	20.43	28.99	24.08
BL_1 X RDF_4	8.86	10.49	16.59	22.46	21.22
BL_2 X RDF_1	14.49	34.75	45.38	53.92	40.65
BL_2 X RDF_2	12.83	23.18	35.19	42.45	34.65
BL_2 X RDF_3	11.05	16.43	25.64	31.94	30.51
BL_2 X RDF_4	9.40	12.60	18.28	25.42	23.86
NO X RDF_1	11.68	23.43	31.99	42.17	29.31
NO X RDF_2	10.04	16.11	25.50	33.15	26.37
NO X RDF_3	9.29	11.85	18.71	27.10	22.33
NO X RDF_4	7.82	8.57	17.62	20.12	16.16
SEm±	0.812	2.472	2.615	1.885	1.172
C D at 5 %	2.252	6.852	7.226	5.215	3.251

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 29a. Nitrogen uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Nitrogen uptake [mg/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	8.34	15.00	24.13	30.80	26.16
PM_2	8.49	16.84	23.90	31.88	28.04
BL_1	8.78	16.35	24.60	31.45	26.02
BL_2	9.08	20.79	29.40	37.45	33.26
NO	9.08	13.27	21.92	28.89	24.24
SEm±	0.285	1.152	1.521	1.275	1.321
C D at 5%	NS	3.631	4.792	4.017	4.162
B.Chemical fertilizers					
RDF_1	9.53	30.44	38.12	49.02	34.72
RDF_2	9.02	17.88	28.86	37.70	29.46
RDF_3	8.14	12.27	20.69	27.63	26.30
RDF_4	7.53	8.59	14.47	18.07	20.57
SEm±	0.925	0.921	1.162	1.372	1.052
C D at 5%	2.262	2.556	3.221	3.801	2.915
Interaction [AXB]					
PM_1 X RDF_1	9.12	27.26	36.13	30.39	31.05
PM_1 X RDF_2	8.55	16.43	27.95	19.44	27.09
PM_1 X RDF_3	8.22	12.09	20.02	26.73	26.15
PM_1 X RDF_4	7.44	7.73	14.77	17.89	21.07
PM_2 X RDF_1	9.89	32.18	38.56	49.42	38.88
PM_2 X RDF_2	8.76	17.55	27.04	38.43	31.72
PM_2 X RDF_3	8.11	11.57	19.93	26.88	24.69
PM_2 X RDF_4	7.50	9.96	13.28	17.21	20.73
BL_1 X RDF_1	9.73	15.68	32.90	47.66	31.59
BL_1 X RDF_2	9.21	17.53	23.40	31.52	27.12
BL_1 X RDF_3	8.34	13.05	20.42	21.59	24.55
BL_1 X RDF_4	7.91	8.21	14.83	17.89	21.07
BL_2 X RDF_1	10.92	38.26	32.32	56.49	42.00
BL_2 X RDF_2	9.92	23.18	83.45	44.28	35.65
BL_2 X RDF_3	8.37	14.97	16.97	31.10	31.98
BL_2 X RDF_4	7.93	11.30	16.89	22.08	14.09
NO X RDF_1	8.60	25.28	22.42	45.31	29.54
NO X RDF_2	7.88	30.02	29.15	34.11	27.00
NO X RDF_3	7.69	9.92	22.06	25.23	24.41
NO X RDF_4	7.06	6.45	15.53	15.07	25.62
SEm±	1.117	3.251	2.421	2.152	1.252
C D at 5 %	3.092	9.015	6.721	5.962	3.471

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 29b. Nitrogen uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Nitrogen uptake [mg/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	12.53	15.87	23.56	32.36	25.54
PM_2	13.24	19.28	28.35	35.55	28.61
BL_1	13.14	16.69	24.32	32.83	25.14
BL_2	14.70	20.80	30.93	37.72	30.65
NO	11.57	15.42	22.87	31.40	23.14
SEm±	0.872	0.872	1.127	1.652	1.275
C D at 5%	2.725	2.752	3.557	5.205	4.021
B.Chemical fertilizers					
RDF_1	16.38	24.33	35.98	43.71	32.81
RDF_2	14.01	19.14	29.21	35.14	29.06
RDF_3	12.28	15.16	21.66	30.31	26.04
RDF_4	9.80	12.32	17.26	26.89	20.08
SEm±	0.721	0.872	1.257	1.225	1.125
C D at 5%	2.001	2.421	3.487	3.392	3.124
Interaction [AXB]					
PM_1 X RDF_1	15.41	20.46	32.32	40.74	29.66
PM_1 X RDF_2	13.69	17.00	26.16	32.76	28.01
PM_1 X RDF_3	11.78	14.55	19.47	29.41	24.13
PM_1 X RDF_4	9.51	12.03	16.88	26.71	20.39
PM_2 X RDF_1	16.47	27.60	39.65	46.66	37.09
PM_2 X RDF_2	13.97	20.62	32.13	37.27	30.46
PM_2 X RDF_3	12.68	16.56	24.94	31.38	27.40
PM_2 X RDF_4	10.22	13.10	17.40	27.48	20.09
BL_1 X RDF_1	16.45	21.04	32.96	23.77	29.43
BL_1 X RDF_2	14.28	18.62	27.49	33.98	26.84
BL_1 X RDF_3	12.24	14.98	19.70	29.82	23.50
BL_1 X RDF_4	9.94	12.73	17.48	27.04	21.09
BL_2 X RDF_1	18.72	31.80	45.10	51.11	39.32
BL_2 X RDF_2	15.85	22.37	35.51	40.20	31.39
BL_2 X RDF_3	14.06	17.50	26.20	49.08	29.05
BL_2 X RDF_4	10.76	13.45	18.80	28.34	22.65
NO X RDF_1	15.00	21.61	30.04	38.88	23.84
NO X RDF_2	12.24	17.12	25.02	32.03	25.74
NO X RDF_3	10.60	13.21	18.27	28.74	20.26
NO X RDF_4	8.57	10.48	15.68	25.06	15.37
SEm±	0.782	2.822	2.952	1.998	1.321
C D at 5 %	2.172	7.821	8.183	5.532	3.662

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

and RDF_2 exerted significantly higher nitrogen uptake over rest of the treatment combinations except due to application of PM_1 X RDF_1, PM_2 X RDF_1, BL_1 X RDF_1 and all these treatments recorded significantly higher nitrogen uptake even over application of RDF_1 alone at 60 DAP/R. Similar trend continued even at latter stages of crop growth. However at harvest significantly higher nitrogen uptake was noticed due to application of PM_2 along with RDF_1 and RDF_2 and further application of BL_2 X RDF_1, BL_2 X RDF_2, BL_2 X RDF_3 PM_1 X RDF_1, PM_1 X RDF_2, BL_1 X RDF_2 exhibited significantly higher nitrogen uptake over rest of the treatments.

4.2.2.2 Phosphorus (mg/plant)

The phosphorus uptake of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.30, 30a and 30b.

The phosphorus uptake (mg/plant) averaged over plant and ratoon crops at various growth stages had significant effect. Application of BL_2 (0.87) recorded significantly higher phosphorus uptake over no organic treatment and it showed on par results with all other organic treatments at 60 DAP/R. However, both plant and ratoon crop individually failed to exhibit significant

results. At 120 DAP/R, significantly higher P_2O_5 uptake was exerted due to application of BL_2 over other treatments. However other treatments including no organic were on par with each other. At latter stages application of BL_2 and PM_2 recorded significantly higher P_2O_5 uptake compared to all other treatments and further BL_1 and PM_2 gave significantly higher uptake of P_2O_5 over no organics.

Among the chemical fertilizers, significantly higher P_2O_5 uptake was noticed with RDF_1 at all the growth stages except at 60 DAP/R and 240 DAP/R as in these growth stages RDF_2 and RDF_3 found on par with each other. Further, at harvest also RDF_1 and RDF_2 were on par with each other with respect to P_2O_5 uptake. The maximum P_2O_5 was noticed with RDF_1 and minimum with RDF_4.

The interaction effects at all the growth stages due to organic and inorganic fertilizers showed significant results. The pooled analysis data revealed that application of organics viz., BL_1, BL_2 and PM_1 and PM_2 in conjunction with mainly RDF_1 exerted significantly higher uptake of P_2O_5 compared to

Table 30. Phosphorus uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Phosphorus uptake [mg/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	0.73	1.05	1.43	1.58	1.59
PM_2	0.77	1.22	1.65	1.88	1.84
BL_1	0.76	1.08	1.47	1.61	1.71
BL_2	0.87	1.32	1.91	1.88	2.06
NO	0.67	1.02	1.37	1.35	1.41
SEm±	0.062	0.039	0.086	0.088	0.078
C D at 5%	0.181	0.118	0.257	0.265	0.235
B.Chemical fertilizers					
RDF_1	1.03	1.74	2.15	2.34	2.21
RDF_2	0.79	1.21	1.83	1.76	2.05
RDF_3	0.63	0.94	1.37	1.52	1.64
RDF_4	0.57	0.69	1.03	1.15	1.22
SEm±	0.084	0.117	0.114	0.084	0.055
C D at 5%	0.232	0.325	0.316	0.232	0.152
Interaction [AXB]					
PM_1 X RDF_1	0.99	1.41	2.17	2.21	1.86
PM_1 X RDF_2	0.77	1.07	1.96	1.34	1.66
PM_1 X RDF_3	0.66	1.00	1.26	1.36	1.35
PM_1 X RDF_4	0.54	0.65	1.00	1.73	1.09
PM_2 X RDF_1	1.06	1.70	2.34	2.49	2.54
PM_2 X RDF_2	0.80	1.27	1.81	2.14	2.01
PM_2 X RDF_3	0.69	0.95	1.51	1.69	1.71
PM_2 X RDF_4	0.59	0.75	1.45	1.26	1.31
BL_1 X RDF_1	1.02	1.57	2.02	1.66	1.98
BL_1 X RDF_2	0.80	1.24	1.59	1.67	1.80
BL_1 X RDF_3	0.64	1.02	1.29	1.49	1.58
BL_1 X RDF_4	0.57	0.68	1.03	1.14	1.29
BL_2 X RDF_1	1.17	2.25	2.82	2.74	2.46
BL_2 X RDF_2	0.86	1.52	2.08	2.21	2.17
BL_2 X RDF_3	0.72	1.12	1.57	2.03	1.99
BL_2 X RDF_4	0.60	0.86	1.11	1.32	1.61
NO X RDF_1	0.90	1.45	1.91	1.92	1.68
NO X RDF_2	0.68	1.10	1.49	1.62	1.51
NO X RDF_3	0.59	0.84	1.09	1.25	1.16
NO X RDF_4	0.49	0.61	0.83	0.91	1.00
SEm±	0.096	0.273	0.327	0.443	0.284
C D at 5 %	0.265	1.169	1.197	1.228	0.788

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 30a. Phosphorus uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Phosphorus uptake [mg/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	0.59	1.25	1.70	1.65	1.62
PM_2	0.56	1.21	1.73	1.88	1.65
BL_1	0.57	1.28	1.60	1.69	1.66
BL_2	0.63	1.44	2.00	1.92	1.99
NO	0.50	1.09	1.49	1.41	1.36
SEm±	0.04	0.036	0.099	0.099	0.081
C D at 5%	NS	0.113	0.312	0.312	0.026
B.Chemical fertilizers					
RDF_1	0.77	1.92	2.22	2.18	1.98
RDF_2	0.55	1.32	1.91	1.88	1.82
RDF_3	0.35	1.02	1.51	1.61	1.47
RDF_4	0.41	0.81	0.28	1.61	1.07
SEm±	0.092	0.119	0.125	0.089	0.062
C D at 5%	0.225	0.325	0.346	0.247	0.172
Interaction [AXB]					
PM_1 X RDF_1	0.79	1.74	2.27	1.43	1.99
PM_1 X RDF_2	0.56	1.31	1.95	0.96	1.66
PM_1 X RDF_3	0.51	1.10	1.55	1.35	1.41
PM_1 X RDF_4	0.45	0.75	1.25	1.09	1.02
PM_2 X RDF_1	0.81	1.78	2.37	2.31	2.31
PM_2 X RDF_2	0.53	1.26	1.86	2.06	2.02
PM_2 X RDF_3	0.46	0.95	1.59	1.72	1.46
PM_2 X RDF_4	0.41	0.82	1.18	1.22	1.22
BL_1 X RDF_1	0.76	1.81	2.11	2.11	1.77
BL_1 X RDF_2	0.58	1.33	1.70	1.78	1.73
BL_1 X RDF_3	0.48	1.12	1.48	1.57	1.67
BL_1 X RDF_4	0.43	0.75	1.29	1.14	1.25
BL_2 X RDF_1	0.86	2.45	2.71	2.65	2.67
BL_2 X RDF_2	0.63	1.85	2.11	2.36	2.05
BL_2 X RDF_3	0.52	1.19	1.69	1.75	1.95
BL_2 X RDF_4	0.46	0.94	1.46	1.29	1.77
NO X RDF_1	0.70	1.57	2.04	2.05	1.70
NO X RDF_2	0.47	2.37	1.59	1.73	1.43
NO X RDF_3	0.41	0.90	1.37	1.30	1.16
NO X RDF_4	0.36	0.63	01.04	0.90	0.96
SEm±	0.098	0.322	0.422	0.432	0.295
C D at 5 %	0.271	0.892	0.834	1.197	0.809

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 30b. Phosphorus uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Phosphorus uptake [mg/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	0.88	0.87	1.05	1.51	1.57
PM_2	1.01	1.13	1.57	1.87	2.03
BL_1	0.92	0.90	1.34	1.54	1.76
BL_2	1.05	1.19	1.66	1.73	2.13
NO	0.83	0.87	1.21	1.29	1.46
SEm±	0.085	0.048	0.088	0.092	0.088
C D at 5%	NS	0.151	0.277	0.289	0.0287
B.Chemical fertilizers					
RDF_1	1.22	1.44	2.08	2.22	2.17
RDF_2	1.02	1.09	1.59	1.63	2.00
RDF_3	0.81	0.86	1.10	1.43	1.63
RDF_4	0.70	0.59	0.80	1.13	1.35
SEm±	0.077	0..206	0.122	0.091	0.058
C D at 5%	0.213	0.571	0.338	0.250	0.161
Interaction [AXB]					
PM_1 X RDF_1	1.10	0.99	2.07	2.08	1.72
PM_1 X RDF_2	1.00	1.02	1.58	1.72	1.66
PM_1 X RDF_3	0.77	0.82	0.99	1.37	1.29
PM_1 X RDF_4	0.62	0.57	0.78	0.97	1.17
PM_2 X RDF_1	1.27	1.67	2.32	2.64	2.76
PM_2 X RDF_2	1.04	1.17	1.76	1.96	2.00
PM_2 X RDF_3	0.91	0.91	1.27	1.66	1.96
PM_2 X RDF_4	0.73	0.68	0.81	1.32	1.39
BL_1 X RDF_1	1.22	1.23	1.93	1.21	2.19
BL_1 X RDF_2	1.04	1.06	150	1.56	1.88
BL_1 X RDF_3	0.82	0.84	0.78	1.40	1.48
BL_1 X RDF_4	0.70	0.60	0.80	1.14	1.34
BL_2 X RDF_1	1.40	1.90	2.93	2.82	2.26
BL_2 X RDF_2	1.10	1.22	2.06	2.06	2.28
BL_2 X RDF_3	0.94	0.96	1.31	2.30	2.02
BL_2 X RDF_4	0.75	071	0.86	1.35	1.44
NO X RDF_1	1.04	1.23	1.62	1.78	1.67
NO X RDF_2	0.88	0.94	1.25	1.51	1.59
NO X RDF_3	0.76	0.69	0.84	1.20	1.16
NO X RDF_4	0.59	0.52	0.656	0.91	1.04
SEm±	0.102	0.267	0.301	0.528	0.306
C D at 5 %	0.283	0.756	0.905	1.146	0.848

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

application of various levels of inorganic fertilizers alone at all the growth stages.

4.2.2.3 Potassium (mg/plant)

The potassium uptake of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.31, 31a and 31b.

The potassium uptake (mg/plant) at various growth stages (averaged over two years) in sugarcane differed significantly. Except at 60 DAP/R (Days after planting/Ratoon initiation) all other stages showed significant difference in K_2O uptake due to application of various organics. However only at 60 DAR significantly higher K_2O uptake was observed due to BL_2 application (18.13) over other treatments except due to PM_2 and BL1. At all the latter stages application of BL_2 recorded significantly higher uptake of K_2O over all the treatments except PM_2. It was also noticed that though application of BL_1 and PM_1 recorded on par K_2O uptake at advanced stages of crop growth but were significantly higher over no organic treatment.

Significantly higher K_2O uptake was exhibited due to application of RDF_1 at all the growth stages. Further reduction in

Table 31. Potassium uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Potassium uptake [mg/plant]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	12.68	21.01	28.13	37.42	25.97
PM_2	13.33	24.09	32.41	40.91	29.84
BL_1	12.87	21.82	28.75	36.68	26.74
BL_2	14.33	27.17	35.31	43.39	33.05
NO	11.72	19.54	25.86	33.93	23.27
SEm±	0.942	1.032	0.982	0.852	1.092
C D at 5%	NS	3.092	2.952	2.564	3.275
B.Chemical fertilizers					
RDF_1	15.63	31.66	41.06	50.89	35.14
RDF_2	13.89	24.66	33.26	41.13	30.16
RDF_3	12.33	19.77	26.24	34.20	25.81
RDF_4	10.35	15.50	20.96	28.52	20.57
SEm±	0.632	0.892	1.181	1.201	1.067
C D at 5%	1.752	2.452	3.262	3.321	2.925
Interaction [AXB]					
PM_1 X RDF_1	15.12	27.78	37.83	48.32	39.60
PM_1 X RDF_2	13.59	19.60	30.47	39.51	27.79
PM_1 X RDF_3	12.07	19.61	24.37	34.16	24.81
PM_1 X RDF_4	10.17	14.78	20.61	28.32	20.33
PM_2 X RDF_1	16.13	32.71	44.33	53.60	40.07
PM_2 X RDF_2	14.06	26.07	36.21	44.47	31.95
PM_2 X RDF_3	12.87	20.01	29.06	36.17	26.41
PM_2 X RDF_4	10.58	16.57	21.59	29.86	22.04
BL_1 X RDF_1	15.33	28.77	38.61	49.76	31.74
BL_1 X RDF_2	13.89	32.94	31.50	38.39	29.64
BL_1 X RDF_3	12.30	20.09	24.57	30.10	25.43
BL_1 X RDF_4	10.60	15.30	21.17	28.32	20.62
BL_2 X RDF_1	17.57	40.44	49.67	55.00	44.62
BL_2 X RDF_2	15.68	29.50	39.73	47.84	36.39
BL_2 X RDF_3	13.42	22.49	31.14	37.23	30.78
BL_2 X RDF_4	11.20	18.09	22.85	30.89	22.99
NO X RDF_1	14.12	27.47	34.77	44.32	28.83
NO X RDF_2	12.48	21.70	28.79	35.98	25.90
NO X RDF_3	11.21	17.09	22.33	30.31	21.91
NO X RDF_4	9.41	13.19	18.44	25.42	18.37
SEm±	1.242	2.851	2.017	0.994	1.882
C D at 5 %	3.421	7.892	5.547	2.752	5.214

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 31a. Potassium uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Potassium uptake [mg/plant]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	9.76	21.63	30.30	37.42	25.00
PM_2	9.89	24.65	33.09	40.55	29.96
BL_1	9.84	22.46	30.51	36.73	26.73
BL_2	10.77	28.69	36.49	43.21	32.69
NO	8.98	19.54	27.00	31.92	22.42
SEm±	1.121	1.555	1.117	1.170	1.321
C D at 5%	NS	4.905	3.521	3.692	4.162
B.Chemical fertilizers					
RDF_1	11.23	33.19	41.54	51.20	33.59
RDF_2	10.74	25.67	33.90	41.47	29.20
RDF_3	9.42	20.12	28.55	33.89	25.81
RDF_4	8.21	15.27	22.80	26.52	21.00
SEm±	0.572	0.917	1.325	1.301	1.715
C D at 5%	1.83	2.541	3.671	3.602	3.242
Interaction [AXB]					
PM_1 X RDF_1	11.19	29.76	39.73	30.22	28.56
PM_1 X RDF_2	10.34	23.32	32.50	22.20	26.14
PM_1 X RDF_3	9.35	20.15	27.50	34.62	24.74
PM_1 X RDF_4	8.18	14.18	22.54	26.46	20.45
PM_2 X RDF_1	11.14	35.59	43.08	53.47	39.53
PM_2 X RDF_2	10.59	27.52	36.36	45.14	31.39
PM_2 X RDF_3	9.65	19.91	30.29	36.56	25.66
PM_2 X RDF_4	8.21	16.46	23.69	28.10	13.76
BL_1 X RDF_1	10.95	31.10	40.41	51.34	30.33
BL_1 X RDF_2	10.38	24.60	32.22	37.74	29.58
BL_1 X RDF_3	9.53	20.57	27.38	25.52	26.22
BL_1 X RDF_4	8.49	14.36	23.21	26.03	20.87
BL_2 X RDF_1	12.68	42.51	49.72	58.85	44.03
BL_2 X RDF_2	12.17	31.79	40.22	49.78	47.07
BL_2 X RDF_3	9.98	22.81	32.96	37.23	30.59
BL_2 X RDF_4	8.51	18.83	25.13	29.44	12.81
NO X RDF_1	15.85	27.69	35.20	43.52	26.64
NO X RDF_2	9.41	23.44	29.47	34.51	23.89
NO X RDF_3	8.63	17.22	24.67	27.83	22.08
NO X RDF_4	7.64	12.64	19.55	22.60	17.33
SEm±	1.522	3.551	3.121	1.252	2.324
C D at 5 %	NS	9.841	8.651	3.472	6.441

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 31b. Potassium uptake in sugarcane at various growth stages as influenced by organic and inorganic fertilizers.

Treatment	Potassium uptake [mg/plant]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	15.80	20.14	25.78	77.09	26.66
PM_2	17.02	23.33	31.66	40.74	29.37
BL_1	16.37	20.86	26.72	36.48	31.98
BL_2	18.13	25.56	34.10	43.14	33.32
NO	14.75	19.37	26.39	35.44	23.97
SEm±	1.034	1.425	1.125	1.052	1.225
C D at 5%	3.252	4.492	3.542	3.312	3.862
B.Chemical fertilizers					
RDF_1	20.32	29.78	40.34	50.39	36.33
RDF_2	17.40	23.44	32.39	40.24	31.06
RDF_3	15.48	19.23	23.74	34.24	26.50
RDF_4	12.73	15.60	18.86	30.45	20.08
SEm±	0.913	0.991	1.421	1.522	1.426
C D at 5%	2.532	2.752	3.942	4.221	3.952
Interaction [AXB]					
PM_1 X RDF_1	19.18	25.20	35.95	47.22	32.60
PM_1 X RDF_2	16.96	22.10	28.46	37.94	29.94
PM_1 X RDF_3	14.99	18.87	21.00	33.39	24.56
PM_1 X RDF_4	12.36	15.26	18.54	30.24	20.00
PM_2 X RDF_1	21.61	33.50	45.34	53.51	40.16
PM_2 X RDF_2	17.61	24.51	36.00	43.10	31.77
PM_2 X RDF_3	16.31	19.94	27.63	35.44	27.16
PM_2 X RDF_4	13.15	16.38	19.34	31.46	20.09
BL_1 X RDF_1	20.02	25.80	36.81	27.53	32.84
BL_1 X RDF_2	17.65	32.13	30.46	38.67	29.44
BL_1 X RDF_3	15.22	19.28	21.58	33.85	24.34
BL_1 X RDF_4	12.92	16.21	18.98	30.63	20.13
BL_2 X RDF_1	22.62	38.10	49.61	50.39	45.71
BL_2 X RDF_2	19.30	26.75	39.24	45.68	35.71
BL_2 X RDF_3	17.32	21.96	29.11	55.97	30.82
BL_2 X RDF_4	15.41	17.18	20.41	32.05	22.85
NO X RDF_1	18.39	26.86	34.10	44.43	30.99
NO X RDF_2	15.80	21.66	27.80	36.74	27.56
NO X RDF_3	14.04	16.69	19.84	32.50	21.42
NO X RDF_4	11.26	13.56	17.06	28.10	19.21
SEm±	1.427	3.721	3.724	1.173	2.971
C D at 5 %	3.952	10.310	10.321	3.254	8.231

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

the levels of inorganic fertilizers from RDF_1 to RDF_4 significantly reduced the K_2O uptake at all the stages of growth. The maximum uptake was recorded with RDF_1 and minimum was with RDF_4.

The pooled analysis of data indicated that the interaction effects due to organic and inorganic fertilizers at various growth stages for K_2O uptake were significant. Except at 60 DAP/R, application of BL_2 and PM_2 in conjunction of RDF_1 exerted significantly the highest K_2O uptake at all the growth stages over other treatment combinations and further it was also revealed that application of BL_2 X RDF_2 recorded significantly higher K_2O uptake over rest of the treatments including RDF_1 alone. The interaction effects were non-signifcant only at 60 DAP.

4.2.3 YIELD COMPONENTS AND YIELD

4.2.3.1 Number of internodes

The number of internodes of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.32, 32a and 32b.

The number of internodes increased progressively from 60 DAP/R (Days after planting/Ratoon initiation) (1.83) till harvest (20.22).

The number of internodes of sugarcane averaged over two years as influenced by various organic manures did not differ significantly at various growth stages of crop due to application of organics at all the growth stages except at 120 DAP.

The chemical fertilizer levels had significant influence on number of internodes production. The data of two years indicated that early growth stages (both plant and ratoon) viz., 60, 120 DAP/R did not exert any significant difference in formation of number of internodes due to varied levels of chemical fertilizers. However, at advanced stages of growth, i.e., 180, 240 DAP/R and at harvest except 180 DAP, significantly higher number of internodes were recorded due to application of RDF_1 compared to RDF_3 and RDF_4 and on par number of internodes were observed due to RDF_2. In all the stages of growth the lowest number of internodes were registered in RDF_4 and the highest being in RDF_1. The interaction effects on number of internodes production were non-significant at all the growth stages of sugarcane.

Table 32. Number of internodes in sugarcane at various growth stages as influenced by organics and inorganic fertilizer[Pooled]

Treatment	Number of internodes				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	1.80	6.39	13.59	17.70	19.95
PM_2	1.85	6.54	13.79	17.71	20.59
BL_1	1.85	6.66	13.44	17.60	20.18
BL_2	1.86	6.66	13.87	17.75	20.37
NO	1.77	6.37	13.28	17.54	19.96
SEm±	0.039	0.159	0.343	0.425	0.467
C D at 5%	NS	NS	NS	NS	NS
B.Chemical fertilizers					
RDF_1	1.87	6.63	14.16	18.40	20.88
RDF_2	1.84	6.69	13.70	17.84	20.27
RDF_3	1.82	6.39	13.32	17.38	19.98
RDF_4	1.79	6.37	13.18	17.07	19.71
SEm±	0.542	0.143	0.307	0.332	0.297
C D at 5%	NS	NS	0.851	0.987	0.835
Interaction [AXB]					
PM_1 X RDF_1	1.88	6.19	14.01	18.60	20.63
PM_1 X RDF_2	1.79	6.68	13.68	17.89	19.97
PM_1 X RDF_3	1.73	6.28	13.40	17.28	19.82
PM_1 X RDF_4	1.84	6.39	13.28	17.03	19.37
PM_2 X RDF_1	1.87	6.71	14.31	18.37	21.04
PM_2 X RDF_2	1.85	6.52	13.87	17.85	20.66
PM_2 X RDF_3	1.85	6.39	13.46	17.48	20.45
PM_2 X RDF_4	1.85	7.01	13.50	17.15	20.17
BL_1 X RDF_1	1.84	6.73	13.77	18.31	20.80
BL_1 X RDF_2	1.85	6.38	13.58	17.96	20.22
BL_1 X RDF_3	1.85	6.51	13.18	17.34	20.05
BL_1 X RDF_4	1.89	6.73	13.19	17.04	19.66
BL_2 X RDF_1	1.86	7.11	14.62	18.52	21.41
BL_2 X RDF_2	1.88	6.43	14.11	17.83	20.60
BL_2 X RDF_3	1.83	6.90	13.51	17.53	19.91
BL_2 X RDF_4	1.84	6.40	13.22	17.13	19.50
NO X RDF_1	1.84	6.90	14.08	18.22	20.53
NO X RDF_2	1.84	6.41	13.29	19.68	19.83
NO X RDF_3	1.78	6.34	13.06	17.25	19.65
NO X RDF_4	1.59	6.28	12.70	17.10	19.83
SEm±	0.099	0.319	0.971	0.849	0.934
C D at 5 %	NS	NS	NS	NS	NS

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 32a. Number of internodes in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Number of internodes				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	1.77	5.56	12.57	17.11	20.41
PM_2	1.80	5.91	12.44	16.97	20.50
BL_1	1.79	6.10	12.33	15.09	20.64
BL_2	1.81	6.07	12.51	17.02	20.65
NO	1.70	5.59	12.37	17.08	19.95
SEm±	0.052	0.190	0.556	0.463	0.601
C D at 5%	NS	0.570	NS	NS	NS
B.Chemical fertilizers					
RDF_1	1.81	6.02	12.09	17.63	21.05
RDF_2	1.79	6.12	12.45	17.22	20.81
RDF_3	1.81	5.78	12.33	16.82	20.58
RDF_4	1.69	5.63	12.29	16.51	19.26
SEm±	0.068	0.172	0.492	0.272	0.597
C D at 5%	NS	NS	NS	0.801	1.722
Interaction [AXB]					
PM_1 X RDF_1	1.82	5.12	12.66	17.58	20.95
PM_1 X RDF_2	1.75	6.87	12.62	17.26	20.75
PM_1 X RDF_3	1.80	5.36	12.55	16.84	20.54
PM_1 X RDF_4	1.72	5.64	12.46	16.75	19.41
PM_2 X RDF_1	1.82	6.20	12.52	17.63	20.87
PM_2 X RDF_2	1.79	5.89	12.19	17.10	20.95
PM_2 X RDF_3	1.82	5.84	12.24	16.85	20.77
PM_2 X RDF_4	1.77	5.68	13.79	13.70	19.40
BL_1 X RDF_1	1.78	6.76	12.39	17.62	21.10
BL_1 X RDF_2	1.80	6.28	12.52	17.27	20.84
BL_1 X RDF_3	1.80	5.47	12.16	16.85	20.80
BL_1 X RDF_4	1.78	5.82	12.23	16.65	19.50
BL_2 X RDF_1	1.82	6.17	13.03	17.80	21.50
BL_2 X RDF_2	1.80	6.85	12.53	17.20	21.00
BL_2 X RDF_3	1.84	5.65	12.28	16.87	20.50
BL_2 X RDF_4	1.79	5.62	12.18	16.20	19.60
NO X RDF_1	1.81	5.800	12.91	17.53	20.85
NO X RDF_2	1.82	5.650	12.40	17.27	20.55
NO X RDF_3	1.79	5.480	12.40	16.88	20.30
NO X RDF_4	1.40	5.413	11.75	16.65	18.10
SEm±	0.121	0.378	0.105	1.267	1.921
C D at 5 %	NS	1.048	NS	NS	NS

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 32b . Number of internodes in sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Number of internodes				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	1.83	7.20	14.61	18.29	19.29
PM_2	1.90	7.17	15.14	18.45	20.27
BL_1	1.91	7.21	14.54	18.22	19.56
BL_2	1.91	7.25	15.23	18.79	20.04
NO	1.82	7.19	14.18	17.99	19.07
SEm±	0.037	0.135	0.428	0.417	0.530
C D at 5%	NS	NS	NS	NS	NS
B.Chemical fertilizers					
RDF_1	1.92	7.24	15.62	19.17	20.71
RDF_2	1.88	7.20	14.96	18.47	19.73
RDF_3	1.82	7.20	14.32	17.89	19.37
RDF_4	1.89	7.16	14.06	17.64	18.61
SEm±	0.067	0.250	0.334	0.437	0.442
C D at 5%	NS	NS	0.926	1.299	1.225
Interaction [AXB]					
PM_1 X RDF_1	1.93	7.25	15.35	19.63	20.31
PM_1 X RDF_2	1.82	7.18	14.75	18.52	19.20
PM_1 X RDF_3	1.05	7.20	14.25	17.72	19.10
PM_1 X RDF_4	1.95	7.15	14.10	17.31	18.58
PM_2 X RDF_1	1.92	7.22	16.10	19.10	21.22
PM_2 X RDF_2	1.91	7.15	15.55	18.60	20.78
PM_2 X RDF_3	1.89	7.71	14.68	18.10	20.13
PM_2 X RDF_4	1.92	7.10	14.21	18.00	18.98
BL_1 X RDF_1	1.96	7.24	15.21	19.00	20.50
BL_1 X RDF_2	1.91	7.18	14.65	18.65	19.60
BL_1 X RDF_3	1.91	7.21	14.21	19.83	19.30
BL_1 X RDF_4	1.92	7.20	14.10	17.42	18.32
BL_2 X RDF_1	1.96	7.28	16.20	19.23	21.32
BL_2 X RDF_2	1.92	7.33	15.70	18.47	20.33
BL_2 X RDF_3	1.91	7.20	14.75	18.20	19.32
BL_2 X RDF_4	1.87	7.18	14.25	18.07	19.20
NO X RDF_1	1.87	7.21	15.25	18.90	20.20
NO X RDF_2	1.86	7.18	14.13	18.10	19.10
NO X RDF_3	1.77	7.20	13.12	17.62	17.99
NO X RDF_4	1.77	7.15	13.62	17.38	18.61
SEm±	0.074	0.561	0.746	1.268	0.987
C D at 5 %	0.205	NS	NS	NS	NS

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

4.2.3.2 Length of internode (cm)

The length of internode in sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables.33, 33a and 33b.

The length of internode increased progressively from 60 DAP/R (Days after planting/Ratoon initiation) (5.92) till harvest (9.10).

The length of internode of sugarcane averaged over two years as influenced by various organic fertilizers failed to exert significant results length of internode of sugarcane at all the growth stages of crop. Application of chemical fertilizers produced significant results on the length of internodes. The two years data showed that application of RDF_1 recorded significantly higher length of internode compared to RDF_3 and RDF_4. However RDF_1 registered on par internodal length with that of RDF_2 at 180, 240 DAP/R and at harvest. At 60 DAP/R length of internode did not differ significantly due to application of various chemical fertilizer levels. However, at 120 DAP/R, pooled analysis indicated that RDF_1 (8.13) registered significantly higher length of internode compared to RDF_3 and RDF_4 and it was on par with RDF_2 (7.83), however at 120 DAP, 180 DAP and 120 DAR, RDF_1,

Table 33. Length of internode in surgarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Length of internode [cm]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	6.14	7.45	7.75	8.75	8.83
PM_2	6.05	6.82	7.92	8.61	8.69
BL_1	6.13	7.66	8.58	9.18	9.00
BL_2	5.83	7.50	8.62	9.68	9.78
NO	5.46	7.08	7.71	8.69	8.80
SEm±	0.291	0.372	0.322	0.371	0.381
C D at 5%	NS	NS	NS	NS	NS
B.Chemical fertilizers					
RDF_1	5.78	8.13	9.23	10.00	10.10
RDF_2	6.13	7.83	8.62	9.32	9.40
RDF_3	6.08	7.42	7.73	8.72	8.74
RDF_4	5.70	6.20	6.72	7.87	7.97
SEm±	0.332	0.243	0.408	0.398	0.391
C D at 5%	NS	0.674	1.222	1.900	1.132
Interaction [AXB]					
PM_1 X RDF_1	5.72	7.91	9.10	9.64	9.74
PM_1 X RDF_2	6.71	7.77	7.98	9.05	9.07
PM_1 X RDF_3	6.32	7.79	7.61	8.42	8.52
PM_1 X RDF_4	5.83	6.32	6.32	7.90	7.98
PM_2 X RDF_1	5.81	7.39	8.47	9.26	9.30
PM_2 X RDF_2	5.81	6.88	8.39	8.90	8.97
PM_2 X RDF_3	6.89	7.09	7.98	8.60	8.70
PM_2 X RDF_4	5.68	5.90	6.90	7.65	7.77
BL_1 X RDF_1	5.42	8.37	9.80	10.45	10.55
BL_1 X RDF_2	6.18	7.80	8.81	9.54	9.63
BL_1 X RDF_3	6.60	8.10	8.30	8.75	8.87
BL_1 X RDF_4	6.30	3.67	7.40	7.97	8.03
BL_2 X RDF_1	6.25	8.45	10.41	10.94	11.03
BL_2 X RDF_2	6.42	8.73	9.32	9.94	10.02
BL_2 X RDF_3	5.21	7.40	8.17	9.60	9.71
BL_2 X RDF_4	5.44	6.37	6.58	8.21	8.36
NO X RDF_1	5.70	7.87	8.33	9.69	9.87
NO X RDF_2	5.53	7.87	8.33	9.69	9.87
NO X RDF_3	5.39	6.44	7.46	8.24	8.33
NO X RDF_4	5.22	6.04	6.37	7.62	7.70
SEm±	0.871	0.927	1.352	1.217	1.271
C D at 5 %	NS	NS	NS	NS	NS

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 33a . Length of internode in surgarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Length of internode [cm]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	6.60	7.75	8.26	8.93	9.01
PM_2	6.47	7.18	8.40	8.71	8.77
BL_1	6.65	7.91	9.04	9.29	9.38
BL_2	6.35	7.60	9.08	9.74	9.86
NO	5.91	7.64	8.17	8.84	8.99
SEm±	0.321	0.385	0.398	0.422	0.472
C D at 5%	NS	NS	NS	NS	NS
B.Chemical fertilizers					
RDF_1	6.24	8.37	9.70	10.20	10.31
RDF_2	6.62	8.31	9.13	9.42	9.50
RDF_3	6.55	7.57	8.35	8.90	8.83
RDF_4	6.16	6.51	7.18	7.87	7.98
SEm±	0.228	0.312	0.415	0.432	0.495
C D at 5%	NS	0.865	1.350	1.272	1.452
Interaction [AXB]					
PM_1 X RDF_1	6.22	8.45	9.50	10.10	10.21
PM_1 X RDF_2	7.11	8.32	8.70	9.10	9.11
PM_1 X RDF_3	6.85	7.92	8.10	8.66	8.78
PM_1 X RDF_4	6.22	6.32	6.75	7.85	7.95
PM_2 X RDF_1	6.21	7.82	8.95	9.47	9.52
PM_2 X RDF_2	6.33	7.32	8.78	9.05	9.10
PM_2 X RDF_3	7.21	7.22	8.46	8.85	8.90
PM_2 X RDF_4	6.13	6.35	7.41	7.45	7.55
BL_1 X RDF_1	5.88	8.44	10.25	10.65	10.75
BL_1 X RDF_2	6.72	8.15	9.31	9.62	9.71
BL_1 X RDF_3	7.10	8.24	8.71	8.82	8.95
BL_1 X RDF_4	6.88	6.79	7.88	8.05	8.10
BL_2 X RDF_1	6.81	8.75	10.89	11.02	11.10
BL_2 X RDF_2	6.95	9.24	9.75	10.00	10.05
BL_2 X RDF_3	5.75	7.50	8.57	9.72	9.87
BL_2 X RDF_4	5.89	6.85	7.10	8.20	8.40
NO X RDF_1	6.10	8.41	8.89	9.75	9.95
NO X RDF_2	6.01	8.41	8.89	9.75	9.95
NO X RDF_3	5.85	6.99	7.93	8.43	8.55
NO X RDF_4	5.67	6.25	6.75	7.82	7.90
SEm±	0.972	1.216	1.562	1.423	1.325
C D at 5 %	NS	NS	NS	NS	NS

DAP/R = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 33b . Length of internode in surgarcane at various growth stages as influenced by organics and inorganic fertilizers

Treatment	Length of internode [cm]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	5.68	7.14	7.24	8.57	8.65
PM_2	5.62	6.45	7.44	8.50	8.61
BL_1	5.60	7.41	8.11	9.07	8.61
BL_2	5.31	7.39	8.16	9.61	9.70
NO	5.01	6.62	7.24	8.53	8.61
SEm±	0.285	0.421	0.374	0.372	0.392
C D at 5%	NS	NS	NS	NS	NS
B.Chemical fertilizers					
RDF_1	5.31	7.89	8.75	9.79	9.89
RDF_2	5.63	7.35	8.10	9.21	9.29
RDF_3	5.61	7.26	7.10	8.54	8.64
RDF_4	5.23	5.88	6.25	7.87	7.95
SEm±	0.322	0279	0.511	0.412	0.392
C D at 5%	NS	0.773	1.350	1.237	1.172
Interaction [AXB]					
PM_1 X RDF_1	5.21	9.37	8.70	9.17	9.26
PM_1 X RDF_2	6.31	7.22	7.25	8.99	9.07
PM_1 X RDF_3	5.78	7.65	7.11	8.17	8.25
PM_1 X RDF_4	5.43	6.31	5.88	7.95	8.00
PM_2 X RDF_1	5.41	6.95	7.99	9.05	9.10
PM_2 X RDF_2	5.28	6.44	7.89	8.75	8.83
PM_2 X RDF_3	6.57	6.95	7.49	8.34	8.50
PM_2 X RDF_4	5.22	545	6.39	7.85	7.99
BL_1 X RDF_1	4.95	8.30	9.34	10.25	10.34
BL_1 X RDF_2	5.63	7.45	8.30	9.45	9.54
BL_1 X RDF_3	6.09	7.95	7.88	8.68	8.78
BL_1 X RDF_4	5.72	5.95	6.92	7.89	7.95
BL_2 X RDF_1	5.69	8.15	9.93	10.86	10.95
BL_2 X RDF_2	5.88	8.22	8.88	9.87	9.95
BL_2 X RDF_3	4.66	7.30	7.77	9.47	9.55
BL_2 X RDF_4	4.99	5.89	6.05	8.22	8.32
NO X RDF_1	5.29	7.33	7.77	9.62	9.78
NO X RDF_2	5.04	7.33	7.77	9.62	9.78
NO X RDF_3	4.93	5.89	6.99	8.05	8.10
NO X RDF_4	4.77	5.82	5.99	7.42	7.50
SEm±	0.922	1.121	1.429	1.375	1.327
C D at 5 %	NS	NS	NS	NS	NS

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

RDF_2 and RDF_3 were on par with each other. Similar trend was also observed at 180 DAP. At all the advanced stages of crop growth i.e. 180 DAP/R onwards the lowest internodal length was recorded with RDF_4 and the highest with RDF_1. The interaction effects due to organic and chemical fertilizers failed to exert any significant impact on the length of internode of sugarcane at various crop growth phases.

4.2.3.3 Cane diameter (cm)

The diameter of sugarcane at various growth stages as influenced by organic and inorganic fertilizers is presented in Tables. 34, 34a and 34b.

The diameter of sugarcane increased progressively from 60 DAP/R (Days after planting/Ratoon initiation) (0.84) to at harvest (2.35).

Due to application of various organic manures the diameter of cane varied significantly. At 60 DAP/R however, it did not differ significantly. Application of BL2 recorded significantly higher cane diameter (1.06) over other organics except PM_2 (1.05), BL_1 (0.98) at 120 DAP/R (Days after planting/Ratoon initiation). However in plant cane BL_2 and PM_2 and in case of

ratoon BL_2, PM_2, BL_1 and PM_1 showed on par results with respect to cane diameter. At 180 DAP/R application of BL_2 (1.78) exerted significantly higher cane diameter over PM_1 and no organic, however at 240 DAP/R, application BL_2 (2.26) registered significantly higher cane diameter over no organics only (2.05). But at harvest significantly better cane diameter was obtained due to application of BL_2 (2.62) over PM_1 and NO and was on par with PM_2 and BL_2.

At 60 DAP/R, different grades of chemical fertilizers did not affect the cane diameter. However at 120 DAP/R, RDF_1 (1.10) significantly exhibited higher cane diameter over RDF_3 and RDF_4 and it was on par with RDF_2 (1.09). As the growth stage advanced, application of RDF_1 had exerted significantly higher cane diameter over rest of the levels of chemical fertilizers. Significantly lower cane diameter was noticed due to application of RDF_4 compared to RDF_1 and RDF_2 in all the growth stages of crop.

The interaction effects due to application of organic and chemical fertilizers were found significant except at 60 and 120 DAP/R. The averaged data of two years indicated that application of BL_2 X RDF_1 registered significantly higher cane

Table 34. Diameter of sugarcane at various growth stages as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Diameter of sugarcane [cm]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	0.83	0.96	1.54	2.14	2.31
PM_2	0.85	1.05	1.69	2.15	2.52
BL_1	0.84	0.98	1.77	2.50	2.62
BL_2	0.87	1.05	1.77	2.25	2.62
NO	0.81	0.97	1.47	2.05	2.20
SEm±	0.02	0.029	0.044	0.059	0.052
C D at 5%	NS	0.086	0.132	0.176	0.156
B.Chemical fertilizers					
RDF_1	0.92	1.10	1.84	2.33	2.70
RDF_2	0.87	1.08	1.64	2.16	2.48
RDF_3	0.81	0.96	1.53	2.08	2.23
RDF_4	0.76	0.84	1.47	2.05	2.19
SEm±	0.06	0.026	0.039	0.053	0.047
C D at 5%	NS	0.072	0.108	0.147	0.130
Interaction [AXB					
PM_1 X RDF_1	0.92	1.07	1.71	2.38	2.48
PM_1 X RDF_2	0.90	1.20	1.64	2.21	2.37
PM_1 X RDF_3	0.76	0.92	1.38	2.11	2.30
PM_1 X RDF_4	0.74	0.89	1.43	1.87	2.95
PM_2 X RDF_1	0.93	1.21	1.97	2.35	2.94
PM_2 X RDF_2	0.85	1.11	1.70	2.21	2.61
PM_2 X RDF_3	0.83	1.05	1.58	2.05	2.34
PM_2 X RDF_4	0.78	0.82	1.51	2.97	2.19
BL_1 X RDF_1	0.93	1.11	1.75	2.16	2.68
BL_1 X RDF_2	0.87	1.03	1.71	2.07	2.14
BL_1 X RDF_3	0.83	0.93	1.56	2.10	2.32
BL_1 X RDF_4	0.75	0.85	1.46	2.40	2.12
BL_2 X RDF_1	0.97	1.06	2.15	2.50	3.01
BL_2 X RDF_2	0.88	1.17	1.76	2.20	2.76
BL_2 X RDF_3	0.84	1.05	1.63	2.12	2.44
BL_2 X RDF_4	0.79	0.93	1.55	2.19	2.25
NO X RDF_1	0.85	5.04	1.63	2.26	2.31
NO X RDF_2	0.85	1.00	1.39	2.10	2.27
NO X RDF_3	0.79	0.88	1.50	2.00	2.20
NO X RDF_4	0.73	0.78	1.38	1.83	1.97
SEm±	0.088	0.181	0.082	0.118	0.105
C D at 5 %	NS	NS	0.241	0.327	0.291

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 34a. Diameter of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Diameter of sugarcane [cm]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	0.80	1.00	1.76	2.49	2.26
PM_2	0.83	1.12	1.89	2.48	2.52
BL_1	0.81	1.03	1.86	2.59	2.65
BL_2	0.86	1.07	2.02	2.59	2.65
NO	0.79	0.97	1.71	2.45	2.13
SEm±	0.027	0.045	0.049	0.138	0.066
C D at 5%	NS	0.142	0.154	0.435	0.208
B.Chemical fertilizers					
RDF_1	0.88	1.12	2.07	2.73	2.76
RDF_2	0.83	1.10	1.85	2.53	2.49
RDF_3	0.79	1.00	1.76	2.49	2.29
RDF_4	0.77	0.93	1.72	2.24	2.15
SEm±	0.028	0.042	0.069	0.095	0.076
C D at 5%	NS	0.116	0.191	0.280	0.211
Interaction [AXB]					
PM_1 X RDF_1	0.86	1.14	1.90	2.73	2.47
PM_1 X RDF_2	0.80	1.06	1.97	2.53	2.50
PM_1 X RDF_3	0.70	0.94	1.47	2.54	2.20
PM_1 X RDF_4	0.76	0.89	1.60	2.15	1.90
PM_2 X RDF_1	0.80	1.28	2.10	2.61	3.00
PM_2 X RDF_2	0.85	1.15	1.80	0.54	2.66
PM_2 X RDF_3	0.81	1.08	1.80	2.42	2.53
PM_2 X RDF_4	0.80	0.98	1.70	2.35	2.10
BL_1 X RDF_1	0.88	1.18	2.0	2.82	2.85
BL_1 X RDF_2	0.80	1.08	1.91	2.45	2.42
BL_1 X RDF_3	0.70	0.95	1.83	2.52	2.30
BL_1 X RDF_4	0.76	0.91	1.73	2.20	2.00
BL_2 X RDF_1	0.96	0.91	2.35	2.75	3.11
BL_2 X RDF_2	0.88	1.20	2.01	2.62	2.85
BL_2 X RDF_3	0.82	1.13	1.90	2.54	2.45
BL_2 X RDF_4	0.80	1.03	1.85	5.44	2.20
NO X RDF_1	0.85	1.10	1.95	2.76	2.40
NO X RDF_2	0.80	1.05	1.51	2.38	2.20
NO X RDF_3	0.77	0.92	1.78	2.42	2.10
NO X RDF_4	0.75	0.84	1.62	2.10	1.85
SEm±	0.092	0.172	0.155	0.213	0.169
C D at 5 %	NS	NS	0.429	0.594	0.488

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 34b. Diameter of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Diameter of sugarcane [cm]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manure					
PM_1	0.85	0.90	1.32	1.80	2.35
PM_2	0.86	0.98	1.48	1.82	2.52
BL_1	0.87	0.91	1.37	1.92	2.59
BL_2	0.88	1.04	1.52	1.92	2.59
NO	0.83	0.87	1.24	1.65	2.27
SEm±	0.039	0.028	0.040	0.018	0.090
C D at 5%	NS	0.088	0.154	0.057	0.284
B.Chemical fertilizers					
RDF_1	0.97	1.07	1.61	1.93	2.64
RDF_2	0.90	1.03	1.43	1.79	2.48
RDF_3	0.82	0.93	1.30	1.67	2.35
RDF_4	0.74	0.75	1.21	1.86	2.23
SEm±	0.039	0.032	0.044	0.021	0.054
C D at 5%	NS	0.088	0.122	0.058	0.150
Interaction [AX					
PM_1 X RDF_1	0.98	1.00	1.45	2.13	2.49
PM_1 X RDF_2	0.99	0.98	1.34	1.88	2.39
PM_1 X RDF_3	0.73	0.90	1.29	1.19	2.35
PM_1 X RDF_4	0.73	0.75	1.22	1.59	2.20
PM_2 X RDF_1	0.97	1.15	1.84	2.10	2.8
PM_2 X RDF_2	0.86	1.08	1.15	1.89	2.10
PM_2 X RDF_3	0.85	1.03	1.34	1.69	2.30
PM_2 X RDF_4	0.71	0.67	1.24	1.60	2.97
BL_1 X RDF_1	0.99	1.05	1.50	1.51	2.50
BL_1 X RDF_2	0.90	0.90	1.52	1.70	2.40
BL_1 X RDF_3	0.88	0.9	1.29	1.68	2.30
BL_1 X RDF_4	0.74	1.79	1.20	2.60	2.20
BL_2 X RDF_1	0.99	1.21	1.95	2.25	2.97
BL_2 X RDF_2	0.86	1.15	1.52	1.79	2.60
BL_2 X RDF_3	0.86	0.96	1.26	1.71	2.40
BL_2 X RDF_4	0.78	0.84	0.26	1.95	2.30
NO X RDF_1	0.92	0.98	1.32	1.76	2.30
NO X RDF_2	0.87	0.95	1.27	1.68	2.30
NO X RDF_3	0.81	0.80	1.22	1.59	2.30
NO X RDF_4	0.72	0.72	1.15	1.57	2.10
SEm±	0.089	0.715	0.152	0.047	0.120
C D at 5 %	NS	NS	NS	0.130	0.333

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

diameter (2.15) over rest of the combinations except PM_2 X RDF_1 (1.97) at 180 DAP/R however at 180 DAR the interaction effects were non-significant. At latter stages also application of BL_2 X RDF_1 consistently recorded significantly higher cane diameter over other treatments except PM_2 X RDF_1.

4.2.3.4 Plant height (cm)

The plant height at various growth stages as influenced by organic and inorganic fertilizer is presented in Tables.35, 35a and 35b

The plant height (cm) averaged over two years as influenced by various organic and inorganic fertilizers differed significantly at various growth stages except at 60, 120 and 180 DAP/R (Days after planting/Ratoon initiation). However, plant height increased progressively from 60 DAP/R (39.27) till harvest (191.68).

Various organic manures failed to exert significant influence on plant height at 60 and 120 DAP/R. The advanced stages of growth produced significant results on plant height due to organics. At 180 DAP/R, plant height was significantly higher due to application of BL_2 (145.14) over other treatments except PM_2. However, plant and ratoon crop individually failed to produce significantly higher plant height due to organics upto

180 DAP and DAR respectively. At 240 DAP/R and at harvest application BL_2 exhibited significantly higher plant height (i.e. 191.84 and 205.61, respectively) compared to other treatments except PM_2 . Both the advanced stages did not produce significant results on plant height due to lower doses of *bhumilabh* (BL_1) and pressmud (PM_1) as both these treatments showed on par results with that of no organic treatment at 240 DAP/R and at harvest.

Significant difference in the plant height on pooled basis was recorded due to application of chemical fertilizers at various growth stages of sugarcane. At 60 DAP/R significantly higher plant height was registered with RDF_1 (39.65) compared to other treatments except RDF_2 and RDF_3 and the lowest plant height of 35.18 was recorded with RDF_4. As the growth stages advanced there was significantly higher plant height due to RDF_1 compared to RDF_3 and RDF_4 except RDF_2 wherein only at harvest RDF_1 registered significantly higher plant height (212.46) over all the levels of chemical fertilizers and all the levels of chemical fertilizers differed significantly only at harvest.

The interaction effects between the organic manures and chemical fertilizers were found significant for all the growth

Table 35. Plant height of sugarcane at various growth stages as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Plant height [cm]				
	60 DAP/R	120 DAP/R	180 DAP/R	240 DAP/R	At harvest
A.Organic manures					
PM_1	37.28	85.75	135.52	177.95	186.16
PM_2	39.34	90.48	142.96	189.35	202.02
BL_1	37.16	86.51	138.71	179.80	186.99
BL_2	39.36	92.58	145.14	191.84	205.61
NO	36.98	84.59	132.76	177.33	180.27
SEm±	0.837	2.311	3.933	3.116	3.537
C D at 5%	NS	6.929	11.797	9.342	10.604
B.Chemical fertilizers					
RDF_1	39.65	96.52	152.67	196.90	212.46
RDF_2	39.16	89.94	142.26	183.93	197.49
RDF_3	38.11	85.09	134.69	172.60	185.19
RDF_4	35.18	81.39	126.29	165.85	173.90
SEm±	0.749	2.067	3.518	2.870	3.164
C D at 5%	2.079	5.729	9.751	7.955	8.770
Interaction [AXB]					
PM_1 X RDF_1	38.92	92.25	147.33	188.17	206.85
PM_1 X RDF_2	38.28	86.97	141.19	177.77	193.50
PM_1 X RDF_3	37.45	83.43	131.19	167.82	174.90
PM_1 X RDF_4	34.48	80.33	122.25	162.60	169.37
PM_2 X RDF_1	41.07	98.80	156.89	204.97	221.84
PM_2 X RDF_2	69.85	93.37	143.77	189.25	205.47
PM_2 X RDF_3	39.12	86.53	139.47	174.45	198.30
PM_2 X RDF_4	37.33	83.23	130.89	171.97	182.49
BL_1 X RDF_1	38.98	93.05	150.20	190.99	201.92
BL_1 X RDF_2	38.62	87.90	145.99	179.99	198.95
BL_1 X RDF_3	37.34	84.45	133.88	170.95	178.65
BL_1 X RDF_4	33.68	80.63	124.78	164.99	169.89
BL_2 X RDF_1	41.32	102.55	161.05	207.77	227.87
BL_2 X RDF_2	40.60	95.65	146.40	192.02	209.45
BL_2 X RDF_3	39.55	88.30	140.65	181.04	201.15
BL_2 X RDF_4	35.98	90.93	147.87	192.64	183.95
NO X RDF_1	32.95	90.93	147.87	192.64	199.47
NO X RDF_2	38.45	85.80	128.30	169.00	184.85
NO X RDF_3	37.12	82.72	128.30	156.43	172.94
NO X RDF_4	34.42	78.93	121.05	136.43	163.80
SEm±	1.675	4.622	7.670	6.232	7.074
C D at 5 %	4.643	12.812	21.260	17.274	19.608

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 35a. Plant height of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Plant height [cm]				
	60 DAP	120 DAP	180 DAP	240 DAP	At harvest
A.Organic manures					
PM_1	33.08	90.93	144.04	177.52	193.90
PM_2	33.93	96.70	149.13	191.12	216.39
BL_1	33.08	91.46	145.28	179.37	193.75
BL_2	34.28	99.69	151.33	192.96	220.50
NO	32.43	89.50	142.58	181.51	187.38
SEm±	1.078	3.978	5.636	1.852	6.498
C D at 5%	NS	NS	NS	5.835	20.473
B.Chemical fertilizers					
RDF_1	34.67	99.95	159.52	201.69	216.98
RDF_2	33.88	94.04	150.76	189.07	207.12
RDF_3	32.97	91.28	142.46	177.85	197.10
RDF_4	31.91	88.23	133.23	169.36	188.37
SEm±	1.461	2.235	4.565	3.442	4.004
C D at 5%	4.049	6.206	12.662	9.541	11.098
Interaction [AXB]					
PM_1 X RDF_1	34.40	93.10	154.20	191.07	208.30
PM_1 X RDF_2	33.50	91.60	153.10	183.20	201.70
PM_1 X RDF_3	32.63	89.50	141.39	172.50	184.50
PM_1 X RDF_4	31.77	87.50	127.20	163.30	181.27
PM_2 X RDF_1	35.73	104.73	162.30	208.50	228.27
PM_2 X RDF_2	34.20	99.33	149.20	193.07	221.42
PM_2 X RDF_3	33.40	92.70	144.60	184.50	215.20
PM_2 X RDF_4	32.40	90.07	140.40	178.40	200.70
BL_1 X RDF_1	34.50	95.80	155.10	194.60	209.40
BL_1 X RDF_2	33.60	92.50	154.60	185.40	197.80
BL_1 X RDF_3	32.60	90.70	142.30	172.97	185.60
BL_1 X RDF_4	31.60	86.70	129.13	164.50	182.20
BL_2 X RDF_1	36.10	110.50	165.60	210.33	235.40
BL_2 X RDF_2	34.62	101.60	151.40	195.70	226.43
BL_2 X RDF_3	33.80	95.20	145.73	186.70	217.80
BL_2 X RDF_4	32.60	91.47	160.40	203.97	202.37
NO X RDF_1	32.60	93.60	160.40	203.97	203.53
NO X RDF_2	33.50	90.20	145.20	172.60	188.27
NO X RDF_3	32.40	88.80	138.30	172.50	182.40
NO X RDF_4	31.20	85.40	126.80	101.50	175.30
SEm±	3.268	5.007	10.215	7.696	8.953
C D at 5 %	9.058	13.879	28.315	21.332	24.816

DAP = Days after planting

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 35b. Plant height of sugarcane at various growth stages as influenced by organic and inorganic fertilizers

Treatment	Plant height [cm]				
	60 DAR	120 DAR	180 DAR	240 DAR	At harvest
A.Organic manures					
PM_1	41.49	80.57	126.99	170.65	178.37
PM_2	44.75	84.27	136.38	179.20	187.65
BL_1	41.24	81.59	132.13	173.93	180.23
BL_2	44.45	85.46	138.95	184.11	190.71
NO	41.53	79.69	122.84	167.84	173.15
SEm±	0.394	4.154	4.587	5.183	6.440
C D at 5%	NS	NS	14.453	16.331	NS
B.Chemical fertilizers					
RDF_1	44.63	91.09	145.81	192.11	207.93
RDF_2	44.44	84.83	133.76	178.79	187.45
RDF_3	43.26	78.79	126.92	167.35	173.27
RDF_4	38.45	74.55	119.35	162.34	159.43
SEm±	0.635	3.066	4.813	4.521	5.228
C D at 5%	1.760	8.498	13.341	12.528	14.491
Interaction [AXB]					
PM_1 X RDF_1	43.44	89.40	140.45	185.26	205.40
PM_1 X RDF_2	43.07	82.33	129.27	172.33	185.30
PM_1 X RDF_3	42.27	77.37	120.95	153.13	145.30
PM_1 X RDF_4	37.20	73.47	117.30	161.90	157.47
PM_2 X RDF_1	46.40	92.87	151.47	201.43	215.40
PM_2 X RDF_2	45.50	87.43	138.33	185.43	189.53
PM_2 X RDF_3	44.83	80.37	134.33	164.40	181.40
PM_2 X RDF_4	42.27	76.37	121.37	165.52	164.27
BL_1 X RDF_1	43.47	90.30	145.30	187.37	203.13
BL_1 X RDF_2	42.63	83.30	137.37	174.57	88.50
BL_1 X RDF_3	42.03	78.20	125.40	168.43	171.70
BL_1 X RDF_4	35.77	74.57	120.43	165.33	157.57
BL_2 X RDF_1	46.53	94.62	156.50	205.20	220.33
BL_2 X RDF_2	46.60	89.69	141.40	188.33	192.47
BL_2 X RDF_3	45.30	81.40	135.56	175.37	184.50
BL_2 X RDF_4	39.37	76.27	135.33	181.30	195.40
NO X RDF_1	43.30	88.27	135.33	181.30	195.40
NO X RDF_2	47.40	81.40	122.73	173.70	181.47
NO X RDF_3	41.83	76.63	118.30	165.40	163.47
NO X RDF_4	37.63	22.47	115.30	151.36	152.30
SEm±	1.419	6.855	10.762	10.109	11.689
C D at 5 %	3.933	14.001	29.831	28.021	32.400

DAR = Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

stages except at 60 DAP/R. At 120 DAP/R, the highest plant height was registered in BL_2 X RDF_1 (102.55) and the dominancy of this treatment continued even at other advanced stages also. This was followed by PM_2 x RDF_1, BL_1 X RDF_1 and further, was found on par with PM_1 X RDF_1 in all advanced stages of growth. The data on the interaction between BL_2 X RDF_3 and BL_2 X RDF_4 showed higher plant height compared to RDF_1 alone at harvest. Similarly no significant difference between BL_2 X RDF_1 and PM_2 X RDF_1 was observed but both these treatments were superior over only RDF_1.

4.2.3.5 Single cane weight (kg)

Single cane weight of sugarcane averaged over two years as influenced by organic and inorganic fertilizers is presented in Tabes.36, 36a and 36b.

Plant cane exerted significantly higher single cane weight (1.11) due to application of BL_2 over rest of the organics. However, PM_2, BL_1 and PM_1 showed on par single cane weight. Significantly lower single cane weight was obtained in no organic treatment (0.93). In case of ratoon significantly higher single cane weight was accounted due to BL_2 and it was on par with PM_2, BL_1, PM_1 and NO showed on par results. Average of two

years data, indicated that BL_2 exhibited significantly higher single cane weight (1.13) over other organics but found on par with PM_2 (1.09) and BL_1 (1.06). However, application of lower dose of pressmud (PM_1) and no organic recorded significantly lower single cane weight and were on par with each other [Fig. 10].

The pooled analysis of both plant and ratoon crops and their individual crop indicated that significantly the highest single cane weight was prevailed due to RDF_1. Further reduction in the quantity of fertilizers application caused significant reduction in single cane weight and it was lowest with RDF_4. All the four grades of fertilizers showed significant difference.

The interaction effects due to organics and inorganics were significant. The highest single cane weight was observed due to BL_2 X RDF_1 (1.28) and the lowest one was with NO X RDF_4 (0.74). However this treatment gave on par single cane weight to that of PM_2 X RDF_1, PM_2 X RDF_1, PM_1 X RDF_1, BL_2 X RDF_2 and NO x RDF_1. Significantly lower single cane weight was recorded due to lower doses of chemical fertilizers in conjunction with organics and also only chemical fertilizers.

4.2.3.6 Number of millable (NMC) ('000/ha)

Number of millable cane ('000/ha) of sugarcane averaged over two years as influenced by organic and inorganic fertilizers

is presented in Tables.36, 36a and 36b.

Application different organics and their doses did not influence the number of millable canes for both plant and ratoon crops and also the pooled analysis. However, application of different levels of chemical fertilizer had significant effect on NMC. Pooled analysis indicated significantly the highest NMC (96.25) due to RDF_1. Significant reduction in the NMC was noticed owing to reduction in the quantity of fertilizer application and the lowest NMC was observed with RDF_4 [74.82].

The interaction effects were found significant. The maximum NMC were observed with BL_2 X RDF_1 which exerted significantly superior result over rest of the treatments except BL_1 X RDF_1, PM_2 X RDF_1, PM_1 X RDF_1, NO X RDF_1, BL_2 X RDF_2, PM_2 X RDF_2, PM_1 X RDF_2, BL_1 X RDF_2 and NO X RDF_2. The decreased level of application of fertilizers either in combination with organics or in isolation significantly reduced NMC. [Fig. 10].

4.2.3.7 Cane yield (t/ha)

Cane yield of sugarcane averaged over two years as influenced by organic and inorganic fertilizers is presented in Tables.36, 36a and 36b.

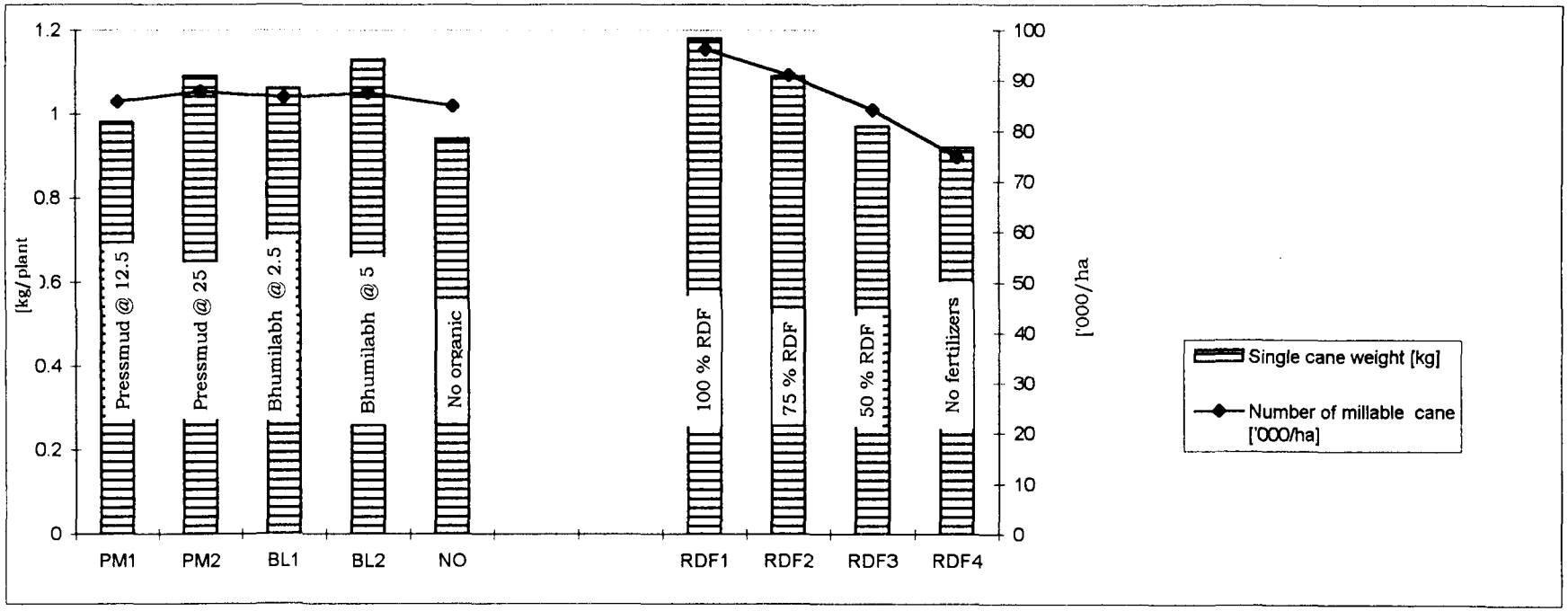

Fig. 10. Single cane weight [kg] and number of millable canes ['000/ha] in sugarcane as influenced by organic and inorganic fertilizers

Yield of plant cane was significantly higher (104.74) due to application of BL2 compared to other organics. Further significantly higher cane yield was obtained due to application of PM_2 [90.87] over rest of the treatments except BL_1. In case of ratoon also application of BL_2 recorded significantly higher cane yield [99.23] over rest of treatments and further application of PM_2 again significantly exihibited higher cane yield [91.16] over PM_1, BL_1 and also no organic treatments. The pooled analysis data revealed that application of BL_2 exerted significantly higher cane yield [101.99] over all the organic sources followed by application of PM_2 [91.02] which again was found significantly superior over PM_1, BL_1 and no organics. Application of PM_1 and BL_1 though increased cane yield numerically but failed to produce appreciable difference compared with no organic treatment Application of pressmud (PM_1) and *bhumilabh* (BL_1) behaved on par with no organics indicating that quantities applied were insufficient to exert significant influence on cane productivity. The perusal of the individual cane performance during 1st and 2nd year showed that application of BL_2 produced the highest cane yield of 104.74 and 99.23 t/ha respectively [Fig. 11].

The highest cane yield averaged over two years produced due to RDF_1. Reduction in the quantity of fertilizer application

brought out significant reduction in the cane productivity and was lowest with RDF_4. All the four levels of fertilizers had significant difference *per se*. Almost similar pattern in the cane productivity was observed for both plant and ratoon canes due to various levels of fertilizers. The highest being against with RDF_1 and the lowest being against RDF_4.

The interaction effects due to organics and inorganics were significant. The highest cane yield was observed due to BL_2 X RDF_1 (129.41) and the lowest one was with only BL_1 X RDF_4 (54.53) and the cane yield due to BL_2 X RDF_2 which was 111.83 t/ha but significantly lower compared to BL_2 X RDF_1. However, the former treatment had on par cane yield with that of PM_2 X RDF_1 and BL_1 X RDF_1 and also with NO X RDF_1 only (104.68).

4.2.3.7 C.C.S. yield (t/ha)

C.C.S yield of sugarcane averaged over two years as influenced by organic and inorganic fertilizers is presented in Tables.36, 36a and 36b.

C.C.S yield of plant cane was significantly higher (14.65) due to application of BL_2 compared to all other organics except PM_2 and further, it was observed that application of PM_2, BL_1 and PM_1 did not exert any significant difference in producing C.C.S

Table 36. Single cane weight,Number of millable canes, Cane and C.C.S yield of sugarcane as influenced by organic and inorganic fertilizers[Pooled]

Single cane weight[Kg]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	1.19	1.20	1.16	1.28	1.08	1.18
RDF_2	1.05	1.16	1.07	1.17	1.04	1.09
RDF_3	0.92	1.07	0.86	1.06	0.92	0.97
RDF_4	0.76	0.93	1.15	0.96	0.74	0.92
Mean	0.98	1.09	1.06	1.13	0.94	-

Number of millable canes['000/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	95.44	97.26	96.29	98.14	94.00	96.25
RDF_2	90.39	91.25	97.54	91.88	90.48	91.11
RDF_3	83.49	86.35	84.55	85.08	82.03	84.30
RDF_4	73.92	76.42	74.55	74.74	73.50	74.82
Mean	85.81	87.85	86.74	87.69	85.00	-

Cane yield[t/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	107.81	109.46	109.19	129.41	104.68	112.11
RDF_2	93.39	100.72	95.12	111.83	90.35	98.28
RDF_3	77.78	84.99	78.43	95.73	73.47	82.08
RDF_4	54.55	68.98	54.53	67.38	52.88	60.37
Mean	83.39	91.02	84.31	101.99	80.34	-

C.C.S yield [t/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	15.56	17.51	15.64	18.29	14.38	16.28
RDF_2	12.88	15.17	12.98	15.40	11.88	13.70
RDF_3	10.63	12.69	10.35	12.83	9.23	11.10
RDF_4	7.26	9.42	7.04	8.56	6.34	7.83
Mean	11.62	12.71	11.50	13.91	10.46	-

Source of variation	Single cane weight	Number of .millable canes	Cane yield	C.C.S yield
SEm+ for chemical fertiliser	0.032	1.575	1.769	0.213
CD at 5% for chemical fertiliser	0.089	4.365	4.905	0.690
SEm+ for Organic manures	0.036	1.760	1.978	0.249
CD at 5% for Organic manures	0.108	NS	5.934	0.746
SEm+ for interaction	0.072	3.521	3.956	0.514
CD at 5% for interaction	0.200	9.759	10.965	1.425

RDF_1=100%RDF
RDF_2= 75%RDF
RDF_3= 50%RDF
RDF_4= No fertiliser

PM_1 =Pressmud @12.5 t/ha
PM_2 =Pressmud @ 25.0 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha

BL_2=*Bhumilabh* @5 t/ha
NO=No organics

Table 36a. Single cane weight,Number of millable canes, Cane and C.C.S yield of plant cane as influenced by organic and inorganic fertilizers

Single cane weight[Kg]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	1.14	1.19	1.14	1.24	1.02	1.15
RDF_2	1.04	1.14	1.06	1.15	1.05	1.09
RDF_3	0.91	1.07	1.07	0.97	0.92	0.92
RDF_4	0.76	0.92	0.94	1.10	0.74	0.97
Mean	0.96	1.08	1.07	1.11	0.93	-

Number of millable canes['000/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	96.60	98.43	97.32	98.85	94.53	97.15
RDF_2	91.38	92.32	92.54	92.65	91.47	92.07
RDF_3	84.37	81.27	85.28	85.57	82.49	84.99
RDF_4	74.17	77.39	75.74	81.03	74.63	75.71
Mean	86.63	88.85	87.71	88.42	85.78	-

Cane yield[t/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	110.04	106.49	111.73	131.40	107.72	113.48
RDF_2	95.22	99.66	97.67	114.64	93.28	100.09
RDF_3	80.34	85.87	81.54	98.34	76.54	84.53
RDF_4	56.62	71.47	56.46	75.69	55.32	62.89
Mean	85.55	90.87	86.85	104.74	83.22	-

C.C.S yield [t/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	16.31	18.37	16.51	19.46	15.21	17.09
RDF_2	13.39	15.94	13.71	16.22	12.58	14.43
RDF_3	11.24	13.47	10.88	13.72	9.71	11.80
RDF_4	7.77	9.93	7.46	7.98	6.82	8.32
Mean	12.25	14.43	12.14	14.05	11.08	-

Source of variation	Single cane weight	Number of millable canes	Cane yield	C.C.S yield
SEm± for chemical fertiliser	0.047	2.463	2.081	0.337
CD at 5% for chemical fertiliser	0.130	6.827	5.768	0.934
SEm± for Organic manures	0.036	2.047	2.370	0.347
CD at 5% for Organic manures	0.113	NS	7.468	1.093
SEm± for interaction	0.104	5.510	4.450	0.621
CD at 5% for interaction	0.288	15.273	12.335	1.721

RDF_1=100%RDF
RDF_2= 75%RDF
RDF_3= 50%RDF
RDF_4= No fertilizer

PM_1 =Pressmud @12.5 t/ha
PM_2 =Pressmud @ 25.0 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha

BL_2=*Bhumilabh* @5 t/ha
NO=No organics

Table 36b. Single cane weight,Number of millable canes, Cane and C.C.S yield of ratoon cane as influenced by organic and inorganic fertilizers

Single cane weight (Kg)

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	1.24	1.22	1.17	1.42	1.13	1.22
RDF_2	1.26	1.18	1.07	1.19	1.02	1.10
RDF_3	0.95	1.07	0.98	1.15	0.91	1.01
RDF_4	0.76	0.94	0.96	1.10	0.74	0.87
Mean	0.99	1.10	1.05	1.18	0.95	-

Number of millable canes['000/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	94.27	96.29	95.28	97.43	93.48	95.35
RDF_2	89.40	90.19	97.53	91.12	89.49	90.15
RDF_3	82.61	85.43	83.82	84.30	81.57	83.61
RDF_4	73.66	75.45	73.37	76.64	72.37	73.92
Mean	84.98	86.83	85.75	86.97	84.23	-

Cane yield[t/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	105.58	117.42	106.62	127.43	101.62	110.74
RDF_2	91.57	101.78	92.57	109.02	87.48	96.47
RDF_3	75.22	84.11	75.31	93.11	70.39	79.63
RDF_4	52.48	66.31	53.60	74.59	50.43	57.84
Mean	85.21	91.16	81.78	99.23	77.47	-

C.C.S yield [t/ha]

Treatment	Organic manures					Mean
	PM_1	PM_2	BL_1	BL_2	NO	
Chemical fertilisers						
RDF_1	14.79	16.65	14.77	17.54	13.54	15.46
RDF_2	12.37	14.47	12.25	14.58	11.17	12.97
RDF_3	10.01	11.90	9.82	11.94	8.74	10.48
RDF_4	6.74	8.90	6.61	9.63	5.86	7.33
Mean	10.98	12.98	10.86	13.16	9.83	-

Source of variation	Single cane weight.	Number of .millable canes	Cane yield	C.C.S yield
SEm± for chemical fertiliser	0.048	2.156	1.571	0.218
CD at 5% for chemical fertiliser	0.133	5.976	4.355	0.604
SEm± for Organic manures	0.055	1.954	1.865	0.257
CD at 5% for Organic manures	0.173	NS	5.876	0.809
SEm± for interaction	0.107	4.823	3.514	0.521
CD at 5% for interaction	0.296	13.369	9.400	1.444

RDF_1=100%RDF
RDF_2= 75%RDF
RDF_3= 50%RDF
RDF_4= No fertiliser

PM_1 =Pressmud @12.5 t/ha
PM_2 =Pressmud @ 25.0 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha

BL_2=*Bhumilabh* @5 t/ha
NO=No organics

yield and the significantly lower C.C.S yield was recorded in control (no organics) (11.08). On the contrary C.C.S yield of ratoon cane was significantly higher with BL_2 (13.16) and was on par with PM_2 (12.98). However BL_1 and PM_1 showed on par results and were significantly superior over no organics. The pooled data, accounted significantly higher C.C.S yield with BL_2 compared to all other treatments. But PM_2 also exerted significantly higher C.C.S yield compared to PM_1, BL_1 and NO.

Averaged over two years, C.C.S yield was found significantly higher due to RDF_1 (16.28). Reduced levels of chemical fertilizers significantly declined the C.C.S yield recording lowest with RDF_4 (7.83). It was observed that all the four levels of chemical fertilizers showed significant influence on productivity of C.C.S yield. [Fig. 11].

The interaction effects owing to organics and inorganic fertilizers were significant. The highest C.C.S yield was recorded with the treatment BL_2 X RDF_1 (18.29) followed by PM_2 X RDF_1 and were on par with each other. The treatment combinations viz., BL_1 X RDF_1, PM_1 X RDF_1, PM_2 X RDF_2, BL_2 X RDF_2 and NO X RDF_1 recorded on par C.C.S yield. In general organics in conjunction

LEGEND

PM_1 X RDF_1	= Pressmud @ 12.5 t/ha + 100 % RDF
PM_1 X RDF_2	= Pressmud @ 12.5 t/ha + 75 % RDF
PM_1 X RDF_3	= Pressmud @ 12.5 t/ha + 50 % RDF
PM_1 X RDF_4	= Pressmud @ 12.5 t/ha + No fertilizer
PM_2 X RDF_1	= Pressmud @ 25 t/ha + 100 % RDF
PM_2 X RDF_2	= Pressmud @ 25 t/ha + 75 % RDF
PM_2 X RDF_3	= Pressmud @ 25 t/ha + 50 % RDF
PM_2 X RDF_4	= Pressmud @ 25 t/ha + No fertilizer
BL_1 X RDF_1	= *Bhumilabh* @ 2.5 t/ha + 100 % RDF
BL_1 X RDF_2	= *Bhumilabh* @ 2.5 t/ha + 75 % RDF
BL_1 X RDF_3	= *Bhumilabh* @ 2.5 t/ha + 50 % RDF
BL_1 X RDF_4	= *Bhumilabh* @ 2.5 t/ha + No fertilizer
BL_2 X RDF_1	= *Bhumilabh* @ 5 t/ha + 100 % RDF
BL_2 X RDF_2	= *Bhumilabh* @ 5 t/ha + 75 % RDF
BL_2 X RDF_3	= *Bhumilabh* @ 5 t/ha + 50 % RDF
BL_2 X RDF_4	= *Bhumilabh* @ 5 t/ha + No fertilizer
NO X RDF_1	= No organics + 100 % RDF
NO X RDF_2	= No organics + 75 % RDF
NO X RDF_3	= No organics + 50 % RDF
NO X RDF_4	= No organics + No fertilizer

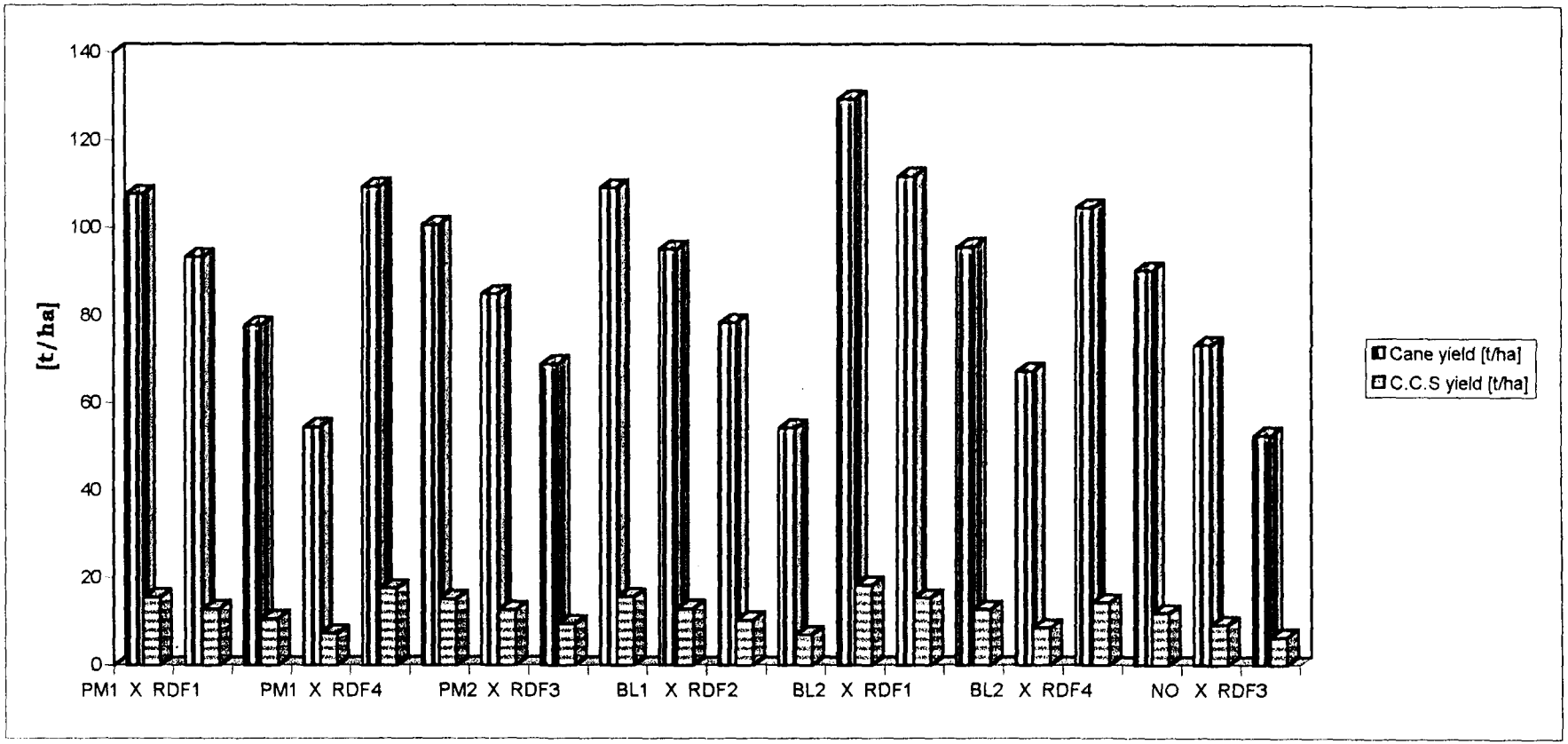

Fig. 11. Sugar cane and sugar yield [t/ha] as influenced by organic and inorganic fertilizers

conjunction with chemical fertilizers exhibited higher C.C.S yield compared to sole application of chemical fertilizers.

4.2.4 QUALITY PARAMETERS

4.2.4.1 Brix (%)

The brix percentage in the juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.37, 37a and 37b.

The brix percentage averaged over plant and ratoon as influenced by organic and inorganic fertilizers showed significant results. However, application of various organics failed to produce significant influence on brix values of cane juice even in both plant and ratoon crops. The varied doses of inorganic fertilizers significantly influenced the brix values. Application of RDF_1, registered significantly higher brix (20.56) over RDF_3 and RDF_4. However, RDF_2 (20.39) was on par with RDF_1. In case of plant and ratoon crops brix percentage was significantly higher in RDF_1 (21.01 and 20.11, respectively) over RDF_4. However RDF_2 and RDF_3 recorded on par brix value with that of RDF_1.

The interaction effects were found significant. Application of PM_2 X RDF1 exerted significantly high brix percentage (21.80)

over other treatments except PM_2 X RDF_2 (21.06), BL_1 X RDF_1 (20.86), PM_2 X RDF_3 (20.70), PM_1 X RDF_1 (20.77), BL_2 X RDF_2 (20.40), PM_1 X RDF_2 (20.38), BL_1 X RDF_2 (20.23).

4.2.4.2 Pol (%)

The pol per cent in the juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.37, 37a and 37b.

The pol per cent in juice averaged over two years as influenced by organic and inorganic fertilizers differed significantly. Although application of PM_2 exhibited highest pol per cent (19.14) in juice compared to other treatments but statistically it was on par with application of PM_1, BL_1 and BL_2 but it did produce significantly higher pol per cent over no organic treatment (17.24). Among inorganic fertilizers, application of RDF_1 [18.96] increased pol per cent significantly over RDF_3 (17.84) and RDF_4 (17.29) however RDF_2 (18.51) was on par with RDF_1. Similarly RDF_3 and RDF_4 showed on par pol values.

The interaction effects were significant due to application of organic and inorganic fertilizers. Application of PM_2 X RDF_1 (20.16) exhibited significantly higher pol per cent compared to

other treatments but it showed on par results with PM_2 X RDF_2 (19.41) and PM_1 X RDF_1 (19.22). Further application of BL_2 X RDF_1, BL_1 X RDF_1 and PM_2 X RDF_3 recorded significantly higher pol per cent compared to sole application of fertilizers.

4.2.4.3 C.C.S. (%)

The C.C.S. per cent in the juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables.37, 37a and 37b.

The C.C.S per cent in juice averaged over two years as influenced by organic and inorganic fertilizers differed significantly. Application of PM_2 increased the C.C.S per cent significantly (14.42) over other treatments except PM_1 (13.83). Further application of BL_1 and BL_2 also recorded significantly higher C.C.S percentage over without organic treatment (12.85). However in case of ratoon crop there was no significant difference between BL_1, BL_2 and no organic treatments.

Among inorganic fertilizers grades, application of RDF_1 exerted significantly higher C.C.S per cent (14.37) over rest of the levels of chemical fertilizers. It was also observed that RDF_2 (13.77) and RDF_3 (13.63) registered equivalent C.C.S percent and both these levels enhancedC.C.S per cent significantly over RDF_4

(13.17).

The interaction effects were found significant due to organic and inorganic fertilizers on C.C.S percentage. Application of PM_2 X RDF_1 (15.29), PM_2 X RDF_2 (14.61) and PM_1 X RDF_1 (14.10) exhibited significantly higher C.C.S per cent over rest of the treatments and combination of BL_1 X RDF_1 (14.31), BL_2 XRDF_1 (14.13) and PM_2 X RDF_3 (14.09) had significantly higher C.C.S per cent over sole application of all the levels of chemical fertilizers.

4.2.4.4 Purity (%)

The purity per cent in the juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables. 37, 37a and 37b.

The purity per cent in juice averaged over two years as influenced by organic and inorganic fertilizers differed significantly only due to organic fertilizers. Among organic fertilizers application of PM_2 exerted significantly the highest (92.05) juice purity compared to without organic fertilizer treatment. However the same treatment exhibited on par results with the application of all other sources of organic fertilizers. The different levels of chemical fertilizers did not influence on the

Table 37. Brix, pol, C.C.S and purity in cane as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Brix [%]	Pol [%]	C.C.S [%]	Purity [%]
A.Organic manures				
PM_1	20.25	18.44	13.83	90.82
PM_2	20.81	19.14	14.81	92.05
BL_1	20.06	17.86	13.84	90.08
BL_2	20.00	18.07	13.88	90.00
NO	19.29	17.24	13.16	89.06
SEm±	0.299	0.272	0.321	1.074
C D at 5%	NS	0.815	0.962	NS
B.Chemical fertilizers				
RDF_1	20.56	18.96	14.79	91.97
RDF_2	20.39	18.51	14.20	90.66
RDF_3	19.93	17.84	13.71	89.63
RDF_4	19.44	17.29	13.72	89.39
SEm±	0.268	0.243	0.215	0.960
C D at 5%	0.743	0.674	0.596	2.660
Interaction [AXB]				
PM_1 X RDF_1	20.77	19.22	14.82	92.67
PM_1 X RDF_2	20.38	19.66	14.38	90.32
PM_1 X RDF_3	20.12	18.21	14.00	90.49
PM_1 X RDF_4	19.74	17.66	13.72	89.81
PM_2 X RDF_1	21.80	20.16	15.77	93.50
PM_2 X RDF_2	21.06	19.41	14.99	92.80
PM_2 X RDF_3	20.70	19.12	14.57	91.49
PM_2 X RDF_4	19.67	17.87	13.89	90.68
BL_1 X RDF_1	20.86	19.08	14.77	91.33
BL_1 X RDF_2	20.23	18.19	14.03	90.82
BL_1 X RDF_3	19.62	16.73	13.20	88.34
BL_1 X RDF_4	19.53	17.42	13.24	89.82
BL_2 X RDF_1	19.83	18.84	14.50	91.50
BL_2 X RDF_2	20.40	18.36	14.14	90.49
BL_2 X RDF_3	19.81	17.86	13.96	89.53
BL_2 X RDF_4	19.97	17.23	12.93	88.49
NO X RDF_1	19.55	17.51	14.11	90.89
NO X RDF_2	19.91	17.92	13.48	88.66
NO X RDF_3	19.41	17.27	12.72	88.32
NO X RDF_4	18.32	16.26	12.32	88.47
SEm±	0.599	0.544	0.521	2.147
C D at 5 %	1.660	0.954	1.444	NS

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 37a. Brix, pol, C.C.S and purity in plant cane as influenced by organic and inorganic fertilizers

Treatment	Brix [%]	Pol [%]	C.C.S [%]	Purity [%]
A.Organic manures				
PM_1	20.96	18.97	13.83	92.25
PM_2	21.41	19.72	14.81	91.67
BL_1	20.69	18.78	13.49	89.66
BL_2	20.68	18.59	13.51	90.51
NO	19.90	17.74	12.85	88.74
SEm±	0.442	0.429	0.195	1.960
C D at 5%	NS	1.352	0.614	NS
B.Chemical fertilizers				
RDF_1	21.01	19.41	14.37	91.47
RDF_2	21.18	19.08	13.77	90.26
RDF_3	22.74	18.57	13.62	89.21
RDF_4	20.01	17.65	13.17	89.21
SEm±	0.390	0.366	0.178	1.277
C D at 5%	1.081	1.015	0.493	3.539
Interaction [AXB]				
PM_1 X RDF_1	21.54	19.76	14.41	92.35
PM_1 X RDF_2	21.64	19.17	14.00	89.65
PM_1 X RDF_3	20.72	18.50	13.66	89.92
PM_1 X RDF_4	20.54	18.23	13.25	89.72
PM_2 X RDF_1	22.64	18.27	15.29	93.01
PM_2 X RDF_2	21.72	19.80	14.61	92.00
PM_2 X RDF_3	21.68	20.10	14.09	92.39
PM_2 X RDF_4	19.67	17.85	13.66	91.60
BL_1 X RDF_1	21.63	19.69	14.31	92.66
BL_1 X RDF_2	21.03	18.71	13.65	92.65
BL_1 X RDF_3	20.15	17.80	13.14	87.68
BL_1 X RDF_4	19.95	17.65	12.90	89.65
BL_2 X RDF_1	19.70	19.33	14.13	91.01
BL_2 X RDF_2	21.19	18.28	13.76	90.00
BL_2 X RDF_3	20.94	18.61	13.40	89.05
BL_2 X RDF_4	22.91	17.03	12.82	88.00
NO X RDF_1	19.56	17.24	13.72	89.98
NO X RDF_2	20.88	18.88	13.13	88.00
NO X RDF_3	20.20	17.92	12.58	87.33
NO X RDF_4	18.75	16.95	11.98	88.68
SEm±	0.870	0.820	0.328	2.855
C D at 5 %	2.412	2.273	0.909	NS

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 37b. Brix, Pol, C.C.S and purity in ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Brix [%]	Pol [%]	C.C.S [%]	Purity [%]
A.Organic manures				
PM_1	19.54	17.02	13.43	91.49
PM_2	20.20	18.58	14.02	92.48
BL_1	19.43	17.32	13.16	90.49
BL_2	19.32	17.56	13.17	90.49
NO	18.69	16.74	12.54	86.39
SEm±	0.328	0.285	0.215	1.902
C D at 5%	NS	0.878	0.677	NS
B.Chemical fertilizers				
RDF_1	20.11	18.52	13.95	92.52
RDF_2	19.52	17.94	13.33	91.06
RDF_3	19.12	17.11	13.03	90.26
RDF_4	18.22	16.92	12.62	89.58
SEm±	0.366	0.315	0.207	1.156
C D at 5%	1.015	0.873	0.574	3.187
Interaction [AXB]				
PM_1 X RDF_1	20.00	18.57	14.00	92.99
PM_1 X RDF_2	19.03	18.15	13.61	90.99
PM_1 X RDF_3	19.51	17.75	13.32	90.99
PM_1 X RDF_4	18.93	17.04	12.78	90.01
PM_2 X RDF_1	21.00	19.31	14.81	90.01
PM_2 X RDF_2	20.30	18.97	14.23	93.02
PM_2 X RDF_3	19.78	18.15	13.61	91.99
PM_2 X RDF_4	19.66	17.89	13.42	90.66
BL_1 X RDF_1	20.08	18.47	13.85	91.99
BL_1 X RDF_2	19.44	17.68	13.26	92.98
BL_1 X RDF_3	19.09	15.95	12.97	86.80
BL_1 X RDF_4	19.10	17.19	12.56	89.93
BL_2 X RDF_1	19.95	18.35	13.76	91.49
BL_2 X RDF_2	19.60	17.84	13.38	90.99
BL_2 X RDF_3	18.69	19.11	12.83	89.99
BL_2 X RDF_4	19.03	16.93	12.70	88.98
NO X RDF_1	19.53	17.71	13.33	91.65
NO X RDF_2	18.93	17.04	12.78	88.33
NO X RDF_3	18.61	16.57	12.43	89.34
NO X RDF_4	17.69	15.57	11.63	88.27
SEm±	0.818	0.705	0.422	2.581
C D at 5 %	2.267	1.954	1.169	NS

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

juice purity per cent. Similarly the interaction effects of organic and inorganic fertilizers on juice purity showed nonsignificant result.

4.2.4.5 Reducing sugars (%)

The reducing sugars per cent in juice of sugarcane as influenced by organic and inorganic fertilizers is presented in Tables. 38, 38a and 38b.

The reducing sugars in juice averaged over two years as influenced by organic and inorganic fertilizers differed significantly only due to application of different levels of chemical fertilizers. All the organic sources of fertilizers failed to exhibit significant results on reducing sugars percentage in cane juice. However varied levels of inorganic fertilizers showed significant results on reducing sugars of cane juice. Significantly lower levels of reducing sugars (0.642) was found with RDF_1 compared to RDF_4 (0.698). Application of RDF_2 and RDF_4 had no bearing in influencing reducing sugars in the cane juice.

The interaction effects were found significant. However, in case of ratoon reducing sugars did not differ due to interaction effect. Significantly lower reducing sugars were observed due to application of PM_2 X RDF_1 (0.587), PM_1 X RDF_1 (0.601), PM_1 X

RDF_2 (0.627) and PM_2 X RDF_3 (0.631) and PM_2 X RDF_2 (0.639) over rest of the treatments.

4.2.4.6 Fibre (%)

The fibre per cent in sugarcane as influenced by organic and inorganic fertilizers is presented in Tables. 38, 38a and 38b.

The fibre per cent in cane averaged over two years as influenced by organic and inorganic fertilizers did not show significant results. The application of various organics and different grades of inorganic fertilizer failed exert any significant influence on fibre per cent. Similarly the interaction effects were also had non-significant influence on fibre content.

4.2.4.7 Moisture (%)

The moisture per cent in sugarcane as influenced by organic and inorganic fertilizers is presented in Tables. 38, 38a and 38b.

The moisture per cent in sugarcane averaged over plant and ratoon crops as influenced by organic and inorganic fertilizers exhibited non-significant result. The use of various organic manures and also the levels of inorganic fertilizers had no significant bearing in influencing the moisture content of

Table 38. Reducing sugars in cane juice, fibre and moisture in cane as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Reducing sugars [%]	Fibre [%]	Moisture [%]
A.Organic manures			
PM_1	0.633	13.92	70.45
PM_2	0.633	13.84	70.15
BL_1	0.682	13.98	70.63
BL_2	0.681	13.90	70.51
NO	0.704	13.85	70.42
SEm±	0.012	0.188	0.813
C D at 5%	NS	NS	NS
B.Chemical fertilizers			
RDF_1	0.642	13.97	70.18
RDF_2	0.661	13.98	71.14
RDF_3	0.668	13.88	70.12
RDF_4	0.698	13.77	70.05
SEm±	0.017	0.169	0.727
C D at 5%	0.047	NS	NS
Interaction [AXB]			
PM_1 X RDF_1	0.601	13.82	70.37
PM_1 X RDF_2	0.627	14.15	70.63
PM_1 X RDF_3	0.639	13.88	69.95
PM_1 X RDF_4	0.664	13.82	70.87
PM_2 X RDF_1	0.482	14.02	69.28
PM_2 X RDF_2	0.639	14.00	71.62
PM_2 X RDF_3	0.631	13.88	69.73
PM_2 X RDF_4	0.674	13.47	69.97
BL_1 X RDF_1	0.692	14.23	70.12
BL_1 X RDF_2	0.663	13.93	71.22
BL_1 X RDF_3	0.661	13.92	71.90
BL_1 X RDF_4	0.731	13.85	69.30
BL_2 X RDF_1	0.679	13.90	70.32
BL_2 X RDF_2	0.673	13.93	71.60
BL_2 X RDF_3	0.678	13.85	68.90
BL_2 X RDF_4	0.672	13.92	69.82
NO X RDF_1	0.650	13.98	70.80
NO X RDF_2	0.701	13.97	70.42
NO X RDF_3	0.713	13.85	70.12
NO X RDF_4	0.351	13.80	70.28
SEm±	0.032	0.377	1.625
C D at 5 %	0.103	NS	NS

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 38b. Reducing sugars in ratoon cane juice, fibre and moisture in ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Reducing sugars [%]	Fibre [%]	Moisture [%]
A.Organic manures			
PM_1	0.714	13.97	70.45
PM_2	0.743	13.81	70.15
BL_1	0.791	14.14	70.63
BL_2	0.789	14.94	70.21
NO	0.783	13.93	70.42
SEm±	0.028	0.181	0.813
C D at 5%	NS	NS	NS
B.Chemical fertilizers			
RDF_1	0.757	14.12	70.18
RDF_2	0.057	14.00	71.14
RDF_3	0.068	13.94	70.12
RDF_4	0.782	13.78	70.05
SEm±	0.026	0.244	0.727
C D at 5%	0.072	NS	NS
Interaction [AXB]			
PM_1 X RDF_1	0.892	13.90	70.37
PM_1 X RDF_2	0.735	14.07	70.60
PM_1 X RDF_3	0.704	13.97	69.95
PM_1 X RDF_4	0.725	13.97	70.87
PM_2 X RDF_1	0.707	14.03	69.28
PM_2 X RDF_2	0.777	14.07	71.62
PM_2 X RDF_3	0.747	13.90	69.73
PM_2 X RDF_4	0.742	13.23	69.97
BL_1 X RDF_1	0.812	14.66	72.00
BL_1 X RDF_2	0.739	14.00	71.22
BL_1 X RDF_3	0.789	14.00	71.90
BL_1 X RDF_4	0.875	13.90	69.30
BL_2 X RDF_1	0.794	14.00	70.32
BL_2 X RDF_2	0.754	14.97	71.80
BL_2 X RDF_3	0.828	13.87	68.90
BL_2 X RDF_4	0.781	13.93	69.82
NO X RDF_1	0.745	14.00	70.80
NO X RDF_2	0.779	13.90	70.48
NO X RDF_3	0.773	13.96	70.12
NO X RDF_4	0.835	13.87	70.28
SEm±	0.059	0.544	1.625
C D at 5 %	NS	NS	NS

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 38a. Reducing sugars in plant cane juice, fibre and moisture in plant cane as influenced by organic and inorganic fertilizers

Treatment	Reducing sugars [%]	Fibre [%]	Moisture [%]
A.Organic manures			
PM_1	0.552	13.86	70.48
PM_2	0.532	13.88	70.38
BL_1	0.582	13.83	71.28
BL_2	0.572	13.86	70.28
NO	0.624	13.77	70.96
SEm±	0.024	0.310	1.083
C D at 5%	NS	NS	NS
B.Chemical fertilizers			
RDF_1	0.534	13.82	70.57
RDF_2	0.564	13.95	71.33
RDF_3	0.569	13.81	70.44
RDF_4	0.615	13.76	70.56
SEm±	0.020	0.224	0.996
C D at 5%	0.552	NS	NS
Interaction [AXB]			
PM_1 X RDF_1	0.511	13.73	70.40
PM_1 X RDF_2	0.518	14.23	70.03
PM_1 X RDF_3	0.574	13.80	70.27
PM_1 X RDF_4	0.604	13.67	71.23
PM_2 X RDF_1	0.468	14.00	70.33
PM_2 X RDF_2	0.502	13.93	71.70
PM_2 X RDF_3	0.515	13.87	69.56
PM_2 X RDF_4	0.606	13.70	69.93
BL_1 X RDF_1	0.571	13.80	70.33
BL_1 X RDF_2	0.587	13.87	72.38
BL_1 X RDF_3	0.533	13.83	71.20
BL_1 X RDF_4	0.635	13.80	71.20
BL_2 X RDF_1	0.564	13.80	70.33
BL_2 X RDF_2	0.562	13.90	70.33
BL_2 X RDF_3	0.568	13.83	70.53
BL_2 X RDF_4	0.563	13.90	69.46
NO X RDF_1	0.556	13.77	71.43
NO X RDF_2	0.622	13.8.3	70.80
NO X RDF_3	0.653	13.73	70.63
NO X RDF_4	0.666	13.73	70.98
SEm±	0.045	0.501	0.238
C D at 5 %	0.125	NS	NS

Organics
PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics
RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

sugarcane. The interaction effects also followed similar trend in exerting influence on moisture content of sugarcane.

4.2.5 ECONOMICS

4.2.5.1 Gross income (Rs'000/ha)

Gross income of sugarcane (Rs. '000/ha) averaged over two years as influenced by organic and inorganic fertilizers is presented in Tables 39, 39a and 39b.

The mean gross income for plant and ratoon cane was 82.33 and 78.98 respectively. The gross income was significantly higher (91.79) due to application of *bhmilabh* @ 5 t/ha compared to other organics and the next higher gross income was obtained due to application of PM_2 (84.91) and it was also found significantly higher than BL_1, PM_1 and NO. However gross income was on par with BL_1 and PM_1 but both these treatments exhibited significantly higher gross income over without organic treatment.

Gross income excited significantly due to application of RDF_1 (101.81) over other reduced levels of chemical fertilizers and the lowest gross income was registered with RDF_4 (54.34). All the chemical levels gave significant results. The reduction in

levels of chemical fertilizers resulted significant decrease in the gross income.

Pooled analysis of the data indicated that application of organic and inorganic fertilizers produced significant results. Application BL_2 X RDF_1 registered significantly higher gross income (116.46) over other treatment combinations and application of PM_2 X RDF_1 also recorded significantly higher gross income over other treatments, except BL_2 X RDF_2. However, PM_1 X RDF_1, PM_2 X RDF_2, BL_1 X RDF_1 and NO X RDF_1 produced on par results with respect to gross income.

4.2.5.2 Net returns (Rs '000/ha)

The net returns (Rs '000/ha) of sugarcane averaged over two years as influenced by organic and inorganic fertilizers is presented in Tables. 39, 39a and 39b.

The net returns were the highest due to application of BL_2 (67.61) and PM_2 (58.91) which exhibited significantly higher net returns over PM_1, BL_1 and NO and latter three organic treatments showed on par results (Fig.12).

Among chemical fertilizers RDF_1 exerted significantly higher net returns (76.71) over other levels of chemical fertilizers

LEGEND

PM_1 X RDF_1	= Pressmud @ 12.5 t/ha + 100 % RDF
PM_1 X RDF_2	= Pressmud @ 12.5 t/ha + 75 % RDF
PM_1 X RDF_3	= Pressmud @ 12.5 t/ha + 50 % RDF
PM_1 X RDF_4	= Pressmud @ 12.5 t/ha + No fertilizer
PM_2 X RDF_1	= Pressmud @ 25 t/ha + 100 % RDF
PM_2 X RDF_2	= Pressmud @ 25 t/ha + 75 % RDF
PM_2 X RDF_3	= Pressmud @ 25 t/ha + 50 % RDF
PM_2 X RDF_4	= Pressmud @ 25 t/ha + No fertilizer
BL_1 X RDF_1	= *Bhumilabh* @ 2.5 t/ha + 100 % RDF
BL_1 X RDF_2	= *Bhumilabh* @ 2.5 t/ha + 75 % RDF
BL_1 X RDF_3	= *Bhumilabh* @ 2.5 t/ha + 50 % RDF
BL_1 X RDF_4	= *Bhumilabh* @ 2.5 t/ha + No fertilizer
BL_2 X RDF_1	= *Bhumilabh* @ 5 t/ha + 100 % RDF
BL_2 X RDF_2	= *Bhumilabh* @ 5 t/ha + 75 % RDF
BL_2 X RDF_3	= *Bhumilabh* @ 5 t/ha + 50 % RDF
BL_2 X RDF_4	= *Bhumilabh* @ 5 t/ha + No fertilizer
NO X RDF_1	= No organics + 100 % RDF
NO X RDF_2	= No organics + 75 % RDF
NO X RDF_3	= No organics + 50 % RDF
NO X RDF_4	= No organics + No fertilizer

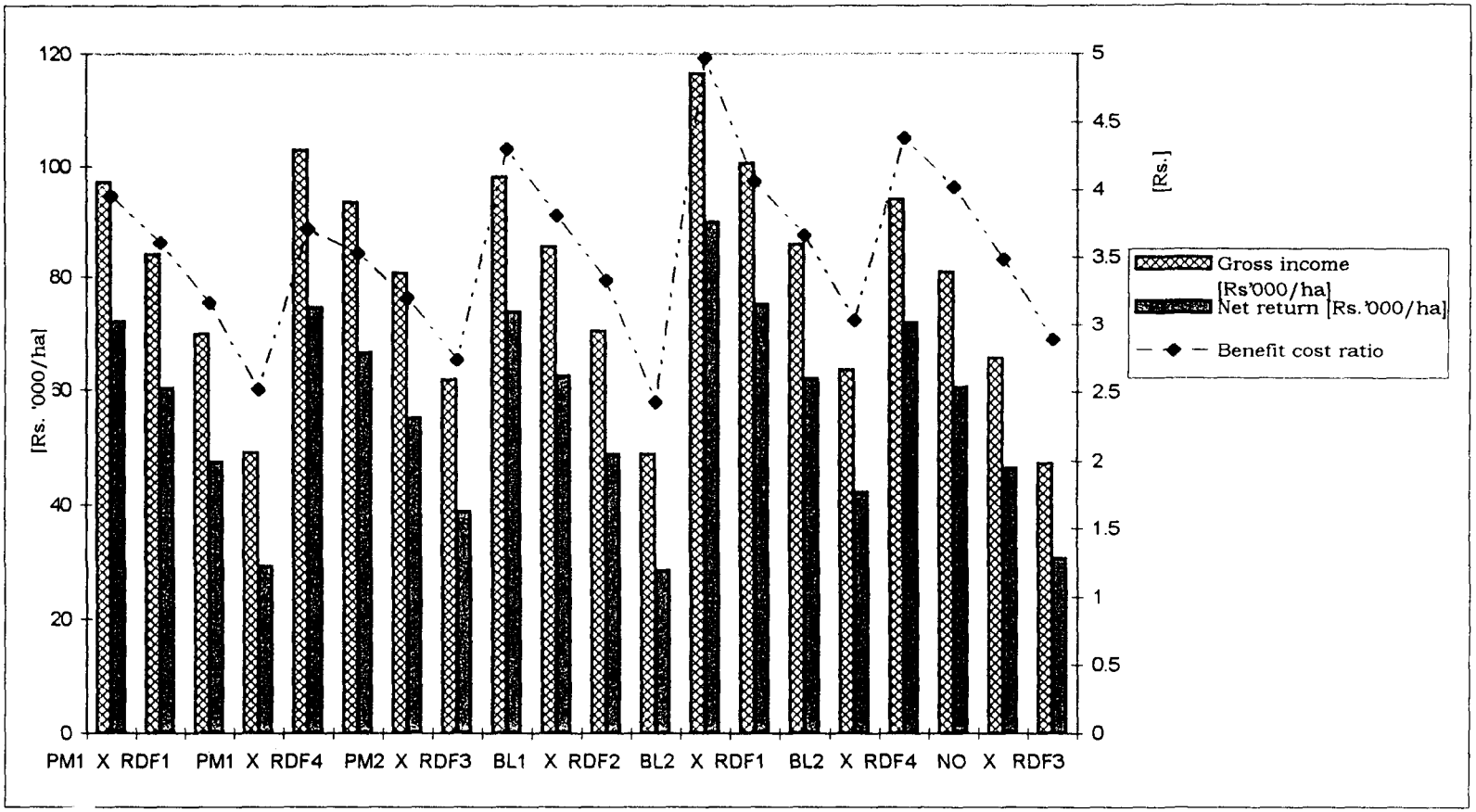

Fig. 12. Gross income, net income [Rs. '000/ha] and B:C ratio of sugar cane as influenced by organic and inorganic fertilizers.

and the lowest net returns were recorded with RDF_4 (34.01). All the chemical fertilizer doses showed significant result.

Interaction effects were found significant due to organics and inorganic fertilizers. Significantly the highest net returns were registered with BL_2 X RDF_1 (90.09) over other treatment combinations. The treatment combinations viz., BL_2 X RDF_3, BL_1 X RDF_1, PM_2 X RDF_1 and NO X RDF_1 exhibited on par net returns and were significantly superior over other combinations.

4.2.5.3 Benefit Cost ratio (B: C ratio)

The Benefit: Cost ratio of sugarcane averaged over two years as influenced by organic and inorganic fertilizers is presented in Tables. 39, 39a and 39b.

Significantly highest B:C ratio of 3.80 was registered due to application of BL_2 over other organic sources. However, significantly higher B:C ratio (3.69) was observed in without organics over lower doses of organics viz., PM_1, PM_2 and BL_1. In general higher B:C ratio was observed in ratoon compared to plant cane. In case of ratoon crop significantly higher B:C ratio (4.19) was exhibited due to application of BL_2 over other organics except no organics and further significantly inferior B: C ratio was obtained with application PM_1, PM_2 and BL_1 (Fig. 12).

Table 39. Economics in sugarcane as influenced by organic and inorganic fertilizers [Pooled

Treatment	Gross income [Rs'000/ha]	Net return [Rs.'000/ha]	Rs. '000/ha increase[+] or decrease[-] over control	Benefit cost ratio
A.Organic manures				
PM_1	75.09	52.33	-0.27	3.29
PM_2	84.91	58.91	6.31	3.29
BL_1	75.92	53.67	1.07	3.42
BL_2	91.79	67.61	15.01	3.80
NO	72.29	52.60	-	3.69
SEm±	0.479	0.438	-	0.031
C D at 5%	1.436	1.313	-	0.093
B.Chemical fertilizers				
RDF_1	101.81	76.71	-	4.12
RDF_2	89.06	65.21	-11.50	3.79
RDF_3	74.79	52.19	-24.52	3.36
RDF_4	54.34	34.01	-42.70	2.72
SEm±	0.546	0.546	-	0.049
C D at 5%	1.513	1.513	-	0.136
Interaction [AXB]				
PM_1 X RDF_1	97.12	72.12		3.94
PM_1 X RDF_2	84.04	60.28		3.59
PM_1 X RDF_3	70.01	47.51		3.15
PM_1 X RDF_4	49.22	29.32		2.51
PM_2 X RDF_1	103.01	74.89		3.70
PM_2 X RDF_2	93.65	66.78		3.52
PM_2 X RDF_3	80.99	55.36		3.19
PM_2 X RDF_4	61.99	38.94		2.73
BL_1 X RDF_1	98.24	74.13		4.30
BL_1 X RDF_2	85.60	62.73		3.80
BL_1 X RDF_3	70.72	49.09		3.32
BL_1 X RDF_4	49.08	28.70		2.42
BL_2 X RDF_1	116.46	90.09		4.97
BL_2 X RDF_2	100.69	75.57		4.06
BL_2 X RDF_3	86.17	62.29		3.66
BL_2 X RDF_4	63.83	42.46		3.03
NO X RDF_1	94.21	72.33		4.38
NO X RDF_2	81.32	60.69		4.02
NO X RDF_3	66.05	46.67		3.48
NO X RDF_4	47.59	30.71		2.89
SEm±	1.220	1.219		0.069
C D at 5 %	3.381	3.379		0.191

DAP/R = Days after planting or Days after ratoon initiation

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 39a. Economics in plant cane as influenced by organic and inorganic fertilizers

Treatment	Gross income [Rs.'000/ha]	Net return(Rs) [Rs. '000/ha]	Benefit cost ratio
A.Organic manures			
PM_1	77.05	51.19	2.94
PM_2	87.03	57.97	2.97
BL_1	78.16	53.09	3.06
BL_2	94.86	66.94	3.42
NO	74.86	52.05	3.24
SEm±	0.659	0.659	0.027
C D at 5%	2.076	2.076	0.085
B.Chemical fertilizers			
RDF_1	103.97	75.74	3.69
RDF_2	91.21	64.31	3.39
RDF_3	77.24	51.52	3.00
RDF_4	56.58	33.35	2.43
SEm±	1.021	1.021	0.039
C D at 5%	2.830	2.830	0.108
Interaction [AXB]			
PM_1 X RDF_1	99.22	71.09	3.53
PM_1 X RDF_2	85.69	58.82	3.19
PM_1 X RDF_3	72.31	46.68	3.82
PM_1 X RDF_4	50.96	27.83	3.20
PM_2 X RDF_1	104.84	73.59	3.36
PM_2 X RDF_2	95.69	65.69	3.19
PM_2 X RDF_3	83.27	54.52	2.89
PM_2 X RDF_4	64.32	38.07	2.45
BL_1 X RDF_1	100.56	73.31	3.69
BL_1 X RDF_2	87.91	61.91	3.38
BL_1 X RDF_3	73.36	48.61	2.56
BL_1 X RDF_4	50.81	28.56	2.28
BL_2 X RDF_1	118.26	88.76	4.01
BL_2 X RDF_2	103.17	74.92	3.65
BL_2 X RDF_3	88.17	61.54	3.28
BL_2 X RDF_4	67.02	42.25	2.73
NO X RDF_1	96.95	71.95	2.88
NO X RDF_2	83.95	60.20	3.54
NO X RDF_3	68.34	46.24	3.05
NO X RDF_4	49.79	29.79	2.71
SEm±	2.284	2.284	0.088
C D at 5 %	6.330	6.331	0.244

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 39b. Economics in ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Gross income [Rs.'000/ha]	Net returns [Rs.'000/ha]	Benefit cost ratio
A.Organic manures			
PM_1	73.15	53.46	3.66
PM_2	82.79	60.01	3.60
BL_1	73.67	54.23	3.76
BL_2	89.33	68.27	4.19
NO	69.72	53.16	4.14
SEm±	0.584	0.585	0.031
C D at 5%	1.840	1.843	0.897
B.Chemical fertilizers			
RDF_1	99.66	77.69	4.56
RDF_2	86.84	66.11	4.21
RDF_3	72.33	52.86	3.72
RDF_4	52.11	34.66	3.00
SEm±	0.384	0.384	0.019
C D at 5%	1.064	1.064	0.052
Interaction [AXB]			
PM_1 X RDF_1	95.03	73.15	4.34
PM_1 X RDF_2	82.37	61.75	3.99
PM_1 X RDF_3	67.70	48.33	3.49
PM_1 X RDF_4	47.48	30.61	2.81
PM_2 X RDF_1	101.18	76.18	4.05
PM_2 X RDF_2	91.61	67.86	3.86
PM_2 X RDF_3	78.70	56.20	3.50
PM_2 X RDF_4	69.68	39.80	3.00
BL_1 X RDF_1	95.96	74.96	4.57
BL_1 X RDF_2	83.30	63.55	4.22
BL_1 X RDF_3	68.08	49.58	3.68
BL_1 X RDF_4	47.35	28.85	2.54
BL_2 X RDF_1	114.67	91.43	4.93
BL_2 X RDF_2	98.22	76.22	4.56
BL_2 X RDF_3	83.79	63.05	4.04
BL_2 X RDF_4	60.64	42.39	3.32
NO X RDF_1	91.46	72.97	4.88
NO X RDF_2	78.68	61.18	4.97
NO X RDF_3	63.36	47.11	3.89
NO X RDF_4	45.39	31.63	3.30
SEm±	0.859	0.858	0.045
C D at 5 %	2.281	2.278	0.122

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Application of RDF_1 produced significantly higher B: C ratio of 4.12 compared to other doses of chemical fertilizers and the lowest being against RDF_4 (2.72). All the chemical fertilizers levels showed significant results.

The interaction effect was found significant due to organic and chemical fertilizers. Significantly highest B:C ratio of 4.97 was exerted with BL_2 X RDF_1 overall other treatment combinations. BL_1 X RDF_1 and NO X RDF_1 produced 4.30 and 4.38 B: C ratio which was significantly superior over other treatments and these were on par with each other.

4.2.6 SOIL PROPERTIES

4.2.6.1 Soil reaction [pH]

The pH of soil after harvest of plant and ratoon crops as influenced by organic and inorganic fertilizers is presented in Tables. 40, 40a and 40b.

The pH of the soil averaged over two years of plant and ratoon crop did not differ significantly. The initial soil pH was 8.1 and it failed to differ significantly either due to application of various organic or due to different levels of inorganic fertilizers. Similarly the interaction effects of organic and inorganic

fertilizers did not exert any significant influence on soil pH. The similar trend was observed for both plant and ratoon crops.

4.2.6.2 Electrical conductivity (dS/m)

The electrical conductivity (EC) of soil after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 40, 40a and 40b.

The initial electrical conductivity of soil was 0.34.The electrical conductivity (dSm^{-1}) of soil averaged over two crops had no significant impact. However, application of different levels of inorganic fertilizers significantly influenced the electrical conductivity of soil. Significantly lower electrical conductivity of 0.30 was observed due to application of RDF_1 compared to RDF_4 (0.32). but, RDF_2 (0.30), RDF_3 (0.31) and RDF_4 [0.31] produced on par electrical conductivity with each other. Similar trend was also exhibited in the soils after harvest of plant cane but in the soils after harvest of ratoon cane both RDF_1 (0.30) and RDF_2 (0.30) had significantly lower electrical conductivity over RDF_3 (0.31) and RDF_4 (0.31).

The interaction effects were significant due to various organic and inorganic fertilizers on electrical conductivity of soil. Application of PM_2 X RDF_1 registered significantly lower electrical

conductivity (0.26) values compared to other treatments except PM_1 X RDF_1 PM_2 X RDF_2, PM_2 X RDF_3, PM_2 X RDF_2 compared to rest of the treatments.

4.2.6.3 Bulk density (g/cc)

The bulk density of soil after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 40, 40a and 40b.

The bulk density of soils averaged over after of harvest of plant and ratoon crops had significant results. The initial soil bulk density was 1.47. Among organics application of PM_2 (1.36) registered significantly lower bulk density compared to no organic treatment (1.44). However, other organics failed to exhibit significant results with respect to bulk density compared to no organic treatment. Similar trend was noticed in case of soils after harvest of ratoon. On the contrary there was no significant effect on bulk density of soil after harvest of plant cane due to application of organic manures. The varied grades of chemical fertilizers failed to influence significantly on bulk density of soil. Similarly the interaction effects were also not found significant in influencing the bulk density of soil.

4.2.6.4 Water holding capacity (%)

The water holding capacity of the soil after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 40, 40a and 40b.

The water holding capacity of the soil averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The initial water holding capacity of soil was 29.36. The application of PM_2 (35.26), PM_1 (32.67) and BL_2 (33.16) exerted significantly higher water holding capacity in the soil over BL_1 (31.10) and no organics (29.27) and latter two were found on par with each other. The water holding capacity of the soil was found significantly the highest due to application of RDF_1 (34.67) and the lowest in RDF_4 (30.17). All the reduced levels of chemical fertilizers decreased the water holding capacity significantly.

The interaction effects on water holding capacity of the soil was significant. Application of PM_2 X RDF_1 (37.37), PM_2 X RDF_2 (36.44), PM_1 X RDF_1 [35.79], BL_1 X RDF_1 [35.02] and PM_1 X RDF_2 [34.44] had significantly higher water holding capacity of soil over rest of the treatments.

Table 40. Soil reaction, electrical conductivity , bulk density and water holding capacity of soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers [Pooled]

Treatment	Soil reaction[pH]	Electrical conductivity [dS/m]	Bulk density [g/cc]	Water holding capacity [%]
A.Organic manures				
PM_1	7.65	0.29	1.37	32.67
PM_2	7.50	0.28	1.36	35.26
BL_1	7.85	0.30	1.40	31.10
BL_2	7.68	0.29	1.39	33.16
NO	8.09	0.32	1.44	29.27
SEm±	0.290	0.021	0.021	1.253
C D at 5%	NS	NS	0.060	3.473
B.Chemical fertilizers				
RDF_1	7.60	0.28	1.38	34.67
RDF_2	7.63	0.29	1.38	33.40
RDF_3	7.53	0.31	1.40	31.72
RDF_4	7.91	0.31	1.41	30.17
SEm±	0.155	0.007	0.021	0.422
C D at 5%	NS	0.019	NS	1.169
Interaction [AXB]				
PM_1 X RDF_1	7.45	0.27	1.37	35.79
PM_1 X RDF_2	7.65	0.28	1.36	34.44
PM_1 X RDF_3	7.75	0.30	1.39	32.82
PM_1 X RDF_4	7.84	0.31	1.40	31.63
PM_2 X RDF_1	7.30	0.26	1.34	37.37
PM_2 X RDF_2	7.40	0.27	1.35	36.44
PM_2 X RDF_3	7.60	0.29	1.37	34.55
PM_2 X RDF_4	7.70	0.30	1.38	32.67
BL_1 X RDF_1	7.65	0.28	1.39	33.90
BL_1 X RDF_2	7.75	0.29	1.40	31.82
BL_1 X RDF_3	7.95	0.31	1.41	30.12
BL_1 X RDF_4	8.55	0.32	1.42	28.55
BL_2 X RDF_1	7.55	0.27	1.36	35.02
BL_2 X RDF_2	7.55	0.28	1.37	33.92
BL_2 X RDF_3	7.75	0.30	1.39	31.92
BL_2 X RDF_4	7.85	0.31	1.40	31.93
NO X RDF_1	8.05	0.32	1.43	31.75
NO X RDF_2	8.10	0.32	1.44	30.40
NO X RDF_3	8.10	0.34	1.44	29.15
NO X RDF_4	8.10	0.34	1.45	26.23
SEm±	0.329	0.010	0.047	0.911
C D at 5 %	NS	0.028	NS	2.525

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 40a. Soil reaction , electrical conductivity , bulk density and water holding capacity of soil after harvest of plant cane as influenced by organic and inorganic fertilizers

Treatment	Soil reaction[pH]	Electrical conductivity [dS/m]	Bulk density [g/cc]	Water holding capacity [%]
Initial value	8.10	0.34	1.47	29.36
A.Organic manures				
PM_1	7.69	0.29	1.32	33.06
PM_2	7.50	0.28	1.32	34.23
BL_1	7.90	0.30	1.40	30.24
BL_2	7.75	0.29	1.38	32.65
NO	8.08	0.32	1.43	29.35
SEm±	0.221	0.027	0.036	1.272
C D at 5%	NS	NS	NS	3.781
B.Chemical fertilizers				
RDF_1	7.64	0.28	1.37	34.32
RDF_2	7.70	0.49	1.38	32.86
RDF_3	7.86	0.31	1.40	31.12
RDF_4	7.93	0.31	1.41	29.80
SEm±	0.218	0.008	0.026	0.431
C D at 5%	NS	0.022	NS	1.211
Interaction [AXB]				
PM_1 X RDF_1	7.50	0.27	1.36	35.47
PM_1 X RDF_2	7.60	0.28	1.36	33.40
PM_1 X RDF_3	7.80	0.30	1.39	32.23
PM_1 X RDF_4	7.87	0.31	1.40	31.13
PM_2 X RDF_1	7.30	0.26	1.35	36.27
PM_2 X RDF_2	7.40	0.27	1.36	35.40
PM_2 X RDF_3	7.60	0.29	1.38	33.73
PM_2 X RDF_4	7.70	0.30	1.39	31.10
BL_1 X RDF_1	7.70	0.28	1.39	34.20
BL_1 X RDF_2	7.80	0.29	1.39	31.43
BL_1 X RDF_3	8.00	0.31	1.41	29.53
BL_1 X RDF_4	8.10	0.32	1.42	28.60
BL_2 X RDF_1	7.70	0.27	1.36	34.43
BL_2 X RDF_2	7.60	0.28	1.32	33.50
BL_2 X RDF_3	7.80	0.30	1.39	31.43
BL_2 X RDF_4	7.90	0.31	1.40	31.23
NO X RDF_1	8.00	0.31	141	31.23
NO X RDF_2	8.10	0.31	1.43	30.57
NO X RDF_3	8.10	0.33	1.43	28.67
NO X RDF_4	8.10	0.33	1.43	26.93
SEm±	0.450	0.031	0.053	0.978
C D at 5 %	NS	NS	NS	2.711

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 40b. Soil reaction, electrical conductivity , bulk density and water holding capacity of soil after harvest of ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Soil reaction [pH]	Electrical conductivity [dS/m]	Bulk density [g/cc]	Water holding capacity [%]
A.Organic manures				
PM_1	7.60	0.28	1.37	34.22
PM_2	7.50	0.27	1.35	36.38
BL_1	7.80	0.29	1.39	31.25
BL_2	7.60	0.28	1.37	33.67
NO	8.10	0.33	1.05	29.58
SEm±	0.333	0.031	0.028	1.605
C D at 5%	NS	NS	0.081	5.057
B.Chemical fertilizers				
RDF_1	7.56	0.27	1.38	35.01
RDF_2	7.64	0.28	1.38	33.24
RDF_3	7.80	0.30	1.39	32.31
RDF_4	7.88	0.31	1.41	30.53
SEm±	0.182	0.009	0.029	0.840
C D at 5%	NS	0.024	NS	2.383
Interaction [AXB]				
PM_1 X RDF_1	7.40	0.26	1.37	36.10
PM_1 X RDF_2	7.50	0.27	1.36	35.47
PM_1 X RDF_3	7.70	0.29	1.38	33.40
PM_1 X RDF_4	7.80	0.30	1.39	32.13
PM_2 X RDF_1	7.30	0.25	1.33	38.42
PM_2 X RDF_2	7.40	0.26	1.34	37.67
PM_2 X RDF_3	7.60	0.28	1.36	35.37
PM_2 X RDF_4	7.70	0.29	1.37	34.23
BL_1 X RDF_1	7.60	0.27	1.28	33.60
BL_1 X RDF_2	7.70	0.28	1.40	32.20
BL_1 X RDF_3	7.90	0.30	1.41	30.70
BL_1 X RDF_4	8.00	0.31	1.41	28.50
BL_2 X RDF_1	7.40	0.26	1.35	35.60
BL_2 X RDF_2	7.50	0.27	1.36	34.33
BL_2 X RDF_3	7.70	0.29	1.38	32.47
BL_2 X RDF_4	7.80	0.30	1.39	32.23
NO X RDF_1	8.10	0.32	1.45	32.27
NO X RDF_2	8.10	0.32	1.45	30.23
NO X RDF_3	8.10	0.34	1.45	29.65
NO X RDF_4	8.10	0.34	1.46	25.55
SEm±	0.401	0.010	0.066	1.923
C D at 5 %	NS	0.028	NS	5.330

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

4.2.6.5 Organic carbon (%)

The organic carbon content in the soils after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 41, 41a and 41b.

The organic carbon content in the soil averaged over two years showed significant difference. The initial soil organic carbon content was 0.78. Among the organics, application of PM_2 enhanced organic carbon content (0.55) significantly followed by application of BL_2 (0.47), PM_2 (0.45), BL_1 (0.41) which were also on par with each other and exhibited significantly higher organic carbon content over no organics (0.36). Similar trend was also noticed in the soils after harvest of ratoon crop. In the soils after harvest of plant cane, although application of PM_2 (0.47) showed highest organic carbon, it was on par with other rest of organics. However, it exerted significantly higher organic carbon content over no organic treatment (0.36).

Application of various levels of inorganic fertilizers had significant effect on the organic carbon content of soil. Significantly the highest organic carbon was observed due to RDF_1 (0.49) over RDF_4 (0.38). However, RDF_1 showed on par

organic carbon content with RDF_2 and RDF_3.

The interaction effects due to various organic and inorganic fertilizers had significant influence on organic carbon content of the soil. The organic carbon content was significantly superior due to application of PM_2 X RDF_1 (0.62), PM_2 X RDF_2 (0.62) and PM_2 X RDF_3 (0.57) over other treatments. Significantly higher organic carbon content was observed due to application of PM_1 X RDF_1, PM_1 X RDF_2 over sole application of various grades of inorganic fertilizers.

4.2.6.6 Available nitrogen (kg/ha)

The available nitrogen content in the soils after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 41, 41a and 41b.

The available nitrogen (kg/ha) in the soils averaged over after of harvest of plant and ratoon crops differed significantly. The initial soil available nitrogen content was 220.40. The application of PM_2 significantly enhanced available nitrogen (254.20) compared to other treatments. Similarly, application of BL_2 (241.95), PM_1 (222.49), BL_1 (209.96) and NO (185.55) showed significant results in their descending order of available nitrogen content. The lowest was found in noorganic treatment. The

same trend was noticed in soils after harvest of ratoon crop. However in soils after harvest of plant cane although application PM_2 exerted significantly higher available nitrogen (246.02) over other treatment but was on par with BL_2 (246.40). Similarly, application of PM_1 and BL_1 recorded on par available nitrogen and produced significantly higher available nitrogen over no organic treatment (191.38). Among chemical fertilizers application of RDF_1 exhibited the highest available nitrogen (251.88) compared to other grades of chemical fertilizers and the lowest with RDF_4 (184.05). As the application of chemical fertilizers decreased there was significant reduction in the available nitrogen content in the soil [Fig13].

The interaction effects were significant due to application of organic and inorganic fertilizers. Significantly the highest available nitrogen (299.32) was noticed due to application of PM_2 X RDF_1 over other treatments. The treatments viz., BL_2 X RDF_1 (277.45), PM_2 X RDF_2 (262.85), BL_2 X RDF_2 (256.44), PM_2 X RDF_3 (254.40), BL_2 XRDF_3 (241.00), PM_1 XRDF_1 (238.94) and PM_1 X RDF_2 (229.45) were found to have significantly higher available nitrogen compared to RDF_1 alone (211.82) and other reduced levels of chemical fertilizers alone.

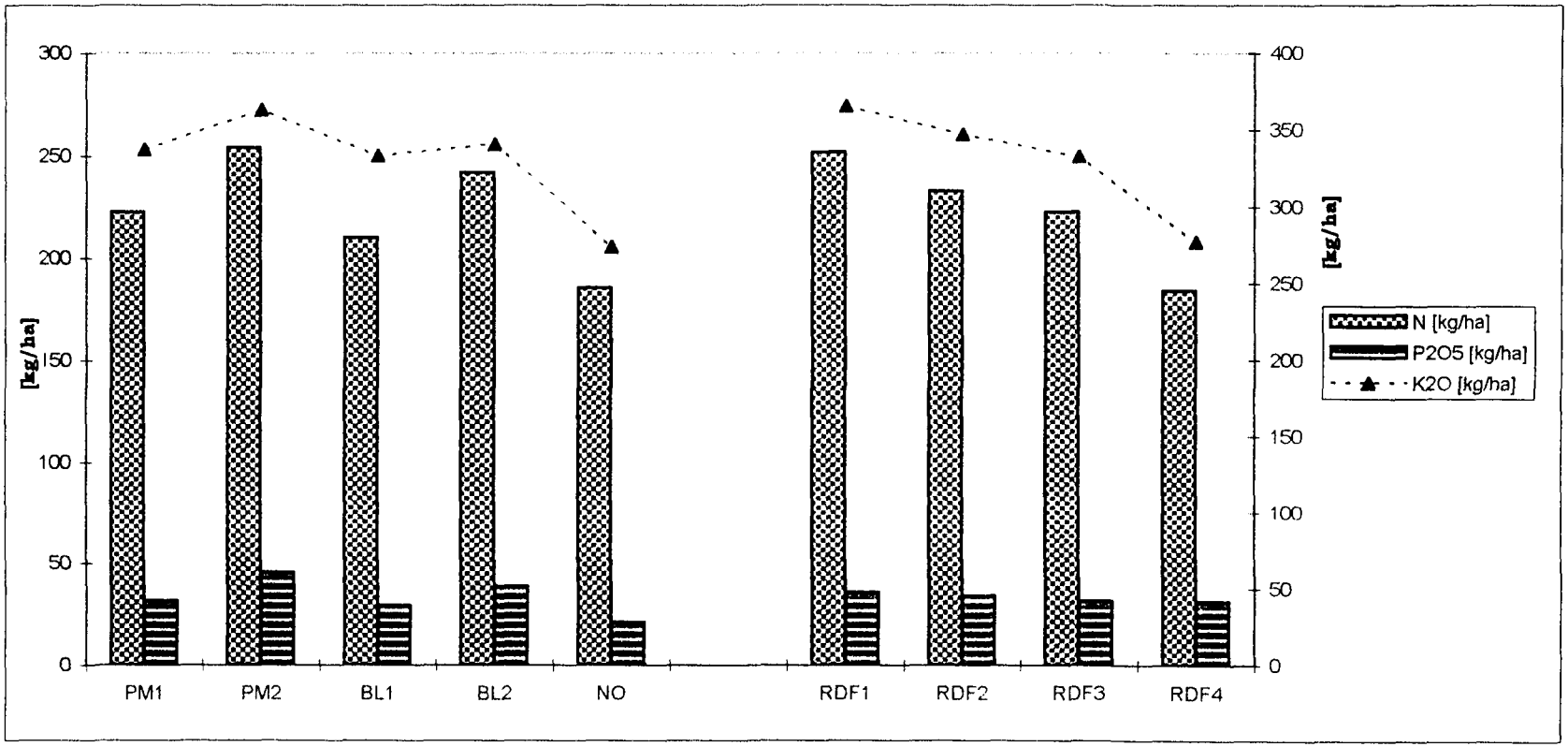

Fig. 13. Available nitrogen, phosphorus and potassium [kg/ha] in the soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers.

4.2.6.7 Available P_2O_5 (kg/ha)

The available phosphorus content in the soils after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 41, 41a and 41b.

The initial available phosphorus content in the soil was 20.20. The available phosphorus (kg/ha) in the soils averaged over two years showed significant difference. Among the organics application of PM_2 exhibited significantly the highest available P_2O_5 (45.29) over other treatments. The available P_2O_5 in the soil was 38.44, 31.44, 29.18 and 21.17 due to application of BL2, PM_1, BL_1 and NO respectively and all these treatments differed significantly over each other. However after harvest of plant cane only PM_2 and BL_2 showed on par available P_2O_5 content.

Significantly higher available P_2O_5 was noticed with application of RDF_1 (35.57) over other levels of chemical fertilizers. However, RDF_3 and RDF_4 showed on par available P_2O_5 content in the soil (Fig.13).

The interaction effects were found significant. Significantly superior available P_2O_5 content in the soil was observed in the treatments viz., PM_2 X RDF_1 (47.53) and PM_2 X RDF_2 (45.78) over

rest of the treatments. Application of RDF_1 alone and lower levels recorded significantly lower available P_2O_5 compared to organics in conjunction with their respective levels of chemical fertilizers.

4.2.6.8 Available potassium (kg/ha)

The available potassium content in the soils after harvest of plant and ratoon crops as influenced by various organic and inorganic fertilizers is presented in Tables. 41, 41a and 41b.

The available potassium (kg/ha) in the soils averaged over two years as influenced by organic and inorganic fertilizers differed significantly. The initial available potassium content was 330.20.Among organics application of PM_2 recorded significantly the higher available K_2O (363.27) over other treatments. Similarly BL_2 exerted significantly higher (341.04) available K_2O compared to without organic treatment (274.03). However, it was on par with PM_1 (337.66) and BL_1 (333.86). The same trend was repeated in the soils after harvest of ratoon crop. However, PM_1 and PM_2 and also BL_1 and BL_2 had on par K_2O content and all these organics registered significantly higher available K_2O compared to no organic treatment (286.37) in case of plant cane.

Table 41. Organic carbon, available nitrogen, phosphorus and potassium in the soil after harvest of plant and ratoon canes as influenced by organic and inorganic fertilizers[Pooled]

Treatment	Organic carbon [%]	N [kg/ha]	P_2O_5 [kg/ha]	K_2O [kg/ha]
A.Organic manures				
PM_1	0.45	222.49	31.44	337.66
PM_2	0.55	254.20	45.25	363.27
BL_1	0.41	209.96	29.18	333.86
BL_2	0.47	241.95	38.44	341.04
NO	0.36	185.55	21.17	274.03
SEm±	0.021	2.481	0.508	4.711
C D at 5%	0.058	6.877	1.408	13.058
B.Chemical fertilizers				
RDF_1	0.49	251.88	35.57	365.72
RDF_2	0.47	232.75	33.85	347.40
RDF_3	0.46	222.64	31.67	32.92
RDF_4	0.38	184.05	31.34	277.25
SEm±	0.014	1.976	0.588	3.278
C D at 5%	0.028	5.477	1.630	9.086
Interaction [AXB]				
PM_1 X RDF_1	0.40	238.94	33.35	373.05
PM_1 X RDF_2	0.46	229.48	32.57	362.45
PM_1 X RDF_3	0.44	215.72	30.29	346.37
PM_1 X RDF_4	0.39	205.80	29.57	318.52
PM_2 X RDF_1	0.62	299.32	47.53	393.47
PM_2 X RDF_2	0.62	262.45	45.78	378.32
PM_2 X RDF_3	0.57	254.40	43.47	365.90
PM_2 X RDF_4	0.44	200.64	44.38	315.38
BL_1 X RDF_1	0.47	231.87	31.04	368.52
BL_1 X RDF_2	0.40	218.00	30.07	341.79
BL_1 X RDF_3	0.37	212.42	27.82	228.58
BL_1 X RDF_4	0.40	177.57	27.79	296.83
BL_2 X RDF_1	0.49	277.48	40.30	375.32
BL_2 X RDF_2	0.47	256.84	39.22	363.22
BL_2 X RDF_3	0.45	241.00	37.44	344.89
BL_2 X RDF_4	0.42	192.50	36.69	280.49
NO X RDF_1	0.37	211.82	25.40	318.27
NO X RDF_2	0.37	196.98	21.62	292.55
NO X RDF_3	0.36	189.66	19.31	263.90
NO X RDF_4	0.33	143.73	18.29	225.02
SEm±	0.031	3.895	1.357	6.854
C D at 5 %	0.086	10.796	3.761	18.998

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 41a. Organic carbon, available nitrogen, phosphorus and potassium in the soil after harvest of plant cane as influenced by organic and inorganic fertilizers

Treatment	Organic carbon [%]	N [kg/ha]	P_2O_5 [kg/ha]	K_2O [kg/ha]
Initial value	0.38	220.40	20.20	330.20
A.Organic manures				
PM_1	0.44	211.22	30.58	330.46
PM_2	0.42	246.02	43.40	349.03
BL_1	0.41	208.39	28.54	330.18
BL_2	0.46	235.40	36.46	331.42
NO	0.32	191.38	22.88	286.37
SEm±	0.024	3.532	0.775	5.131
C D at 5%	0.076	11.29	2.442	16.167
B.Chemical fertilizers				
RDF_1	0.45	247.68	35.31	350.74
RDF_2	0.45	229.91	32.91	336.69
RDF_3	0.44	221.69	30.63	320.48
RDF_4	0.39	174.63	30.65	294.06
SEm±	0.018	2.575	0.899	3.452
C D at 5%	0.049	7.139	2.381	9.569
Interaction [AXB]				
PM_1 X RDF_1	0.48	235.37	32.63	354.33
PM_1 X RDF_2	0.45	228.43	31.66	341.70
PM_1 X RDF_3	0.42	216.07	29.47	329.50
PM_1 X RDF_4	0.40	165.00	28.56	396.30
PM_2 X RDF_1	0.46	285.23	45.73	369.27
PM_2 X RDF_2	0.55	251.70	43.36	361.13
PM_2 X RDF_3	0.48	248.70	40.66	345.50
PM_2 X RDF_4	0.42	198.80	43.83	320.23
BL_1 X RDF_1	0.46	231.06	30.37	350.70
BL_1 X RDF_2	0.41	215.60	29.70	341.00
BL_1 X RDF_3	0.30	211.36	27.40	329.62
BL_1 X RDF_4	0.49	175.53	26.70	300.00
BL_2 X RDF_1	0.48	268.53	38.67	355.27
BL_2 X RDF_2	0.46	245.38	37.33	343.10
BL_2 X RDF_3	0.42	239.40	35.27	328.50
BL_2 X RDF_4	0.39	188.30	34.57	298.30
NO X RDF_1	0.38	218.23	29.13	324.27
NO X RDF_2	0.38	208.46	22.47	296.53
NO X RDF_3	0.37	193.30	20.37	269.23
NO X RDF_4	0.34	145.50	19.57	255.47
SEm±	0.041	5.759	1.922	7.720
C D at 5 %	0.113	15.960	5.328	21.398

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 41b. Organic carbon, available nitrogen, phosphorus and potassium in the soil after harvest of ratoon cane as influenced by organic and inorganic fertilizers

Treatment	Organic carbon [%]	N [kg/ha]	P_2O_5 [kg/ha]	K_2O [kg/ha]
A.Organic manures				
PM_1	0.45	233.75	32.30	344.85
PM_2	0.63	262.38	47.18	277.51
BL_1	0.40	211.53	29.81	227.53
BL_2	0.47	248.49	40.46	350.66
NO	0.34	179.72	19.45	263.42
SEm±	0.028	1.121	0.512	5.712
C D at 5%	0.088	3.532	1.613	17.998
B.Chemical fertilizers				
RDF_1	0.52	256.07	35.82	380.69
RDF_2	0.48	235.59	34.79	35873
RDF_3	0.47	223.58	32.71	339.38
RDF_4	0.37	193.47	32.03	260.43
SEm±	0.017	2.501	0.696	5.539
C D at 5%	0.047	6.932	1.929	15.357
Interaction [AXB]				
PM_1 X RDF_1	0.49	242.50	34.07	391.76
PM_1 X RDF_2	0.47	230.53	33.47	383.70
PM_1 X RDF_3	0.46	215.36	31.10	363.23
PM_1 X RDF_4	0.38	246.60	30.57	240.73
PM_2 X RDF_1	0.78	313.40	49.33	417.70
PM_2 X RDF_2	0.68	273.20	48.20	395.50
PM_2 X RDF_3	0.65	260.46	46.27	386.30
PM_2 X RDF_4	0.41	202.47	44.93	310.53
BL_1 X RDF_1	0.48	232.67	31.70	386.33
BL_1 X RDF_2	0.39	220.40	30.43	342.57
BL_1 X RDF_3	0.43	213.47	28.23	327.53
BL_1 X RDF_4	0.31	179.60	28.87	293.66
BL_2 X RDF_1	0.49	286.37	42.33	395.37
BL_2 X RDF_2	0.48	268.30	41.10	383.33
BL_2 X RDF_3	0.42	242.60	39.60	361.27
BL_2 X RDF_4	0.44	196.70	38.80	262.67
NO X RDF_1	0.36	205.40	21.67	312.27
NO X RDF_2	0.35	185.50	20.77	288.57
NO X RDF_3	0.34	186.01	18.37	258.57
NO X RDF_4	0.31	141.96	17.00	194.56
SEm±	0.039	5.867	1.557	12.386
C D at 5 %	0.108	16.262	4.316	34.332

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

The reduced levels of chemical fertilizers significantly declined the available K_2O content in the soils.

The interaction effects due to various organic and inorganic fertilizers showed significant result. Application of PM_2 X RDF_1 and PM_2 X RDF_2 exhibited significantly higher available K_2O (393.49 and 378.32, respectively) over other treatments. Further, application of PM_1 X RDF_1, PM_1 X RDF_2, PM_1 X RDF_3, PM_2 X RDF_3, BL_1 X RDF_1, BL_1 X RDF_2, BL_2 X RDF_1, BL_2 X RDF_2 an BL_2 X RDF_3 exerted significantly higher available K_2O compared to sole RDF_1 and its reduced levels of chemical fertilizers.

4.2.6.9 P-solubilizers count (10^4/g soil)

The phosphorus-solubilisers count as influenced by organic and inorganic fertilizer is presented in Tables. 42, 42a and 42b.

P-solubilisers count averaged over two years differed significantly. The initial P-solubilizers count was 5.72. Among organics application of BL_2 significantly enhanced P-solubilisers (16.00) over other organic sources. This was followed by BL_1, which also registered significantly higher (10.46) P-solubiliser over PM_2, PM_1 and NO. Lower P – solubilisers were found in control (no organic). Similar trend was noticed in the soils after

harvest of plant and ratoon crops also for plant as well as ratoon crops. However, in general P-solubilisers count was more pronounced after harvest of ratoon cane compared to plant crop.

P-solubilisers count was significantly influenced due to application of chemical fertilizers. Significantly higher P-solubilisers count was exerted in RDF_1 (12.07) compared to other levels of chemical fertilizers. Reduction in levels of chemical fertilizers significantly reduced P-solubilisers count recording lowest with RDF_4 (8.08). Similar trends also observed for plant and ratoon crops except in ratoon where RDF_1 and RDF_2 recorded on par P-solubilisers count.

P-solubilisers count showed significant effects due to combinations of organic and inorganic fertilizers. Pooled data indicated that application of BL_2 in conjunction with RDF_1 and RDF_2 (i.e. 18.00 and 17.00, respectively) produced significantly higher P-solubilisers compared to other treatments. Application of PM_1 and PM_2 failed to exert significant results on P-solubilizers count compared to BL_2 and BL_1, however both these levels registered significantly higher P-solubilisers compared to only chemical fertilizers.

4.2.7.0 Actinomycetes count (10^4/g soil)

The actinomycete count as influenced by influenced by organic and inorganic fertilizers is presented in Tables. 42, 42a and 42b.

Actinomycetes count averaged over two years as influenced by various organic and chemical fertilizers differed significantly. The initial count was 18.0.Application of BL_2 exhibited significantly higher actinomycetes count (24.34) over other treatments except BL_1 and PM_2. However, PM_1 and PM_2 showed on par results and were significantly superior over no-organic which registered lowest actinomycetes count of 16.58.

RDF_1 significantly increased actinomycetes count (23.90) compared to other reduced levels of chemical fertilizers except with RDF_2 (22.64). Further reduced levels of chemical fertilizers significantly lowered the actinomycetes count recording the lowest with RDF_4 (18.80). Similar trend was observed in ratoon. However, in plant cane all the levels of chemical fertilizer registered significantly differing actinomycetes count being the highest against RDF_1 (24.00) and the lowest against RDF_4 (19.00).

The interaction effects of pooled analysis indicated that application of BL_2 X RDF_1, BL_2 X RDF_2, BL_1 X RDF_1 and BL_1 X RDF_2 significantly enhanced actinomycetes count compared to rest of the treatment combinations. However, the pressmud in conjunction with chemical fertilizers at both the levels (PM_1 and PM_2) registered significantly higher actinomycetes over only chemical fertilizers.

4.2.7.1 Fungi (10^4/g soil)

The total fungal count as influenced by organic and inorganic fertilizers is presented in Tables. 42, 42a and 42b.

Fungal count averaged over two years differed significantly. The initial fungal count was 19.07.Application of BL_2 recorded significantly higher fungal count (23.92) compared to other organics. However, it was on par with BL_1 (21.76), PM_2 [21.21] and PM_1 [20.63] and further observed that these treatments were recorded significantly higher fungal count compared to no organic treatment.

Reduction in the levels of chemical fertilizers significantly reduced the fungal count except RDF_1 and RDF_2 that showed on par results. Similar trend was observed in RDF_3 and RDF_4. The

highest fungal count was registered with RDF_1 (22.87) and lowest being with RDF_4 (19.73).

The interaction effects were significant due to application of organic and inorganic fertilizers. Application of BL_2 X RDF_1 recorded significantly higher (26.5) fungal count over other treatments except BL_2 X RDF_2, BL_2 X RDF_3, PM_2 X RDF_1, BL_1 X RDF_1, BL_1 X RDF_2 and BL_2 X RDF_4. Further significantly lower fungal count was accounted due to application of fertilizers alone.

4.2.7.2 Azotobacteria count (10^4/g soil)

The azotobacteria count as influenced by organic and inorganic fertilizer is presented in Tables. 42, 42a and 42b.

Azotobacteria count averaged over two years differed significantly. The initial azotobacteria count was 7.67.Significantly the higher azotobacteria count (20.38) was registered due to application of BL_2 compared to other organic fertilizers. However, application of BL_1 and PM_2 recorded on par azotobacteria count. No organics accounted significantly lower azotobacteria count of 7.42.

Table 42. Biological properties of soil after harvest of plant and ratoon cane as influenced by organic and inorganic fertilizers [Pooled]

Treatment	P-solubilizers [10^4/g soil]	Actinomycetes [10^4/g soil]	Fungi [10^4/g soil]	Azotobacteria [10^4/g soil]
A.Organic manures				
PM_1	9.29	20.63	20.63	11.09
PM_2	9.30	21.42	21.21	13.21
BL_1	10.46	24.34	21.76	14.51
BL_2	16.00	24.34	23.92	20.38
NO	5.34	16.58	18.17	7.42
SEm±	0.315	1.050	0.829	0.821
C D at 5%	0.644	3.237	2.485	2.461
B.Chemical fertilizers				
RDF_1	12.07	23.90	22.87	15.24
RDF_2	11.09	22.64	21.60	14.37
RDF_3	9.74	20.45	20.20	11.95
RDF_4	8.08	18.80	19.73	11.43
SEm±	0.322	0.014	0.621	0.39
C D at 5%	0.893	1.424	1.721	1.103
Interaction [AXB]				
PM_1 X RDF_1	10.67	22.84	22.00	12.00
PM_1 X RDF_2	10.00	21.84	21.33	12.33
PM_1 X RDF_3	8.50	19.83	20.00	9.83
PM_1 X RDF_4	6.50	18.00	19.17	9.17
PM_2 X RDF_1	11.83	22.83	23.33	15.00
PM_2 X RDF_2	9.84	22.83	27.83	14.50
PM_2 X RDF_3	9.22	21.17	20.00	11.83
PM_2 X RDF_4	6.17	17.83	19.67	11.33
BL_1 X RDF_1	12.50	26.17	23.67	16.67
BL_1 X RDF_2	11.50	25.00	22.17	15.50
BL_1 X RDF_3	9.83	21.50	20.67	13.17
BL_1 X RDF_4	8.00	24.50	20.00	12.67
BL_2 X RDF_1	18.00	27.67	26.50	23.00
BL_2 X RDF_2	17.00	26.30	24.17	21.67
BL_2 X RDF_3	15.67	24.00	22.83	19.00
BL_2 X RDF_4	13.28	19.17	22.17	17.83
NO X RDF_1	6.60	19.00	18.33	8.50
NO X RDF_2	7.34	17.00	18.50	7.83
NO X RDF_3	5.33	15.33	17.50	7.07
NO X RDF_4	6.17	10.50	17.83	6.12
SEm±	0.878	1.108	1.579	0.956
C D at 5 %	1.602	3.071	4.377	2.649

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 42a. Biological properties of soil after harvest of plant cane as influenced by organic and inorganic fertilizers

Treatment	P-solubilizer [10^4/g soil]	Actinomycetes [10^4/g soil]	Fungi [10^4/g soil]	Azotobacter [10^4/g soil]
Initial values	5.72	18.00	19.00	7.67
A.Organic manures				
PM_1	9.25	20.33	20.08	10.00
PM_2	8.42	21.42	21.17	12.33
BL_1	9.67	22.59	21.92	14.34
BL_2	12.50	24.33	22.59	18.50
NO	4.67	18.08	19.17	7.92
SEm±	0.408	1.273	1.240	1.139
C D at 5%	1.286	4.011	3.907	3.589
B.Chemical fertilizers				
RDF_1	11.47	24.00	22.40	14.60
RDF_2	9.73	20.90	21.80	13.67
RDF_3	8.87	20.20	20.20	11.18
RDF_4	6.73	19.00	19.27	10.93
SEm±	0.377	0.577	0.721	0.491
C D at 5%	1.045	1.599	1.999	1.361
Interaction [AXB]				
PM_1 X RDF_1	10.38	22.67	22.00	12.00
PM_1 X RDF_2	9.67	91.33	21.33	11.33
PM_1 X RDF_3	8.67	19.33	19.00	8.32
PM_1 X RDF_4	5.32	18.00	18.00	8.33
PM_2 X RDF_1	11.33	23.33	27.33	14.00
PM_2 X RDF_2	8.67	2.33	22.33	13.67
PM_2 X RDF_3	8.30	10.67	20.00	10.22
PM_2 X RDF_4	5.33	19.33	19.00	10.33
BL_1 X RDF_1	11.67	24.67	23.67	16.67
BL_1 X RDF_2	10.33	23.67	22.67	15.33
BL_1 X RDF_3	9.33	21.33	20.67	12.67
BL_1 X RDF_4	7.33	20.67	15.33	12.67
BL_2 X RDF_1	14.67	26.67	23.67	21.33
BL_2 X RDF_2	13.33	25.33	22.67	19.67
BL_2 X RDF_3	12.67	23.33	22.33	16.67
BL_2 X RDF_4	9.23	22.80	21.67	16.33
NO X RDF_1	6.67	22.67	19.33	9.00
NO X RDF_2	7.00	18.33	20.00	8.33
NO X RDF_3	5.33	16.32	19.00	7.23
NO X RDF_4	6.73	15.00	18.33	7.00
SEm±	0.840	1.291	1.612	1.091
C D at 5 %	2.337	3.578	4.468	3.024

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Table 42b. Biological properties of soil after harvest of ratoon cane as influenced by organic and inorganic fertilizers

Treatment	P-solubilizer [10^4/g soil]	Actinomycetes [10^4/g soil]	Fungi [10^4/g soil]	Azotobacter [10^4/g soil]
A.Organic manures				
PM_1	9.33	20.92	21.17	12.17
PM_2	10.17	21.42	21.25	14.68
BL_1	11.25	26.09	21.59	14.67
BL_2	19.50	24.34	25.25	22.25
NO	6.08	15.08	17.17	6.92
SEm±	0.359	1.081	0.896	0.766
C D at 5%	1.131	3.406	2.823	2.414
B.Chemical fertilizers				
RDF_1	12.66	23.80	23.33	15.87
RDF_2	12.45	23.07	21.40	15.07
RDF_3	10.60	20.33	20.20	12.80
RDF_4	9.33	18.60	20.20	11.93
SEm±	0.395	0.831	0.894	0.529
C D at 5%	1.095	2.303	2.479	1.466
Interaction [AXB]				
PM_1 X RDF_1	11.00	23.00	22.00	14.00
PM_1 X RDF_2	10.33	22.33	21.33	13.33
PM_1 X RDF_3	8.33	21.33	21.00	11.33
PM_1 X RDF_4	7.67	18.00	20.33	10.00
PM_2 X RDF_1	10.33	24.33	23.32	16.00
PM_2 X RDF_2	11.00	23.33	21.32	15.33
PM_2 X RDF_3	10.33	21.67	20.00	12.67
PM_2 X RDF_4	7.00	16.33	20.23	12.33
BL_1 X RDF_1	13.33	27.67	23.67	16.67
BL_1 X RDF_2	12.67	26.33	21.67	15.67
BL_1 X RDF_3	10.33	21.67	20.67	13.67
BL_1 X RDF_4	8.67	28.33	20.33	12.67
BL_2 X RDF_1	21.33	28.67	29.33	24.67
BL_2 X RDF_2	20.67	21.67	25.67	22.67
BL_2 X RDF_3	18.67	20.63	23.33	21.33
BL_2 X RDF_4	17.33	16.33	22.67	19.33
NO X RDF_1	5.33	15.33	18.33	8.00
NO X RDF_2	7.67	15.67	17.00	7.33
NO X RDF_3	5.33	15.33	16.00	7.00
NO X RDF_4	6.00	14.00	17.33	5.33
SEm±	0.834	1.257	1.998	1.100
C D at 5 %	2.450	5.147	5.538	3.271

Organics

PM_1 = Pressmud @ 12.5 t/ha
PM_2 = Pressmud @ 25 t/ha
BL_1 = *Bhumilabh* @ 2.5 t/ha
BL_2 = *Bhumilabh* @ 5 t/ha
N O = No organics

Inorganics

RDF_1 = 100 % RDF
RDF_2 = 75 % RDF
RDF_3 = 50 % RDF
RDF_4 = No fertilizer

Various levels of chemical fertilizers influenced significantly on azotobacteria count. However, RDF_1 and RDF_2 registered significantly higher azotobacteria count but were on par. The highest azotobacteria count was noticed against RDF_1[15.25) and the lowest being against RDF_4 (11.43).

The interaction effects of organic and inorganic fertilizers were significant with respect to azotobacteria count. Significantly higher azotobacteria count was exerted due to application of BL_2 X RDF_1, BL_2 X RDF_2, BL_1 X RDF_1 and BL_1 X RDF_2 compared to other treatments. It was also observed that application of pressmud along with chemical fertilizers (both PM_1 and PM_2) produced significantly higher azotobacteria count compared to sole chemical fertilizers.

Table 43. Correlation of cane yield with growth and yield parameters

Parameter	Correlation coefficient [r]	
	Experiment I	**Experiment II**
Growth parameters		
Tiller count	0.625**	0.529*
Plant height	0.893**	0.815**
Number of internodes	0.778**	0.860**
Length of internodes	0.825**	0.932**
Diameter of Cane	0.925**	0.900**
Total dry matter	0.921**	0.889**
Leaf area	0.618**	0.961**
Yield attributes		
Single cane weight	0.884**	0.697**
Number of millable cane	0.911**	0.954**
C.C.S Yield	0.961**	0.982**

* Significant at 5% level
** Significant at 1% level

Table 43a.Correlation of cane yield with nutrient uptake,juice quality and soil parameters

Parameter	Correlation coefficient [r]	
	Experiment I	**Experiment II**
Nutrient uptake		
N	0.939**	0.911**
P2O5	0.962**	0.952**
K2O	0.908**	0.912**
Juice quality		
Brix	NS	0.529*
Pol	0.666**	0.694**
Reducing sugars	-0.587**	NS
Purity	0.605**	0.641**
C.C.S per cent	0.616**	0.732**
Soil physical properties		
Organic carbon	0.597**	0.534*
Bulk density	-0.769**	-0.571**
Available N	0.823**	0.615**
Available P2O5	0.777**	0.636**
Available K2O	0.816**	0.712**
Soil biological properties		
P-solubilizer	0.704**	0.577**
Fungi	0.627**	0.639**
Actinomycetes	0.565*	0.683**
Azotobacter	NS	0.523*

* Significant at 5% level NS = Non-significant
** Significant at 1% level

DISCUSSION

V. DISCUSSION

Organic farming is gaining importance towards achieving sustainability in crop production. Vermiculture with crop residue, use of bulky organic manures like FYM, vermicompost, pressmud, pressmud-based biocompost, trash and green manuring grown *in situ* have been tried with enormous success in various crops including sugarcane. Some workers (Bhawalkar and Bhawalkar, 1993) advocate total organic farming, while others expressed the necessity of integrated use of organic and inorganic fertilisers to achieve sustainability and reach the targeted production. Since the nutrient turn over in soil-plant system is considerably high under intensive farming, neither the chemical fertilisers nor the organic sources alone can achieve sustainability. Even with so called balanced use of NPK fertilisers in long-term studies, high yield level can not be maintained over years because of emergence of secondary and micronutrients deficiencies and deterioration in soil physical environment.

Apart from the other management practices, increased productivity of sugarcane in recent past was mainly due to the higher use of chemical fertilisers. However, the supply of nutrients through fertilisers has aggravated the problems of nutritional imbalances. Spiralling prices coupled with short availability of fertilisers have posed a question whether the nutritional shortages and imbalances can effectively be met through the use and re-cycling of organic farm wastes like FYM, compost, trash and green manures.

Hot climate and intensive cultivation have exhausted the nitrogen and organic matter contents of Indian soils. Therefore organic matter content of soils has to be built-up by re-cycling the organic wastes so that the production level is sustained at a desired level. Organics also provide balanced nutrition in addition to enhancing water holding capacity and improving physical, chemical and biological properties of soils in addition facilitating the growth of micro-organisms, assists in better uptake of nutrients. Therefore, the present experiments were

formulated to findout the effects of organic and inorganic fertilisers on the productivity of sugarcane, possibility of saving inorganic fertilisers and the effect on soil properties.

5.1 INTEGRATED NUTRIENT MANAGEMENT IN SUGARCANE

5.1.1 The effect of organic and inorganic fertilisers on yield attributes and growth of sugarcane.

Sugarcane on an average produces 10-12 t/ha of trash after harvest. Utilisation of trash as an organic manure assumes great significance in sugarcane cultivation. Incorporation of trash @ 8 t/ha in combination with urea and cellulolytic decomposing microorganisms significantly increased the cane yield (77.91 t/ha) over control. The increase in tonnage was to an extent of 6.42 t/ha with 8.98 per cent enhancement over control. Similarly C.C.S yield also increased by 11.67 per cent over control. Further, it was observed that trash incorporation along with 100 per cent RDF recorded significantly higher yield of 102.38 t/ha over 100 per cent RDF alone [95.10 t/ha). Reduced levels of inorganic fertilisers even in conjunction with trash

incorporation failed to produce desirable cane and C.C.S yield [Table 16]. Many workers [Sahi and Rai (1978), Shinde *et al.* (1984), Jadhav *et al.* (1985), Ramalingswamy *et al.* (1996) and Sundara and Tripathi (1999)] have also reported such effects due to incorporation of trash. However, the experimental results due to trash incorporation are contradictory to the reports of Lorenzi *et al.* (1986) who observed lower cane yield due to blanket application of trash due to allelo-chemicals released from trash. But the direct utilization of organic material is possible by enriching it with nitrogen fertilisers as added N is utilised for decomposition at the expense of soil nitrogen with a result that the level of available nitrogen eventually falls and also aggravates the process of decomposition. Similarly, Ramalingaswamy *et al.* (1996) were of the view that urea appears to be the best source of energy for native or added micro-organisms in the decomposition of cane trash and absorption of major nutrients which might have led to high cane and sugar yields. Hence the present investigation also indicated that incorporation of trash along with

urea and decomposing culture helped trash to decompose faster owing to added N coupled with composite decomposing microbial culture and thereby enhanced the mineralisation process leading to higher nutrients availability. The incorporation of trash @ 8 t/ha increased cane yield over control due to significant increase in the total dry matter production and yield attributes viz., single cane weight, cane diameter, length of internodes over control. However, the NMC remained unaltered due to trash incorporation as compared to control. Similar findings were reported by Ramalingswamy *et al.* (1996). Further Shinde *et al.* (1984) found nonsignificant results with respect to tillering and germination as observed in the present investigation. It was also observed that leaf area and leaf area index were significantly higher in trash incorporation treatment when compared to control. The plant height and number of internodes did not show significant response due to trash incorporation. However, significant yield increment is attributed due to higher single cane weight, cane diameter and also length of

internodes [Table 12, 14 and 16] in addition to increased leaf area and leaf area index [Table 7 and 8]. Significantly better improvements were recorded with all the yield and growth parameters due to incorporation of trash in combination with 100 per cent RDF than their individual applications.

The addition of organic manure to soil in one form or other creates a favourable environment and further increased the degree of response by cane crop to fertiliser application along with them. Addition of fertilisers along with organics enhanced the response considerably. Farm yard manure is the oldest manure known to mankind and is made up of solid excreta or dung of animals, urine and plant remains which are allowed to decay with the help of native soil micro-organisms capable of decomposing complex organic debris into substances that are easily assimilated by plants. Therefore in the present investigation the application of FYM @ 25 t/ha recorded significantly higher cane (84.39 t/ha) and sugar yield (11.39 t/ha) over control (71.49 and 9.34 t/ha, respectively). The

increase in cane and sugar yield was to the tune of 18.04 and 21.95 per cent respectively over no organic. Further FYM @ 25 t/ha along with 100 per cent RDF exerted significantly higher cane and sugar yield over only application of 100 per cent RDF. The responses in the increase of cane and sugar yield were 11.40 and 16.59 per cent respectively. Though FYM contains the essential nutrients required for the crop growth,but the concentration of major [nitrogen, phosphorus, potassium] and secondary [calcium, magnesium, sulphur] nutrients in it are so low that these are to be supplied by inorganic sources to meet the crop requirement. The manurial value of FYM depends on the nature of raw materials used and the extent of its decomposition. Sahi and Rai (1978), Dhillon *et al.* (1993), Jadhav *et al* (1993),Hapase (1993),Turambekar and Lubree (1995) andAnon,(1998a)also obtained similar results due to application of FYM on cane and sugar yields. Further, Tamilsel and Jayabal (1993)opined that application of FYM @12.5t/ha proved insufficient when applied with 100 percent RDF in influencing cane and sugar yield. However, in the present finding, application

cane and sugar yield. However, in the present finding, application of FYM along with 100 per cent RDF exerted significantly higher cane and sugar yield over only 100 per cent RDF as combined application of organic manure and chemical fertilisers have the complementary and supplementary affects with each other and resulted in adequate supply of nutrients (Mathukai *et al.*, 1999). Further Singh and Yadav (1994) on long-term experimental results indicated that FYM was ineffective in alluvial soils which had no limiting factors, like P, Ca and micronutrients and texture, on the other hand, when P_2O_5 was a limiting factor in black soils it proved superior in providing higher tonnage of cane as observed in this experiment.

Significant increase in cane yield due to application of FYM @ 25 t/ha was attributed due to significant increase in number of internode, single cane weight, internodal length and NMC over control. Dhillon *et al.* (1993) also noticed significantly higher NMC due to application of FYM. However, the plant height, cane diameter did not differ significantly due to application of FYM @

25 t/ha. Hapase (1993) also obtained similar results on cane height and diameter. The higher leaf area and leaf area index were indicative of better photosynthetic area which reflected in terms of significantly greater total dry matter production and thereby direct impact on cane yield due to application of FYM @ 25 t/ha. Further all these parameters of yield and growth showed significantly higher when FYM was applied with 100 per cent RDF compared to sole application of 100 per cent RDF. Tambe *et al.* (1998) and Mathukai *et al.* 1999 also observed similar results. Singh and Nambiar (1986) reported boosted cane yield due to application of FYM plus RDF on long term expermental basis which signifies the importance of organic and as well as inorganic fertilisers for increasing and sustaining cane yield.

The recycling of organic wastes through earthworms is called vermitechnology or vermicomposting (Bano and Kale, 1992). The end product of vermitechnology is vermicompost. Application of vermicompost @ 5 t/ha significantly enhanced cane and C. C . S yield over control and the increases were

5.63 and 0.83 t/ha respectively. The response to the tune of 7.88 and 8.89 per cent in terms of cane and sugar yield over no organics treatment was observed due to application of vermicompost. Further application of vermicompost @ 5 t/ha in conjunction with 100 per cent RDF increased the cane and sugar yield to the extent of 3.73 and 4.82 per cent over 100 per cent application of RDF only. Vermicompost in conjunction with 50 per cent RDF and control [no fertiliser] failed to produce significant results. Hapase (1993) obtained greater response to a tune of 12.66 per cent in cane yield owing to application of vermicompost @ 5 t/ha. Similarly Solayappan *et al.* (1995) observed increased cane yield in the range of 8.4 to 34.1 t/ha due to application vermicompost along with biofertilisers. Perumal (1996) reported that application of vermicompost @ 5 t/ha prepared out of pressmud and enriched with nutrients and biofertilisers produced cane yield equivalent to even 50 per cent RDF, which means that chemical fertilisers to the extent of 50 per cent of the recommended dose could safely be reduced contrary to this findings, the lesser cane yield response

due to vermicompost in the present investigation should draw the attention to assess the additional merits of vermicompost over conventional FYM / Composts, because overall nutrient status and comparative performance of the vermicomposts were in similar range of conventional FYM as opined by Shinde *et al.* (1992). Kale *et al.* (1992) felt that vermicompost was like any other organic manure depending on the nature of wastes used as feed for worms and the nutrient status varied. It is their opinion that vermicompost should be used in bulk quantities like other manures for achieving fruitflul results. The picturial view of different treatments are depicted (Plate 1, 2, 3, 4, 5, 6 and 7).

The increase in the cane yield was attributed due to significant increase in yield attributes *viz.*, single cane weight, NMC, cane diameter, length of internode and number of internodes over control. However, plant height did not differ significantly. The increased photosynthetically active area reflected in increased leaf area and leaf area index which augmented the total dry matter production and later on were converted into higher cane yield due to application of vermicompost. Application of

LEGEND

BL = *Bhumilabh*

FYM = Farm Yard Manure

GM = Green Manure (Sunnhemp)

PM = Pressmud

TR = Trash

VC = Vermicompost

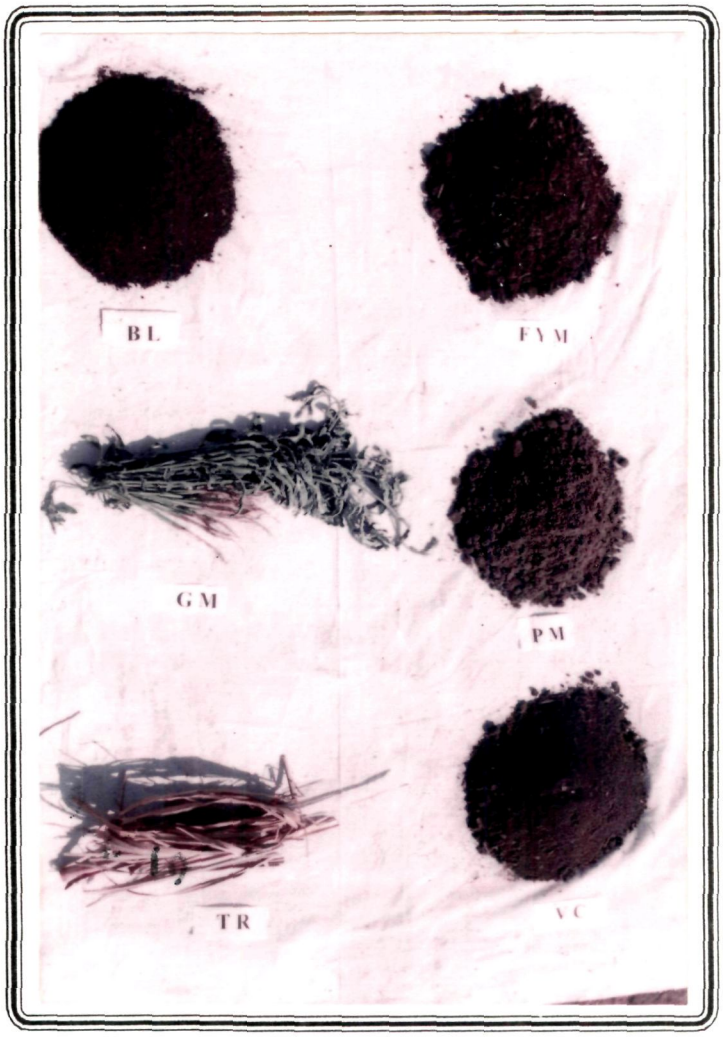

Plate 1. Different organic manures

Plate 2. General view of experiment-1.

Plate 3. Application of organic manures.

Plate 4. Green manure *in situ* + 100% RDF

Plate 5. Green manure *in situ* + 50% RDF

Plate 6. Trash placement

Plate 7. Microbial culture to decompose trash

vermicompost along with 100 per cent RDF significantly increased yield attributes and growth parameters over application of only 100 per cent chemical fertilisers. Perumal (1996) reported similar findings due to application of vermicompost. However, in the present experiment, germination percentage and tiller count of cane failed to exert significant variation due to application of vermicompost and its interaction with chemical fertilisers.

Application of *bhumilabh* @ 10.0 t/ha was responsible for significant increase in cane yield [97.06 t/ha] over control (71.49 t/ha). The increase was by 25.57 t/ha and per cent wise it was to a tune of 35.76 per cent over control. Similarly, the C.C.S yield was maximum due to application of *bhumilabh* @ 10.0 t/ha (13.67 t/ha) over control and the increase was even slightly higher than increase in the cane yield (46.36 per cent) as C.C.S yield is governed by cane yield and the pol per cent in cane juice quality which was found higher due to application of *bhumilabh* over control (Table 17).

It was also observed that application of *bhumilabh* @ 10 t/ha in conjunction with 100 per cent RDF (117.23 t/ha) exerted significantly higher cane yield over only application of 100 per cent RDF and additional yield benefit was 22.23 t/ha. Further *bhumilabh* @ 10 t/ha along with 50 per cent RDF also gave higher cane yield (100.55 t/ha) over 100 per RDF only with additional cane yield of 5.45 t/ha. However, sole 100 per cent RDF and application of *bhumilabh* @ 10 t/ha along with 50 per cent RDF showed on par results. The yield reduction to a tune of 22.81 per cent was observed due to application of *bhumilabh* @ 10 t/ha over 100 per cent RDF alone indicating even the essentiality of inorganic fertilisers for obtaining desired cane yield. Similarly, C.C.S yield obtained was higher when *bhumilabh* along with 100 per cent RDF was applied (16.52) and the higher C.C.S yield was also recorded due to application of *bhumilabh* in conjunction with 50 per cent RDF (14.21) compared to 100 per cent RDF only. The results reveal that application of *bhumilabh* saved 50 per cent RDF apart from improving the cane and C.C.S

yield and its effect was more pronounced when applied along with inorganic fertilisers. Hapase (1993) and Turambekar and Lubree (1995) also observed similar trends of increased cane and C.C.S yield due to application of *bioearth*. The increase in yield due to application of even other composts prepared out of pressmud and distillery spent wash mixture also produced significantly higher cane and C.C.S yield as opined by Jadhav *et al.* (1992) and Dey *et al.* (1997).

Significant increase in cane yield was associated with the significant improvement in the yield attributes viz., cane weight, NMC, length and number of internode, cane diameter and plant height over other organics and control due to application of *bhumilabh*. Increased photosynthetic area measured in terms of leaf area and leaf area index further produced significantly higher dry matter production and translocated to sink (stem) which reflected in cane and sugar yield production. Similarly, all other parameters, viz., yield attributes, growth parameters including dry matter accumulation due to application of

bhumilabh along with 100 per cent RDF found significantly superior over 100 per cent RDF only. The 50 per cent RDF plus *bhumilabh* produced equivalent performance for most of yield attributes, growth parameters with 100 per cent RDF only except in case of NMC where *bhumilabh* along with 100 per cent RDF gave maximum NMC (91,560/ha) however, it was on par with sole 100 per cent RDF. Similar observations were made by Tiwari *et al.* (1997) on cane diameter and plant height and Tambe *et al.* (1998) in case of plant height, cane diameter, number of internodes, NMC and also Hapase (1993) with respect to NMC. However the germination and tiller count did not differ significantly due to application of *bhumilabh*.

The practice of green manuring of soil is as old as agriculture itself. Apart from enrichment of soil nitrogen, green manuring enriches the phosphorus, calcium, sulphur and other mineral contents of soil. Growing green manures as intercrops and incorporating in soil improved sugarcane yield. Sunnhemp grown as intercrop incorporated at 45 days after sowing

significantly enhanced the cane yield (84.25 t/ha) over control and the increase in the yield was to the tune of 17.85 per cent over control. The additional cane tonnage obtained due sunnhemp grown *in situ* was 12.76 t/ha. Similarly C.C.S yield was increased by 13.06 per cent over control. C.C.S yield increase was slightly lesser than cane yield owing to the lower pol values in cane juice.

Sunnhemp grown *in situ* along with 100 per cent RDF exerted significantly higher cane yield (108.01) i.e. with increase of 13.58 per cent over 100 per cent RDF only (95.10). However sunnhemp grown *in situ* along with 50 per cent fertilisers failed to record appreciable results. Similarly, C.C.S yield was significantly higher due to incorporation of sunnhemp along with 100 per RDF compared to 100 per cent RDF only and the increase was to the extent of 12.24 per cent over only 100 per cent RDF. The increase in yield of cane and sugar was attributed due to incorporation of biomass of sunnhemp (dry weight) 4.41 t/ha (3.7 to 4.9 t/ha) which contributed 86.86, 22.24 and 46.19

kg N, P_2O_5 and K_2O per ha (Appendix 1). Similar observations were made by Singh (1963), Hunsigi (1982), Zende *et al.* (1991), Prammanee *et al.* (1996) with sunnhemp and Bose and Thakur (1980), Pandit and Sinha (1981) with cowpea. Shankaraiah and Nagaraju (1997) with frenchbean, Kathiresan and Ayyamperumal (1996), Jayapaul *et al.* (1997) with dhaincha and Nasir Ahmed *et al.* (1998) with dhaincha and sunnhemp.

The increase in cane yield was attributed due to significant change occurred in yield attributes viz., single cane weight, number of internode, diameter of cane and length of internode due to sunnhemp incorporation over control. However, germination percentages, NMC, plant height were not altered. Further, it was observed that significantly lower tiller count (Table 3) was found due to sunnhemp grown *in situ* compared to control and this change was corroborated by Patil (1994) and Gangawar and Sharma (1997). However, incorporation of sunnhemp *in situ* which facilitated the reduction of mortality from tiller to millable canes by providing essential plant nutrients

to intercropped sugarcane (Nasir Ahmed *et al.*, 1998) and also indication that early formed shoots survive better due to their physiological age and vertical growth in search of light which might have suppressed the production of late tillers and also diversion of photosynthates (Jayapaul *et al.*, 1997). Similarly, Zende *et al*, (1991) and Gangawar and Sharma (1997) obtained higher cane diameter and cane height due to green manuring. The leaf area and leaf area index also found significantly higher than control and yielded significantly higher total dry matter, showing a positive correlation with cane yield (Table 43). The yield attributes, growth parameters including total matter accumulation were significantly higher due to incorporation of sunnhemp plus 100 per cent RDF over 100 per cent RDF only. The lower cane yields were obtained due to sunnhemp grown *in situ* and applied with 50 and zero per cent recommended fertilizers.

Reduced levels of chemical fertilisers from 100 per cent RDF to 50 and zero per cent RDF significantly decreased the

cane yield. The reduction in cane yield was 23.19 and 41.43 per cent, respectively. Similarly, the C.C.S yield also decreased by 24.95 and 44.69 per cent due to reduced levels of inorganic fertilisers from 100 per cent RDF to 50 and zero per cent RDF, respectively. The reduced levels of inorganic fertilisers decreased the percentage of C.C.S yield more rapidly than cane yield owing to reduced levels of pol per cent in juice due to insufficient use of inorganic fertilisers. Similarly, reduced levels of inorganic fertilisers significantly reduced the cane and C.C.S yield as reported by Dhillon *et al.* (1993) and also Srivastava *et al.* (1992). Further, the reduction in yield attributes, growth parameters, dry matter accumulation were significantly declined owing to the reduced levels of inorganic fertilisers and these parameters collectively influenced in bringing the significant reduction in cane and sugar yield.

The cane yield showed a positive but significant correlation with tiller count (0.625), number of internode (0.778), length of internode (0.825) and leaf area (0.618) total dry matter

production (0.921), plant height (0.893), cane diameter (0.925) single cane weight (0.884), NMC (0.911) and C.C.S yield (0.961) (Table 43).

The present investigations revealed that of the different organics tested, application of *bhumilabh* @ 10 t/ha enhanced cane yield significantly over all other organics and the maximum increase in cane yield was 35.76 per cent over no organic. Further, it is also worthwhile to observe that application of FYM and green manuring produced equivalent cane yield indicating green manuring forms as an alterative to the shortage availability of FYM. The effect of trash @ 8 t/ha and vermicompost @ 5 t/ha on cane yield was similar which showed that trash as a cheap source of organic manure compared to vermicompost. The highest increase in cane and sugar yield due to application of *bhumilabh* was attributed due to its higher nutrient contents [Appendix. 3] and further it enhanced microbial flora inaddition to improvement on soil properties [Table 20, 21 and 22] and

thereby increased nutrients uptake by sugarcane which in nutshell reflected on higher cane yield [Table.16].

5.1.2 Effect of organic and inorganic fertilisers on cane quality

The juice quality parameters influence the sugar content in the juice. Application of *bhumilabh* @ 10 t/ha significantly increased pol, purity and C.C.S per cent over other organics indicating its role in improving juice quality parameters. This is attributed due to the higher content of P_2O_5 in *bhumilabh* whichhelped in greater purity and pol per cent of cane juice and thereby improving C.C.S per cent of cane juice. Similar results were also reported by Turambekar and Lubree (1995) and Hapase (1993).

The reducing sugars were significantly lower due to application of *bhumilabh* @ 10 t/ha. However, the moisture and fibre content of cane were unaltered due to application of *bhumilabh*. The application of trash, FYM, vermicompost showed better juice quality parameters over control. Similar observations were made by Sahi and Rai (1978) and Mathukia *et al.* (1999).

The other parameter viz., reducing sugars, moisture and fibre per cent in cane did not differ significantly due to application of trash, FYM and vermicompost. However incorporation of sunnhemp significantly reduced the brix, pol, purity and C.C.S per cent over control. This may be due to prolonged supply of nitrogen, to the crop which has adverse effect on juice quality parameters especially when nitrogen was applied at later stages. Zende *et al.* (1991), Nasir Ahmed *et al*, (1998) found similar results for juice quality parameters due to green manuring. Further, there was no significant effect on reducing sugars, moisture and fibre content of cane due to sunnhemp incorporation.

All the organics except green manuring gave higher juice quality parameters when applied along with 100 per cent RDF compared to 100 per cent RDF only (Tables 17 and 18) and further reduction in the levels of chemical fertilisers also significantly proved detrimental to cane juice quality attributes indicating the essentiality of even higher inorganic fertilisers for obtaining better juice quality.

5.1.3 Effect of organic and inorganic fertilisers on economics of sugarcane.

Application of *bhumilabh* @ 10 t/ha realised significantly higher gross returns (Rs. 87,340/ha) and as well net returns (Rs. 58,940) over other organics. The higher returns were to the extect of 23.03 and 13.63 per cent more, respectively over control. The additional net returns realised due to application of *bhumilabh* were Rs.13,990/ha with B:C ratio of 3.08. It was also observed that the significantly higher gross income, net returns and B: C ratio were found due to application *bhumilabh* @ 10 t/ha along with 100 per cent RDF compared to all other treatment combinations. Further gross income and net returns were comparable due to application of *bhumilabh* @ 10 t/ha along with 50 per cent RDF were on par with only 100 per cent RDF indicating 50 per cent saving in the chemical fertilizers. Similarly Jadhav *et al*. (1992) noticed that the application of

compost prepared out of pressmud spentwash was more economical than FYM and chemical fertilisers.

The gross and net income were found on par due to application of FYM and green manuring (sunnhemp) showed on par results as far as gross income and net returns were concerned. However, by virtue of lower cost involved in sunnhemp incorporation, the net returns and B: C ratio (3.64) were higher compared to FYM. Green manuring and FYM in conjunction with 100 per cent RDF individually recorded significantly higher gross income and net returns over 100 per cent RDF alone. Jayapaul *et al.* (1997) and Nasir Ahmed *et al.* (1998) also obtained higher net returns and B: C ratio due to green manuring in sugarcane. Tamilsel and Jayabal (1993) also obtained the higher income due to application of FYM @ 25 t/ha under mulched condition. Incorporation of trash @ 8 t/ha recorded Rs. 5,930 and Rs, 1,800 per ha gross income and net returns respectively and further it also showed significantly higher gross income and net returns when trash incorporated

along with 100 per cent RDF compared to 100 per cent RDF only. Jadhav *et al.* (1993a) also obtained extra profit due to trash plus green manure application. Though the additional gross income of Rs. 5,100/ha was obtained due to application of vermicompost @ 5 t/ha but the net returns were negative (Rs. 4,920 per ha) owing to very high cost of vermicompost and increase in cane yield was marginal. Similarly even application of vermicompost along with 100 per cent RDF also failed to produce extra profit compared to 100 per cent RDF only.

Reduced levels of chemical fertilisers significantly decreased the gross income, net returns and B: C ratio. The decrease in gross income was Rs. 21,600 and Rs. 38,300 per ha due to 50 and 100 per cent reduced levels of inorganic fertilisers respectively. Similarly the net returns were also reduced from by Rs. 19,130 and Rs. 33,770 per ha due to decreased levels of chemical fertiliser to 50 and 100 per cent RDF, respectively (Table 19).

5.1.4 Effect of organic and inorganic fertilisers on nutrient uptake and soil properties

The nutrient uptake of Nitrogen,Phoshorus and Potassium established highly significant positive correlation with cane yield (r=0.939, 0.962 and 0.908, respectively) (Table 44). Among the organics, application of *bhumilabh* @ 10 t/ha recorded significantly maximum uptake of N, P_2O_5 and K_2O over other organics, followed by FYM @ 25 t/ha and green manuring which were found on par in nutrients uptake but in turn they too had higher uptake of all these three nutrients compared to control. Further, trash and vermicompost recorded significantly lower nutrients uptake but were significantly superior compared to control. The higher uptake of nutrients due to green manuring was reported by Kathiresan and Ayyamperumal (1996) and due due to application of FYM by Tamilsel and Jayabal, (1993) and Trivedi *et al.* (1997). Among the interactions, Application of *bhumilabh* @ 10 t/ ha along with 100 per cent RDF exerted significantly higher uptake of N, P_2O_5 and

K_2O over other treatments. The other organics viz., trash, FYM, vermicompost and green manuring along with 100 per cent RDF also exhibited significantly higher uptake of nutrients over application of 100 per cent RDF only. However, the uptake of nutrients due to *bhumilabh* @ 10 t/ha along with 50 per cent RDF showed on par results with application of only 100 per cent RDF. The application of organic in conjunction with higher levels of inorganic fertilisers have favoured the mineralisation process of nutrients and thereby making them more available for rapid uptake and translocation by plant (Table 9, 10 and 11).

The soil reaction was not influenced by organic or inorganic fertilisers and also due to their interactions. Shankariah and Nagaraju (1997) while reviewing long term experimental results indicated the influence of organics in improving the pH of acidic soils. Similarly EC also failed to show any significant change due to the use of these organics, inorganic and their interactions.

The organic carbon and water holding capacity were significantly higher due to application of organics. Among the

organics, *bhumilabh*, trash FYM, green manuring and vermicompost increased the organic carbon by 61.4, 36.11, 36.11, 25.00 and 22.22 over control respectively. The higher WHC was observed due to application of *bhumilabh* @ 10 t/ha (37.47 per cent) followed by FYM, trash, vermicompost and green manuring in the descending order and further bulk density (g/cc) was significantly lower due to application of *bhumilabh* (1.34), green manuring (1.38), trash (1.36) and FYM (1.37) compared to control (1.44) and also vermicompost (1.42). Shankaraiah and Nagaraju (1997) obtained similar results due to green manuring. Perumal (1996) obtained higher organic carbon due to vermicompost application. Kumar and Sagwal (1998) observed higher WHC and organic carbon due to trash incorporation. Similar results were also observed by Rabindra *et al.* (1985) and Hapase (1993) and Anon, (1994). Application of all organics in conjunction with inorganic fertilisers improved organic carbon, bulk density and WHC of the soil compared to the sole application of inorganic fertilisers.

The available N, P_2O_5 and K_2O in the soil after harvest of cane significantly increased due to application of organics. Among organics the maximum available N, P_2O_5 and K_2O was noticed due to application of *bhumilabh* @ 10 t/ha, the increase was 47.39, 116.75 and 43.54 per cent, respectively over control and the least increase of 16.77, 37.16 and 34.02 per cent respectively was observed due to vermicompost application over control. Similarly, the interactions due to organic and inorganic fertilisers on nutrient availability in the soil were significant and the highest available nutrient increase was observed in case of *bhumilabh* along with 100 per cent RDF followed by application of trash, FYM, green manuring, vermicompost along with 100 per cent RDF and *bhumilabh* coupled with 50 per cent RDF, in the order for these treatments increase in N, P_2O_5 and K_2O in the descending order over only 100 per cent RDF respectively. The observations made by Turambekar and Lubree (1995) were also similar due to application of *bioearth*. Further, Hapase (1993) also expressed the same opinion while, Anon. (1994), Jadhav *et al.*

(1993a), Shinde *et al.* (1984), Buragonhain and Medhi (1999) obtained consonant results. The increase in available nutrients due to green manuring to sugarcane is associated due to immobilisation forced by green manuring itself or due to reduced leaching losses of nitrate N below 10 cm layer which helped in increased cane yield and this later on attributed to increased mineralisation of N and P and dehydrogenase activity which ensured steady release of nitrate N as expressed by Perumal (1996). Despite this green manuring had better soil structure and helped in release of enzymes and vitamins during decomposition of legume roots *in situ* (Yadav and Prasad, 1986a). Kumar and Sagwal (1998) found improvements in soil structure due to trash incorporation. These improvements were due to excreted microbial cell, decomposition product which act as binding agents for stable aggregates. Significantly positive correlation established for organic carbon, available N, P_2O_5 and K_2O also lends support for significant increase in cane yield due to improvement in all these properties of the soil. Further the

significant negative correlation (-0.769) was established for bulk density with cane yield indicating lower bulk density due to organics enhanced the cane yield owing to greater microbial activities and more mineralisation of nutrients (Table 4.3a)

Reduced levels of inorganic fertilisers decreased organic carbon, available N, P_2O_5 and K_2O due to removal of nutrients by crops and also under supply of nutrient. The soil reaction and EC were unaltered due to varied levels of inorganic fertilisers and the bulk density also improved due to 100 per cent RDF over 50 and zero per cent RDF.

Microbial population in the soil indicates the soil health. Among organics significantly higher microbial population of P-solubilisers, actinomycetes, fungi and azotobacteria were observed due application of *bhumilabh* @ 10 t/ha over all other organics. Further all the organics recorded significantly higher microbial population over control. Among organics, green manuring recorded the lowest microbial population indicating microbial presence especially as trash, vermicompost, FYM and

also *bhumilabh*, which helped to further increase their population in the soil over green manuring. Application of all organics in conjunction with 100 as well as 50 per cent RDF significantly increased the population of all microbes under study. The increased levels of P-solubilisers and fungi established highly significant (0.704 and 0.627) correlation. Actinomycetes (0.565) had significant positive relation with cane yield, however azotobacteria did not establish significant correlation with cane yield (Table 45). The soil organic carbon with addition of the organics played vital role for enhanced microbial activity. Anger *et al.* (1995) was of the opinion that dynamics of soil organic matter and microbial biomass were most important and had greater influence on soil fertility enrichment. Perumal (1996) also observed higher microbial count due to application of vermicompost. Gaur and Mukherjee (1980) noticed higher microbial count due to trash mulching owing to regulation of temperature, conservation of moisture and improvement in humic content of soil which are important factors in increasing

these numbers and activity and hence greater nutrient availability. Similarly, Jadhav (1996) obtained higher microbial population due to trash incorporation along with microbial culture.

The increased levels of actinomycetes are more responsible for degradation of complex organic matter like lignin and cellulose and also produce antibiotics that have powerful antifungal and antibacterial properties. Azotobacteria have also been found to be highly effective in stimulating growth of sugarcane (Dobereiner and Day, 1975) as they produce vitamins and growth regulating substances like gibberellins, auxins and cytokinins. (Rangaswami, 1966) and increase in fungal population is also known to help in degradation of organic matter, maintenance of humic substances, degradation of complex molecules or agro-chemicals and also by arresting growth and development of certain pathogenic fungi by competition, antagonism and hyperparasitism.

EXPERIMENT II.

5.2 PERFORMANCE OF *BHUMILABH* VIS-A-VIS PRESSMUD IN AN INTEGRATED NUTRIENT MANAGEMENT SYSTEM OF SUGARCANE

Pressmud is an important sugarcane by-product. About 3-4 per cent of pressmud is obtained on cane weight basis. Its economic importance lies in the fertiliser value as it contains 1-1.5 per cent N, 2.5-3.5 per cent P_2O_5 and 0.5-0.8 per cent K_2O with 35 to 37 per cent organic carbon (Kale, 1981). Hitherto, the raw pressmud was directly used as an organic manure in the crop production. However, a fortified product *"bhumilabh"* was tried to know its optimum levels of application and its efficiency with pressmud in conjunction with inorganic fertilisers on various yield and quality parameters of sugarcane, economics and soil properties. The response of sugarcane to pressmud and *bhumilabh* is presented in Plates 8 and 9.

Plate 8. General view of experiment-2.

Plate 9. ***Bhumilabh*** **@ 5t/ha + 100% RDF and only 100% RDF.**

5.2.1 Effect of organic and inorganic fertilisers on cane and sugar yield, yield attributes and growth of sugarcane.

To realise the acceptable cane and sugar yield in different agro-climatic conditions, various agro-techniques play pivotal role and are known to bring significant differences in cane productivity. In the investigation application of *bhumilabh* @ 5 t/ha augmented cane yield (101.99 t/ha) significantly and the cane yield increase was to an extent of 26.9 per cent over control (80.34 t/ha). Similar results were reported by Turàmbekar and Lubree (1995) Jadhav *et al.* (1992). The increase in cane yield was to the tune of 21.6 t/ha due to application of *bhumilabh* @ 5 t/ha. These results are also in conformity with the findings of Zende *et al.* (1991). Hapase (1993) Jadhav *et al.* (1993) and Dey *et al.* (1997). The next highest cane yield was obtained due to application of pressmud @ 25 t/ha (91.00 t/ha) which was found significantly superior over pressmud @ 12.5 t/ha (83.39t/ha) and also *bhumilabh* @ 2.5t /ha (84.31 t/ ha) and control. The

increase in cane yield due to application of pressmud @ 25 t/ha was by 10.68 t/ha over control. Though numerically higher cane yield was obtained in the treatments of *bhumilabh* @ 2.5 t/ha and pressmud @ 12.5 t/ha but they failed to produce significant change in the cane yield owing to their insufficient quantity over no organic treatment. The findings of Sahi and Rai (1978), Patil and Shingate (1981) and Singh *et al.* (1995) also corroborated similar reports with respect to sugarcane response to various rates of pressmud. However, compared to application of *bhumilabh* @ 5.0 t/ha, the effect of pressmud even at the rate of 25 t/ha was less pronounced on cane yield. This may be attributed to the better dispersion and reversible flocculation of colloidal matter of *bhumilabh* than pressmud Tiwari *et al.* (1997) compared the decomposed compost with pressmud and noted the presence of wax in the pressmud [to the extent of 15 per cent] which slowed down the entire decomposition process of pressmud ultimately blocking the readily available nutrient flow in the soil (Patil and Kale, 1983). In addition, it is very much

essential to add appropriate microbial culture to manures having high cellulolytic composition [Anon, 1995b).

The inorganic fertilisers play significant role in influencing the cane yield. The maximum cane yield was obtained with application of 100 per cent RDF (112.11 t/ha). Decrease in the application of inorganic fertilisers from 100 to 50 and further no fertilisers decreased the cane yield significantly and the reduction in the cane yield was 13.83, 16.20 and 21.71 t/ha respectively. Yadav and Prasad (1986) also observed significant reduction in cane yield due to lower doses of chemical fertilisers indicating the essentiality of chemical fertilisers for obtaining desired cane yield.

The interaction effects were significant. It was vividly observed that application of *bhumilabh* @ 5 t/ha along with 100 per cent RDF significantly enhanced cane yield and increase was by 23.6 per cent over sole 100 per cent RDF. Further it was observed that application of *bhumilabh* @ 5 t/ha in conjunction with 75 per cent RDF produced equivalent yields as obtained due

to pressmud @ 25 t/ha along with 100 and 50 per cent RDF and also *bhumilabh* coupled with 50 per cent RDF and also *bhumilabh* coupled with 50 per cent RDF indicating that application of *bhumilabh* @ 5 t/ha in conjunction with 75 per cent RDF produced more or equivalent yield as obtained due to 100 per cent RDF only. This proved that in addition to improvement in cane yield there was also saving of 25 per cent inorganic fertilisers due to use of *bhumilabh* @ 5 t/ha. Similar results were also observed due to use of pressmud @ 25 t/ha. These results are in line with the findings of Dineshkumar *et al.* (1996), Durai (1997) and Patil *et al.* (1978) due to application of pressmud and also Hapase (1993) and Dey *et al.* (1997) due to use of pressmud based biocompost.

The C.C.S yield or sugar yield is an indicator of sugar production per hectare per unit time and it has a direct relevance in the net income realisation of sugar industry and farmers too. The C.C.S yield was enhanced to the tune 32.98 per cent due to application of *bhumilabh* @ 5 t/ha followed by pressmud @ 25

t/ha (21.50%) over control. These results confirm the data of Jadhav *et al.* (1992), Dey *et al.* (1997) and Tiwari *et al.* (1997). Lower doses of pressmud (12.50 t/ha] and *bhumilabh* (2.5 t/ha) produced significantly higher C.C.S yield over control. Application of inorganic fertilisers are known to decrease significantly the C.C.S yield. Since, the C.C.S yield is the product of cane and pol per cent in juice the variables affecting these two parameters also influence the C.C.S yield.

The interaction effects were found significant. Application of *bhumilabh* @ 5 t/ha in conjunction with 100 and 75 per cent RDF showed significantly higher C.C.S yield over sole 100 per cent RDF. Similar trends were also observed in case of pressmud @ 25 t/ha along with 100 and 75 per cent RDF. The higher levels of C.C.S yield was recorded due to application of organics when applied with chemical fertilisers than application of them in isolation revealing their complimentary and supplementary influence on cane yield as well as juice quality parameters (Table 36).

The higher cane productivity is mainly attributed due to cane associated parameters viz., plant height, single cane weight, cane diameter, NMC, C.C.S yield, leaf area and leaf area index and accumulation and distribution of photosynthates in leaf and stem which measured interms of dry matter production had significant effect on cane yield (Table 43).

The response of sugarcane to *bhumilabh* @ 5 t/ha and pressmud @ 25 t/ha was traced back with trends obtained in case of plant height, single cane weight and cane diameter and further in total dry matter production and also to leaf area and leaf area index which were greatly influenced over control and had significant correlation with cane yield. These observations confirm the results of Zende *et al.* (1991), Dineshkumar (1996), Tiwari *et al.* (1997) and Singh *et al.* (1995). However NMC, number of internodes, length of internode, tiller count and germination per cent failed to exhibit significant change due to use of both these organics. Zende *et al.* (1991) also observed similar trend with these parameters. The significantiy higher

plant height, length of internode and number of internodes caused higher cane yield due to higher levels of chemical fertilisers application and these parameters also showed significantly lower values as the dose of inorganic fertilisers decreased and it reflected proportionately interms of cane yield.

Except the length of internode, the number of internodes, tiller count and germination exerted significantly superior values leading to significantly higher cane yield due to use of *bhumilabh* @ 5 t/ha and pressmud @ 25 t/ha along with 100 and 75 per cent RDF over fertilisers only. These results are in line with the results of Tambe *et al.* (1998), Tiwari *et al.* (1997) and Singh *et al.* (1995).

5.2.2 Effect of organic and inorganic fertilisers on quality parameters

The quality parameters have major role in influencing sugar yield. Application of pressmud @ 12.5 and 25 t/ha exerted significantly higher pol, purity, C.C.S per cent values over control and these results are in consonance with the observations made

by Patil and Shingate (1981), Patil and Kale (1983) and Singh *et al.* (1995) and they opined that pressmud is a rich source of P_2O_5 and its higher presence in the juice enhances purity of cane juice thereby increasing recoverable sucrose in the juice in the form of C.C.S per cent. Other parameters, viz., brix, reducing sugars, fibre and moisture per cent did not show significant variation due to application of pressmud. Sahi and Rai (1978), Zende *et al.* (1991) and Bhanavase *et al.* (1996) also found nonsignificant results for brix and reducing sugars of cane juice due to application of pressmud.

Application of *bhumilabh* (@ 5 and 2.5 t/ha) had also significant effect on juice quality parameters viz., pol, C.C.S and purity per cent over control. These findings are in conformity with the observations made by Jadhav *et al.* (1993a) and Turambekar and Lubree (1995). The higher pol, C.C.S and purity per cent recorded pertains to better photosynthates and their translocation and accumulation in the form of sucrose in the juice of sugarcane as opined by Tambe *et al.* (1998). However,

other parameter viz., reducing sugars, fibre and moisture did not differ significantly.

Reduction in the level of fertiliser application affected adversely the juice quality parameters viz., brix, and pol, C.C.S per cent. However purity, reducing sugars and moisture per cent were unaltered. Therefore to maintain optimum juice quality parameters application of chemical fertilisers is inevitable.

The juice quality parameters except purity did exert significant effect due to interaction of organic and inorganic fertilisers. Application of both pressmud and *bhumilabh* in conjunction with inorganic fertilisers produced significantly superior juice quality parameters compared to sole application of inorganic fertilisers Patil and Kale (1983) and Tambe *et al.* (1998) also reported similar results and it was found that reducing sugars were significantly and negatively correlated with cane yield (-0.587) (Table 43a], while fibre and moisture per cent were unaffected due to interactions (Table 38).

5.2.3 Effect of organic and inorganic fertilisers on economics of sugarcane

The gross income due to application of *bhumilabh* @ 5 t/ha was maximum (Rs. 91,790/ha) and the net increase was to the tune of Rs. 19,500/ha over control. Application of pressmud @ 25 t/ha also enhanced gross income by Rs. 12,620/ha over control and further there was increase in gross income by Rs. 2,800 and Rs. 3,630/ha due to application of pressmud (@ 12.5 t/ha) and *bhumilabh* (@ 2.5 t/ha) respectively.

Reduction in RDF significantly reduced the gross income in sugarcane and it was observed that the loss in gross income were Rs. 12,760, 29,020 and 47,470 per ha due to 25, 50 and 100 per cent reduction in levels of RDF, respectively.

The interaction effects for gross income differed significantly. The maximum gross return was recorded due to application of *bhumilabh* (@ 5 t/ha) along with 100 per cent RDF (Rs. 22,250/ha) followed by pressmud @ 25 t/ha plus 100 per

cent RDF (Rs. 8,800/ha) over 100 per cent RDF alone. The negative gross returns were observed due to reduced levels of inorganic fertilisers even in conjunction with organic manures.

The maximum net returns were observed due to application of *bhumilabh* @ 5 t/ha (Rs. 15,010/ha) inspite of its high cost of Rs. 900/t (Annexure.5) and followed by pressmud @ 25 t/ha (Rs. 6,310/ha). The increase in the net returns was also observed due to *bhumilabh* @ 2.5 t/ha but it was very marginal (Rs. 1,070/ha). Significant reduction in net returns was observed due to reduced levels of inorganic fertilisers.

The highest net return was to the tune of Rs. 17,760/ha and then followed Rs. 3,240 and Rs. 2,560/ha due to application of *bhumilabh* @ 5 t/ha along with 100 and 50 per cent RDF and pressmud @ 25 t/ha plus 100 per cent RDF, respectively over only application of 100 per cent RDF.

Significantly the highest B: C ratio (3.80) was observed due to application of *bhumilabh* @ 5 t/ha where as, application of

pressmud @ 25 and 12.5 t/ha and *bhumilabh* @ 2.5 t/ha recorded significantly lower B: C ratio compared to control (3.69). Reduced levels of inorganic fertilisers also reduced B: C ratio significantly with lowest B: C ratio of 2.72 due to no fertiliser application.

The B: C ratio was significantly superior due to application of *bhumilabh* @ 5 t/ha plus 100 per cent RDF (4.97) over 100 per cent RDF only. Other combinations did not differ significantly even for different levels of pressmud application also (Table 39). In general, it was observed that the net returns were high in case of ratoon cane than plant owing to its lower cost of production .All these findings lend support of the observation made by Rai *et al.* (1980], Singh *et al.* (1995) and Anon (1995a) with respect to pressmud on the contrary, Jadhav *et al.* (1992) obtained more economical returns due to application of compost prepared out of pressmud and distillery spent wash as observed in the present investigation due to application of *bhumilabh.*

5.2.4 Effect of organic and inorganic fertilisers on nutrient uptake and soil properties

The nutrient uptake by sugarcane was significantly higher due to use of organic and inorganic fertilisers. Major three nutrients uptake were found significantly higher due to application of *bhumilabh* @ 5 t/ha over control and they were equivalent to application of pressmud @ 25 t/ha. The nutrient uptake was reduced considerably due to reduction in application of inorganic fertilisers. The interaction effects on these nutrients uptake were found significant and it was observed that application of organics coupled with 100 per cent RDF and 75 per cent RDF were significantly exerted higher uptake over sole RDF. The significant nutrient uptake was attributed due to significant increase in total dry matter production. The uptake of N, P_2O_5 and K_2O was highly correlated with cane yield (Table 44) and uptake of these nutrients may be also higher due to application of organics owing to greater mineralization of

nutrients in presence of higher microbial population as evidenced by significantly the higher nutrient availability of N, P_2O_5 and K_2O in the soils after harvest of plant and ratoon cane due to application of *bhumilabh* and pressmud (Table 41). Tambe *et al.* (1998) also obtained significantly increased uptake of N, P_2O_5 and K_2O due to application of biocompost. Similarly, Tiwari *et al.* (1997) reported significantly higher uptake of N, P_2O_5 and K_2O due to application of pressmud. They opined that the synergistic effect of N and P might have enhanced the total uptake of both these nutrients. Similar trend was also reported by Bhanavase *et al.* (1996).

The soil reaction and EC did not differ significantly either due to organic or inorganic fertilisers and their interaction effects. However, orgainc carbon, bulk density, WHC and available N, P_2O_5 and K_2O in the soil differed significantly. Application of organic manures both pressmud and *bhumilabh* (25 and 5 t/ha, respectively) increased organic carbon, available

N, P_2O_5 and K_2O by 52.78 and 30.56, 36.99 and 30.39, 113.93 and 81.67 and 32.13 and 24.05 per cent respectively over control. The bulk density was significantly lower due to application of pressmud @ 25 t/ha (1.36 g/cc) and *bhumilabh* @ 5 t/ha (1.38 g/cc) over control (1.44 g/cc) (Table 40 and 41). These results are in accordance with the findings of Sapkal (1974), Hapase (1993), Jadhav *et al.* (1993) and Turambekar and Lubree (1995). Further it was also observed that reduced levels of inorganic fertilisers significantly reduced the organic carbon, available N, P_2O_5 and K_2O in the soil due to the depletion of nutrients by crop and insufficient nutrient supply. The overall decline in crop productivity in long term trials, inspite of applying the recommended dose of NPK fertilisers to rice was associated mainly with less enhanced soil fertility according to Pillai and Palaniappan (1994) as the crop removal far exceeded the rate of nutrient replenishment.

The interaction effects due to organic and inorganic fertilisers were also found significant on soil properties. The

organic carbon, WHC and available N, P_2O_5 and K_2O exerted significantly higher value due to application of pressmud @ 25 t/ha and *bhumilabh* @ 5 t/ha in conjunction with 100 and 75 per cent RDF over 100 per cent RDF only. Similar observations were made by Sapkal (1974) and also Turambekar and Lubree (1995). The lower bulk density was also obtained due to higher doses of pressmud [@ 25 t/ha]and *bhumilabh* [5 t/ha] along with 100 and 75 per cent RDF over 100 per cent RDF alone. Positive correlation existed between cane yield and organic carbon, available N, P_2O_5 and K_2O. However, significantly negative correlation was established with bulk density (-0.571) (Table 44).

For assessing the good health of soil, microbial flora is an important parameter. Application of *bhumilabh* @ 5 t/ha significantly exerted higher P-solubilisers, actinomycetes, azotobacter and fungi over control. Further application of pressmud @ 25 t/ha also slightly enhanced microbial count over control. The increased of microbial count due to application of *bhumilabh* have helped in greater mineralization of nutrients and considerable availability of the nutrients causing higher nutrient

uptake and inturn produced maximum cane yield. All microbes studied were also established positive correlation with cane yield (Table 44). Jadhav *et al.* (1993b) also observed considerable improvement in microbial population of azotobacter, fungi and actinomycetes due to application of pressmud-spentwash based biocompost.

The reduction in inorganic fertilisers levels also significantly declined the microbial count of P-solubilisers, actinomycetes, azotobacteria and fungi due to reduced nutrient supply even for the microbial growth in the soil.

The interaction effects produced pronounced effect of these microbial counts wherever *bhumilabh* was applied in conjunction with chemical fertilisers rather than either of their individual application. These microbial counts were also found higher due to pressmud application compared to control but less number than *bhumilabh* application since *bhumilabh* itself enriched with microbes (Table 42).

SUMMARY

VI. SUMMARY

Two experiments were carried out at the Karnataka Institute of Applied Agricultural Research, Sameerwadi (Dist. Bagalkot) during 1996-97 and 1997-98 seasons on sustainable production of sugarcane through integrated nutrient management system.

1. Integrated nutrient management in sugarcane

Five organics, viz., sugarcane trash (@ 8 t/ha), FYM (@ 25 t/ha), vermicompost (@ 5 t/ha), *bhumilabh* (@ 10 t/ha) and green manuring (sunnhemp) along with no organic (control) were tried in main plots and three levels of chemical fertilisers (100, 50 per cent RDF and control) in subplots in split-plot design with four replications were evaluated on plant and ratoon sugarcane crops during 1996-97 and 1997-98 respectively.

II. Performance of *bhumilabh* vis-a-vis pressmud in an integrated nutrient management system of sugarcane.

Two levels of pressmud (@ 12.5 and 25 t/ha) and *bhumilabh* (@ 2.5 and 5.0 t/ha) along with no organic (control) were assigned to main plots and four levels of chemical fertilisers (100, 75, 50 per cent RDF and no fertiliser] in sub plot were replicated

thrice in split plot design and tried on plant and ratoon crops of sugarcane during 1997 and 1998. The salient findings of the study are summarised below.

1. The organic manures viz., *bhumilabh* @ 10 t/ha, FYM @ 25 t/ha, green manuring (sunnhemp), trash incorporation @ 8 t/ha and vermicompost @ 5 t/ha increased cane yield respectively to the extent of 35.75, 18.04, 17.85, 8.98 and 7.88 per cent than control.

2. The C.C.S yield was maximum with *bhumilabh* @ 10 t/ha (13.67 t/ha) (46.36 per cent increase over control) followed by FYM, green manuring, trash incorporation and vermicompost with respective increase by 21.95, 13.06, 11.67 and 8.89 per cent over no organics.

3. Application of *bhumilabh* @ 10 t/ha in conjunction with 100 per RDF gave significantly maximum cane yield (117.23) and C.C.S yield (16.52) over other treatment combinations but was on par with 50 per cent RDF plus *bhumilabh* @ 10 t/ha which indicates that 50 per cent fertilizers could be saved with application of *bhumilabh*.

4. Application of FYM, green manuring, trash incorporation and vermicompost along with 100 per cent RDF exerted

significantly higher cane and C.C.S yield over 100 per cent RDF alone.

5. The nutrients uptake viz., N, P and K were significantly superior due to application *bhumilabh* over other organics and further produced significantly higher nutrients uptake over no organics. Integrated use of organic and inorganic fertilisers increased the uptake of nutrients than application of fertilisers alone.

6. Application FYM and green manuring (sunnhemp) were on par but produced significantly higher cane and C.C.S yield over vermicompost and trash incorporation and latter two also were on par with each other.

7. Total dry matter production was significantly higher due to application of *bhumilabh* over other treatments and further other all organics produced significantly more total dry matter accumulation over no organics. Application of organics along with 100 per cent fertilisers exerted significantly higher total dry matter accumulation over 100 per cent RDF only.

8. Juice quality parameters viz., brix, pol, C.C.S per cent, purity and reducing sugars were superior due to application of all

organics except green manuring (sunnhemp) over no organics. However, fibre and moisture per cent of cane were unaltered. Improvement in juice quality was also observed due to application of organics along with 100 per cent RDF compared to only RDF.

9. The additional net returns of Rs. 13,630, Rs. 9,630, Rs. 5,340 and Rs, 1,800 per ha were realised due to application of *bhumilabh*, green manuring, FYM and trash incorporation with B: C ratio of 3.08, 3.64, 2.99 and 3.02 respectively.

10. Reduction in bulk density was significant due to application of *bhumilabh* @ 10 t/ha, green manuring, and FYM and trash incorporation over no organics and vermicompost failed to influence the bulk density. However, soil reaction and electrical conductivity did not differ significantly.

11. The increase in organic carbon, available N, P_2O_5 and K_2O were 36.11, 36.11, 22.22, 61.11, 25, 39.60, 17.99, 16.77, 47.39, 18.29, 100.24, 82.53, 37.16, 116.75, 45.56, 39.79, 33.31, 34.02, 43.54 and 28.72 per cent due to incorporation of trash @ 8 t/ha, FYM @ 25 t/ha, vermicompost @ 5 t/ha, *bhumilabh* @ 10 t/ha and green manuring (sunnhemp)

respectively. The improvements in these soil quality parameters were also observed due to application of organics in conjunction with 100 per cent RDF over only 100 per cent RDF and also due to application of *bhumilabh* @ 5 t/ha and pressmud @ 12.5 and 25 t/ha.

12. Among organics, application of *bhumilabh* recorded highest P-solubilizers, actinomycetes, fungi and azotobacteria count and further other organics including pressmud except green manuring also produced higher microbial count of these microorganisms compared to no organic treatment.

13. Substantial decrease in cane and sugar yield to the extent of 41.43 and 44.69 per cent respectively was observed due to chemical fertilisers. Further, 50 per cent RDF caused 23.19 and 24.95 reduction in both cane and sugar yield respectively leading to a net return loss of Rs. 19,130 and Rs. 33,770 per ha due to 50 per cent RDF and without chemical fertilisers compared to 100 per cent RDF. Observations on yield attributes, growth parameters and nutrient uptake were also followed similar trends.

14.Due to reduced levels of chemical fertilisers without altering the soil pH and EC, there was significant reduction in organic carbon, available N, P_2O_5, K_2O and WHC with increase in the bulk density of soil.

15.Application of *bhumilabh* @ 5 t/ha recorded significantly higher cane and sugar yield and the increase was 26.95 and 32.98 per cent respectively overall other organics. Lower doses of *bhumilabh* and pressmud (@ 2.5 t/ha, @ 12.5 t/ha, respectively) failed to exhibit significant effect on cane yield and but significantly increased C.C.S yield over control.

16.Significantly higher cane and sugar (91.02 t/ha, 12.71 t/ha, respectively) yield were obtained due to application of pressmud @ 25 t/ha over no organic but it was significantly lower than *bhumilabh* @ 5 t/ha. Lower doses of pressmud (@12.5 t/ha) and *bhumilabh* [@ 2.5 t/ha] proved insufficient in exerting significant variation on cane and sugar yield.

17.The maximum cane and sugar (129.41 t/ha, 18.29 t/ha, respectively) yield was obtained due to application of *bhumilabh* along with 100 per cent RDF and the increase was to the tune of 23.62 and 27.19 per cent respectively over only

100 per cent RDF. Similarly application of pressmud along with 100 per cent RDF recorded extra cane and sugar of 5.08 t/ha and 3.13 t/ha respectively.

18. Application of *bhumilabh* @ 5 t/ha along with 75 per cent RDF produced equivalent yield of cane and sugar as obtained due to that of only 100 per RDF with additional cane and sugar yield benefit of 7.15 and 1.02 t/ha respectively.

19. The nutrients uptake viz., N, P_2O_5 and K_2O was significantly higher due to application of *bhumilabh* @ 5 t/ha and pressmud (@ 25 t/ha) and also their use in conjunction with 100 per cent RDF.

20. The total dry matter production was maximum with application of *bhumilabh* (@ 5 t/ha) and pressmud (@ 25 t/ha) over other lower doses of both organics and only chemical fertilisers. Significantly higher total dry matter production was also observed due to application of *bhumilabh* and pressmud @ 5 and 25 t/ha respectively along with 100 per cent RDF.

21. The juice quality parameters viz., brix, pol, C.C.S and purity per cent were improved due to application of pressmud and *bhumilabh* over control and the improvement was more

pronounced due to application pressmud than *bhumilabh*. reducing sugars, moisture and fibre per cent did not show significant difference.

22.The reduced levels of inorganic fertilizers by 25, 50 per cent RDF and no fertilisers decreased cane and sugar yield to the extent of 12.34, 26.79 and 46.15 and 15.85, 31.82 and 51.90 per cent, respectively. The gross income (Rs. 19,500/ha) and net returns (Rs. 15,000/ha) and B: C ratio (3.80) were highest due to application of *bhumilabh* @ 5 t/ha over other doses of pressmud and *bhumilabh* and also no organic treatment.

23.The highest net returns of Rs. 17,760 per ha were obtained due to application of *bhumilabh* @ 5 t/ha along with 100 per cent RDF indicating saving of 25 per cent of chemical fertilisers with additional net returns of Rs. 3,240 per ha.

RESULTS OF PRACTICAL UTILITY

1. *Bhumilabh* @ 10 t/ha can be successfully used in sugarcane for enhancement of cane and C.C.S productivity.
2. Application of bhumilabh @ 10 t/ha in conjunction with 50 per RDF produces equivalent cane and C.C.S yield as 100 per cent RDF indicating 50 per cent saving in inorganic fertilisers.

3. Application of FYM @ 25 t/ha and green manuring (sunnhemp) were found equally effective in increasing cane productivity showing green manuring is an alternative to FYM.

4. Trash incorporation @ 8 t/ha (Urea and microbial culture @ 8 kg and one kg/tonne of trash respectively) and vermicompost @ 5 t/ha significantly enhanced cane and C.C.S yield in isolation and also integrated with inorganic fertilisers.

5. Substantial improvement in cane and C.C.S yield was obtained when all the organics were used in conjunction with inorganic fertilisers compared to inorganic fertilisers alone.

6. Application of *bhumilabh* @ 5 t/ha was more effective than raw pressmud @ 25 t/ha in enhancing cane and sugar yield.

7. Pronounced effect on biological properties of the soil was observed due to use of organics in general and *bhumilabh* in particular compared with other organics.

8. Reduction in the inorganic fertiliser's application decreased cane and C.C.S yield significantly inexclusion to the reduced soil fertility status.

1. Recommendations need to be generated on cropping system, basis especially when organic manures are used in sugarcane.

2. The requirement of organic along with inorganic fertilisers for targeted cane yield should to be studied.

3. To optimise returns and quantify the long-term gains from different combinations of organic and inorganic sources in sugarcane based cropping systems.

4. Long range studies on integrated use of crop residue and organic manures on dynamics of soil organic matter and nutrient dynamics need to be taken-up.

5. Studies need to be made on soil and plant and the allelochemicals involved in use of trash in sugarcane.

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APPENDICES

Appendix 1. Fresh weight , dry weight [t/ha], chemical composition [%] and contribution of nutrients [kg/ha] by sunnhemp at 45 DAS grown *in situ* in sugarcane.

Treatment	Dry matter with [t/ha]	% of nutrients			Contribution [kg/ha]			Fresh weight[t/ha]
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	
0 Per cent RDF	3.78	1.85	0.48	1.10	69.93	18.14	41.58	12.60
50 per cent RDF	4.47	1.93	0.52	1.68	86.27	23.24	48.28	15.40
100 per cent RDF	4.97	2.10	0.51	0.98	104.37	25.35	48.71	18.41
Average	4.41	1.96	0.50	1.05	86.86	22.24	46.19	15.47

DAS: Days after sowing

RDF: Recommended dose of fertilizer.

Appendix 2. Price of inputs and outputs used in calculating cost of cultivation and returns.

Inputs.	Unit	Price [Rs]
Seed		
Sugarcane seed	t	900
Sunnhemp seed	kg	15
Nutrients		
Nitrogen	kg	8.62
Phosphorus	kg	17.5
Potash	kg	6.16
Pesticides/Fungicide		
Degrading culture	kg	50
Bhumilabh	t	900
Vermicompost	t	2000
Trash	t	10
Farm yard manure	t	100
Pressmud	t	200
Labour		
Male		30
Female		20
Bullock pair	Rs.	120/-per day
Tractor ploughing	Rs.	1500/- per hectare
Tractor disking	Rs.	625/- per hectare
Tractor ridging	Rs.	625/- per hectare
B. Out puts		
Item		
Sugarcane	Rs. per tonne	Rs. 900/-

Appendix 3.Chemical composition of different organic manures

Sl.No	Name of the organic manure	% of nutrients			Organic carbon[%]
		N	P_2O_5	K_2O	
1	Farm Yard Manure	0.64	0.11	0.50	28.30
2	Trash	0.35	0.10	0.60	39.59
3	Vermicompost	0.89	0.14	1.02	23.20
4	Bhumilabh	1.80	2.47	2.90	30.70
5	Pressmud	1.20	3.88	1.40	35.20
6	Green manure [sunnhemp]	1.85	0.47	1.25	29.20

Appendix 4. The cost of cultivation of different treatment combinations [Experiment I]

Treatment	Plant [Rs.'000/ha]	Ratoon [Rs.'000/ha]	Mean [Rs.'000/ha]
A.Organic manures			
TR	26.50	20.25	23.38
FYM	28.75	22.50	25.63
VC	32.00	26.25	29.38
BL	31.33	25.25	28.21
GM	24.00	17.25	20.88
NO	22.50	16.25	19.28
B.Chemical fertilizers			
RDF 1	30.04	24.29	27.17
RDF 2	27.63	21.38	24.51
RDF 3	25.13	18.88	22.00
Interaction [AXB]			
TR X RDF 1	29.00	22.75	25.88
TR X RDF 2	26.50	20.25	23.38
TR X RDF 3	24.00	17.75	20.88
FYM X RDF 1	31.25	25.00	28.13
FYM X RDF 2	28.75	22.50	25.63
FYM X RDF 3	26.25	20.00	23.13
VC X RDF1	35.00	28.75	31.88
VC X RDF 2	32.50	26.25	29.38
VC X RDF 3	30.00	23.75	26.88
BL X RDF 1	34.00	27.75	30.38
BL X RDF 2	31.50	25.25	28.38
BL X RDF 3	29.00	22.75	25.88
GM X RDF 1	26.50	20.25	23.38
GM X RDF 2	24.00	17.05	20.88
GM X RDF 3	21.50	15.25	18.38
NO X RDF 1	25.00	18.75	21.85
NO X RDF 2	22.50	16.25	19.38
NO X RDF 3	20.00	13.75	16.88

Organics

TR = Trash incorporation @ 8 t/ha
FYM = Farm yard manure@ 25 t/ha
VC = Vermicompost @ 5 t/ha
GM = Green Manure [Sunnhemp] grown *in situ*
BL = Bhumilabh @10 t/ha
NO= No organics

Inorganics

RDF 1 = 100 % RDF
RDF 2 = 50 % RDF
RDF 3 = No fertilizer

Appendix 5. The total cost [Rs.'000/ha] of different treatments imposed in the experiment II

Treatment	Plant	Ratoon	Mean
A.Organic manures			
PM 1	29.13	22.78	25.96
PM 2	25.06	18.81	21.94
BL 1	25.94	19.69	22.82
BL 2	27.31	19.94	23.62
No	22.81	16.56	19.69
B.Chemical fertilizers			
RDF 1	28.23	21.98	25.11
RDF 2	26.78	20.73	23.76
RDF 3	25.73	19.48	22.61
RDF 4	23.23	16.95	20.09
Interaction [AXB]			
PM 1 X RDF 1	28.13	21.88	25.01
PM 1 X RDF 2	26.88	20.63	23.76
PM 1 X RDF 3	23.13	19.38	22.51
PM 1 X RDF 4	23.14	16.88	20.01
PM 2 X RDF 1	31.25	25.00	28.13
PM 2 X RDF 2	30.00	23.75	26.88
PM 2 X RDF 3	28.75	22.50	25.63
PM 2 XRDF 4	26.25	19.88	23.07
BL 1 X RDF 1	27.05	21.00	24.13
BL 1 X RDF 2	26.00	19.75	27.88
BL 1 X RDF 3	24.75	18.00	21.63
BL 1 X RDF 4	22.25	16.00	19.13
BL 2 X RDF 1	29.50	23.25	26.38
BL 2 X RDF 2	28.25	22.00	25.13
BL 2 X RDF 3	27.00	20.75	23.88
BL 2 X RDF 4	24.50	18.25	21.38
No X RDF 1	25.00	18.75	21.88
No X RDF 2	23.75	17.50	20.63
No X RDF 3	22.00	16.25	19.38
No X RDF 4	20.00	13.75	16.88

Organics

PM 1 = Pressmud @ 12.5 t/ha
PM 2 = Pressmud @ 25 t/ha
BL 1 = Bhumilabh @ 2.5 t/ha
BL 2 = Bhumilabh @ 5 t/ha
No = No organics

Inorganics

RDF 1 = 100 % RDF
RDF 2 = 75 % RDF
RDF 3 = 50 % RDF
RDF 4 = No fertilizer

INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE PRODUCTION OF SUGARCANE

R.B.KHANDAGAVE 2000 Dr. C.J.ITNAL
Major Advisor

ABSTRACT

Field experiments were conducted at the Karnataka Institute of Applied Agricultural Research, Sameerwadi on integrated nutrient management for sustainable production of sugarcane during 1996-97 and 1997-98 seasons. Five organics, viz. Sugarcane trash (@ 8 t/ha), FYM (@ 25 t/ha), Vermicompost (@ 5 t/ha), *Bhumilabh* (@ 10 t/ha) and Green manuring (*Sunnhemp*) along with no organic were tried in main plots and three levels of chemical fertilizers (100, 50 per cent RDF and control) in subplots in a split plot design with four replications. Another experiment consisting of two levels of pressmud (@ 12.5 and 25.0 t/ha) and *Bhumilabh* (@ 2.5 and 5.0 t/ha) and also no organic were tried with four levels of fertilizers (100, 75, 50 and no fertilizer) in a split plot design and replicated thrice.

Organic manures viz. *Bhumilabh*, FYM, Green manuring, Trash incorporation and Vermicompost increased the cane yield significantly by 35.75, 18.04, 17.85, 8.98 and 7.88 per cent respectively over control. Further, application of these organics facilitated for higher soil fertility and microbial population over fertilizers applications. *Bhumilabh* in conjunction with 50 per cent RDF produced cane yield on par with 100 per cent RDF, which helped to save 50 per cent of fertilizers.

In the second experiment also, application of *bhumilabh* @ 5.0 t/ha recorded significantly higher cane and sugar yield (26.95 and 32.98 per cent, respectively) over other organics. Pressmud applied @ 25.0 t/ha exhibited favourable influence on cane yield. It was observed that reduction in the level of fertilizers application had substantial effect in decreasing the yield of sugarcane besides affecting the soil fertility status and juice quality. Application of pressmud and *bhumilabh* improved the juice quality parameters.