

EFFECT OF LEVELS OF FERTILIZER AND ROW PROPORTIONS ON SWEET CORN (*Zea mays saccharata*) AND GROUNDNUT (*Arachis hypogaea*) INTERCROPPING

A thesis submitted to the

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI
(Agricultural University)
Dist. Ratnagiri (Maharashtra State), India

in partial fulfilment of the requirements for the degree of
DOCTOR OF PHILOSOPHY (AGRICULTURE)

in

AGRONOMY

by

SHRI. SHIVARAM BALU BHAGAT
M.Sc. (Agri.)

DEPARTMENT OF AGRONOMY,
FACULTY OF AGRICULTURE
DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
DAPOLI - 415 712, DIST. RATNAGIRI, MAHARASHTRA

MAY, 2007

**EFFECT OF LEVELS OF FERTILIZER AND ROW PROPORTIONS
ON SWEET CORN (*Zea mays saccharata*) AND GROUNDNUT
(*Arachis hypogaea*) INTERCROPPING**

A thesis submitted to

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI
(Agricultural University)
District - Ratnagiri (Maharashtra), India

In partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY (AGRICULTURE)

in

AGRONOMY

By

SHIVARAM BALU BHAGAT

APPROVED BY THE ADVISORY COMMITTEE
Chairman and Research Guide

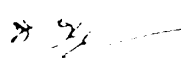


(S.A. Chavan)

Professor,

Department of Agronomy,
College of Agriculture, Dapoli

Members


(B.P. Patil)

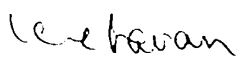
Head,

Department of Agronomy,
Dr. B.S. Konkan Krishi Vidyapeeth,
Dapoli, Dist. Ratnagiri


(G.D. Joshi)

Dean,

Faculty of Agriculture,
Dr. B.S. Konkan Krishi Vidyapeeth,
Dapoli, Dist. Ratnagiri


(K. N. Chavan)

Ex. Head,

Department of Agril. Chemistry
and Soil Science,
Dr. B.S. Konkan Krishi Vidyapeeth,
Dapoli, Dist. Ratnagiri


(H. K. Patil)

Head,

Department of Agril. Economics,
Dr. B.S. Konkan Krishi Vidyapeeth,
Dapoli, Dist. Ratnagiri

Dr. S. A.Chavan
M Sc. (Agri.), Ph. D.
Professor of Agronomy,
College of Agriculture,
Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
Dist. Ratnagiri (Maharashtra State).

CERTIFICATE

This is to certify that the thesis entitled “EFFECT OF LEVELS OF FERTILIZER AND ROW PROPORTIONS ON SWEET CORN (*Zea mays saccharata*) AND GROUNDNUT (*Arachis hypogaea*) INTERCROPPING” submitted to FACULTY OF AGRICULTURE, DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI, Dist. Ratnagiri, Maharashtra State, India in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY in AGRONOMY embodies the results of a piece of bonafide research carried out by Shri. SHIVARAM BALU BHAGAT under my guidance and supervision. No part of this thesis has been submitted for any other degree or diploma or published in other form. All the assistance and help received during the course of investigation and the sources of literature have been duly acknowledged by him.

Dapoli
Dated: 18/5/2007



(S. A. Chavan)
Chairman of Advisory Committee
and Research Guide

ACKNOWLEDGEMENT

I take it to be my proud privilege to avail the opportunity to express my sincere and deep sense of gratitude to Hon. Chairman and Research Guide **Dr. S.A. Chavan**, Professor, Deptt. of Agronomy, Dr.B.S.K.K.V., Dapoli for his valuable guidance, versatile advises, inspiring discussion, critically going through the manuscript, incessant encouragement bestowed upon me during the entire period of investigation, which enabled me to create this eternal dissertation.

I owe obliged depth of gratitude to the members of my advisory committee **Dr. B.P. Patil**, Head, Deptt. of Agronomy, Dr. B.S.K.K.V., Dapoli, **Dr. G.D. Joshi**, Dean, Faculty of Agriculture, Dr.B.S.K.K.V., Dapoli, **Dr. K.N. Chavan**, Ex-Head, Deptt. of Agril. Chemistry and Soil Science Dr.B.S.K.K.V., Dapoli and **Dr. H.K. Patil**, Head, Deptt. of Agril. Economics, Dr.B.S.K.K.V., Dapoli for their generous gestures and valuable suggestions during the course of investigation.

I am deeply grateful to **Dr. V.B. Mehta**, Hon. Vice-chancellor, Dr. B.S.K.K.V., Dapoli for providing necessary facilities for research work.

My sincere thanks are also due to **Dr. A.J. Dixit**, Ex-Associate Professor, Deptt. of Agronomy, **Dr. A.C. Sawant**, **Dr. L.G. Pawar**, Associate Professors and **Dr. S.T. Thorat**, **Dr. M.V. Zagade**, **Prof. A.S. Bal**, **Prof. P.P. Shinde**, **Prof. M.G. Chavan**, **Prof. A.V. Dahiphale**, **Prof. V.M. Kanade**, Assistant Professors, **Dr. M.S. Talathi** and **Shri. S.C. Bhore**, Department of Agronomy and **Dr. J.S. Dhekale**, Assistant Professors of the Deptt. of Agril. Economics for their generous help and co-operation during the course of investigation.

I would like to offer my sincere thanks to Mr. Joshi, Tamhankar, Nakate, Salgaonkar, Diwale and Bhuwad for their kind help during the course of investigation.

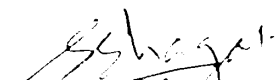
It is a true friend who shares secrets. He is the one who provides crutches to the crumbling house of confidence and forebrams. Special thanks to **Mr. Haldavanekar**, **Zende**, **Gedam**, **Raut**, **Gawande**, **Mhaskar**, **Pinjari**, **Pawar**, **Patil** and **Gaikawad** for their excellent company, noteworthy help and warm affection during the course of investigation. Thanks are also due to Mr. Joshi, Shinde, Kunjir, Dacung, Vankar, Talpade and Mahale due to their generous help.

I feel short of words to express my hearty feelings to my wife **Mrs. Sunita Bhagat** and daughters **Sneha** and **Sharayu** for their sacrifice, affection and encouragement during the entire period of investigation to achieve the most committed goal for higher education.

No words could justice to express my deepest sense of respect and gratitude towards my beloved parents **Shri. Balu Posha Bhagat** and **Sau. Gangabai Bhagat**, brothers **Haribhau**, **Yashwant**, their family members and my sisters **Mrs. Shanta**, **Radha**, **Sindhu** and their family members for their warm affection and encouragement.

Lastly big thanks to **Sachin Sandye** for the speedy and sincere devotion in preparing this manuscript on computer.

Place : Dapoli
Date : 18/5/2007


(S.B. Bhagat)

LIST OF TABLES

Table No.	Particulars	Page No.
1.	Mechanical, physical and chemical composition of the soil (0-30 cm)	64
2a.	Weather data during the crop growth period, 2003-04	65
2b.	Weather data during the crop growth period, 2004-05	66
3.	Cropping history of the experimental plot	67
4.	Treatment details	68
5.	Schedule of field operations	69
6.	Details of biometric and other observations of groundnut	73
7.	Details of biometric and other observations of sweet corn	77
8.	Mean plant population of groundnut and sweet corn as influenced by different treatments	88
9.	Mean plant height (cm) of groundnut as affected periodically by different treatments	90
10.	Mean number of branches of groundnut per hill as affected periodically by different treatments	92
11.	Mean number of leaves of groundnut per hill as affected periodically by different treatments	95
12.	Dry matter production of groundnut per plant (g) as affected periodically by different treatments	97
13A.	Mean yield attributing characters of groundnut as affected by different treatments at harvest	99
13B.	Mean yield attributing characters of groundnut as affected by different treatments at harvest	100

Table No.	Particulars	Page No.
14A.	Dry pod yield, haulm yield and kernel yield of groundnut as affected by different treatments	105
14B.	Actual, expected and per cent increase or decrease dry pod yield of groundnut	106
15.	Oil content (%) and oil yield (q/ha) of groundnut as affected by different treatments	109
16.	Protein content (%) and protein yield (q/ha) of groundnut as affected by different treatments	112
17.	Effect of different treatments on nitrogen content (%) of groundnut	114
18.	Effect of different treatments on nitrogen uptake (kg/ha) of groundnut	116
19.	Effect of different treatments on phosphorous content (%) of groundnut	118
20.	Effect of different treatments on phosphorous uptake (kg/ha) of groundnut	120
21.	Effect of different treatments on potassium content (%) of groundnut	122
22.	Effect of different treatments on potassium uptake (kg/ha) of groundnut	124
23.	Effect of different treatments on total uptake of nutrients (kg/ha) by groundnut crop	126
24.	Mean height (cm) of sweet corn plant as affected periodically by different treatments	128
25.	Mean number of leaves of sweet corn per plant as influenced periodically by different treatments	130
26.	Mean dry matter (g) per plant of sweet corn as affected periodically by different treatments	132

Table No.	Particulars	Page No.
27A.	Mean yield attributing characters of sweet corn as affected by different treatments	135
27B.	Mean yield attributing characters of sweet corn as affected by different treatments	136
28.	Green cob yield, green stover yield and total green biomass of sweet corn (q/ha) as affected by different treatments	140
29.	Protein content (%) of dry grains and sucrose content (%) of fresh grains of sweet corn	144
30A.	Nitrogen content (%) in different parts of sweet corn as affected by different treatments	146
30B.	Nitrogen content (%) in different parts of sweet corn as affected by different treatments	147
31A.	Nitrogen uptake (kg/ha) by the different parts of sweet corn as affected by different treatments	150
31B.	Nitrogen uptake (kg/ha) by the different parts of sweet corn as affected by different treatments	151
32A.	Phosphorous content (%) of sweet corn as affected by different treatments	156
32B.	Phosphorous content (%) in different parts of sweet corn as affected by different treatments	157
33A.	Phosphorous uptake (kg/ha) by the different parts of sweet corn as affected by different treatments	160
33B.	Phosphorous uptake (kg/ha) by the different parts of sweet corn as affected by different treatments	161
34A.	Potassium content (%) in the different parts of sweet corn as affected by different treatments	164

Table No.	Particulars	Page No.
34B.	Potassium content (%) in the different parts of sweet corn as affected by different treatments	165
35A.	Potassium uptake (kg/ha) by the different parts of sweet corn as affected by different treatments	168
35B.	Potassium uptake (kg/ha) by the different parts of sweet corn as affected by different treatments	169
36.	Total nutrient uptake (kg/ha) by sweet corn as affected by different treatments	171
37.	Total N, P, K uptake (kg/ha) by groundnut + sweet corn intercropping as affected by different treatments	174
38.	Mean available N, P, K content (kg/ha) in the soil as affected by different treatments after harvest of crops	179
39.	Nitrogen balance sheet (2003-04) in the soil after harvest	181
40.	Nitrogen balance sheet (2004-05) in the soil after harvest	182
41.	Weed count and dry matter of weeds (g/sq.m.) at 30DAS	185
42.	Weed count and dry matter of weeds (g/sq.m.) after harvest of the crops	190
43.	Effect of different treatments on combined pod yield of groundnut and cob yield of sweet corn (q/ha)	195
44.	LER and Crop Equivalent Yield (q/ha) as affected by different treatments (Mean of two years)	197
45.	Effect of different treatments on competitive coefficients (Mean of two years)	199
46.	Economics of sole cropping and intercropping treatments	203

LIST OF FIGURES

FIG. No.	TITLE	After page
1	Meteorological observations during the crop growth period 2003-04 and 2004-05	66
2	Plan of layout of the experiment	68
3	Mean plant height (cm) of groundnut as affected periodically by different treatments	90
4	Mean number of branches of groundnut per hill as affected periodically by different treatments	92
5	Mean number of leaves of groundnut per hill as affected periodically by different treatments	95
6.	Dry matter production of groundnut per plant (g) as affected periodically by different treatments	97
7	Yield attributing characters of groundnut as affected by different treatments at harvest	99
8	Yield attributing characters of groundnut as affected by different treatments at harvest	100
9	Dry pod yield (q/ha) and haulm yield (q/ha) of groundnut as affected by different treatments	105
10	Oil content (%) and oil yield (q/ha) of groundnut as affected by different treatments	109
11	Protein content (%) and protein yield (q/ha) of groundnut as affected by different treatments	112
12	Effect of different treatments on nitrogen uptake (kg/ha) of groundnut	116
13	Effect of different treatments on phosphorus uptake (kg/ha) of groundnut	120
14	Effect of different treatments on potassium uptake (kg/ha) of groundnut	124

FIG. No.	TITLE	After page
15	Effect of different treatments on total uptake of nutrients (kg/ha) by groundnut crop	126
16	Mean height (cm) of sweet corn plant as affected periodically by different treatments	128
17	Mean number of functional leaves of sweet corn per plant as influenced periodically by different treatments	130
18	Dry matter production of sweet corn per plant (g) as affected periodically by different	132
19	Mean yield attributing characters of sweet corn as affected by different treatments	135
20	Mean yield attributing characters of sweet corn as affected by different treatments	136
21	Green cob yield, green stover yield and total biomass of sweet corn (q/ha) as affected by different treatments	140
22	Protein content (%) of dry grains and sucrose content (%) of fresh grains of sweet corn	144
23	Total nutrient uptake (kg/ha) by sweet corn as affected by different treatments	171
24	Total N, P, K uptake (kg/ha) by groundnut + sweet corn intercropping as affected by different treatments	174
25a	Yields of groundnut and sweet corn as influenced by fertilizer levels and row proportion for the year 2003-04	195
25b	Yields of groundnut and sweet corn as influenced by fertilizer levels and row proportion for the year 2004-05	195
25c	Mean yields of groundnut and sweet corn as influenced by fertilizer levels and row proportion	195
26	Economics of sole cropping and intercropping treatments	203

LIST OF PLATES

Plate. No.	CAPTION	After page
I.	General view of the experimental plot	68
II	Sole groundnut	87
III	Sole sweet corn	87
IV.	Groundnut + Sweet corn in 1 : 1 ratio	88
V.	Groundnut + Sweet corn in 2 : 1 ratio	88
VI.	Groundnut + Sweet corn in 3 : 1 ratio	88
VII.	Groundnut + Sweet corn in 1 : 1 ratio	88

**DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
DAPOLI, DIST. RATNAGIRI, MAHARASHTRA STATE**

Name of the student : Shri. Shivaram Balu Bhagat
Registration Number : 36
Research Guide : Dr. S.A. Chavan
Professor,
Department of Agronomy,
Dr.B.S.K.K.V., Dapoli.
Discipline : Agronomy
Year of Award of Degree : 2007
Title of Thesis : Effect of levels of fertilizer and row proportions on sweet corn (*Zea mays saccharata*) and groundnut (*Arachis hypogaea*) intercropping

ABSTRACT

A field experiment was conducted during *rabi* season of 2003-04 and 2004-05 at Agronomy Farm, College of Agriculture, Dapoli. The soil of the experimental field was clay loam in texture, slightly acidic in pH and high in organic carbon content. It was medium in available nitrogen, low in phosphorus and moderately high in available potassium. The experiment was laid out in randomized block design with three replications. The treatments consisted of two sole crops namely groundnut and sweet corn grown with three levels of fertilizer i.e. 75, 100 and 125% RDF and intercropping combinations of groundnut and sweet corn in 1:1, 2:1 and 3:1 ratios with 75, 100 and 125% RDF.

The results revealed that height of groundnut crop in groundnut + sweet corn in 1:1 ratio was more than sole groundnut and under 2:1 and 3:1 ratios of intercropping, while all the three intercropping ratios supplied with 125% RDF recorded statistically similar number of branches and leaves per plant as compared to the sole groundnut with 125% RDF. Sole groundnut provided with 100 and 125% RDF recorded significantly higher dry matter per plant than the other treatments except groundnut + sweet corn in 3 : 1 ratio with 125% RDF.

Among the intercropping treatments as well as in sole groundnut crop, all the yield attributes namely number of pods, weight of pods, weight of kernels per plant increased with increase in the level of fertilizer and they were higher under 125% RDF. The test weight of groundnut was not influenced due to different fertilizer levels or intercropping ratios. However, the shelling percentage was higher under sole groundnut provided with 125% RDF.

Dry pod, kernel and haulm yield of groundnut under sole cropping with 100 and 125% RDF was significantly higher than all the intercropping treatments. In respect of intercropping, dry pod yield, haulm yield as well as kernel yield was significantly higher in 3:1 ratio of groundnut + sweet corn intercropping with 125% RDF than the other intercropping treatments except groundnut + sweet corn at 3:1 ratio with 100% RDF.

In case of quality aspects i.e. oil content and protein content in groundnut kernels and major nutrient content in groundnut kernel, haulm and shell were not influenced under sole or intercropping treatments. However, oil yield, protein yield and major nutrients i.e. N, P and K uptake were significantly higher in sole groundnut applied with 125% RDF.

Sole sweet corn with 125% RDF produced significantly taller plants than the lower fertilizers doses in sole cropping or intercropping. As far as number of leaves of sweet corn was concerned, groundnut + sweet corn in 3:1 ratio with 125% RDF recorded maximum number of leaves of sweet corn and was at par with sole sweet corn receiving 125% RDF during 2004-05 and it was significantly superior over the remaining treatments. In respect of dry matter accumulation per plant, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the other treatments with 125% RDF both in sole or intercropping. Further, former treatment i.e. T₁₅ was significantly superior over the remaining treatments in sole or intercropping. The cob length, weight of cob, number of kernel rows per cob, number of kernels per cob and weight of kernels per cob were higher under the treatments receiving 125% RDF to sole sweet corn than the lower fertilizer levels in intercropping as well as sole cropping. Same trend was observed in case of cob yield, stover yield and biomass yield. In case of intercropping treatments, ground nut + sweet corn in 1:1 ratio with

125% RDF was significantly superior over the remaining intercropping treatments.

As far as quality of sweet corn was concerned protein content and sucrose content in the kernels was significantly higher under groundnut + sweet corn in 3:1 ratio with 125% RDF. In case of nutrient uptake by sweet corn, it was observed that, sole sweet corn with 125% RDF recorded significantly higher nitrogen, phosphorus and potassium uptake. However, in case of intercropping treatments, the uptake of nitrogen and potassium in the above referred parts was significantly higher under 1:1 ratio with 125% RDF. The total uptake of nitrogen, phosphorus and potassium by groundnut and sweet corn was significantly higher when 125% RDF was applied.

In case of sweet corn, sole sweet corn with 125% RDF recorded significantly higher nitrogen content in the soil than the remaining treatments of sole and intercropping. The phosphorus and potassium content in the soil after harvest of the crops was not influenced due to either sole cropping or intercropping treatments. In case of sweet corn, though the uptake of nitrogen was comparatively low than the added nitrogen, it has recorded net loss in the nitrogen balance. However, groundnut showed the ameliorative effects in terms of nitrogen balance in the soil.

In respect of weeds, it was observed that the weed count as well as dry weight of broadleaved weeds and grasses and sedges was significantly higher under sole sweet corn and it was considerably lower under sole groundnut.

The LER was maximum (1.24) due to groundnut+ sweet corn intercropping at 3:1 ratio with 125% RDF. Groundnut equivalent and sweet corn equivalent yields were the highest due to the sole cropping of sweet corn with 125% RDF. In case of intercropping combinations, groundnut + sweet corn in 1:1 ratio with 125% RDF recorded the higher values of groundnut equivalent and sweet corn equivalent yields. Relative Crowding Coefficient (RCC) values and Relative Yield Total (RYT) values were improved due to intercropping of groundnut + sweet corn in 3:1 ratio. Groundnut crop remained aggressive and more competitive in 1:1 ratio of intercropping while, sweet corn was more dominant at 2:1 and 3:1

ratios. Crop Performance Ratio (CPR) was improved in 3:1 ratio of intercropping. Relative Yield Loss (%) values were negative for both the crops indicating the gain in yield due to intercropping which was maximum for groundnut at 1:1 ratio while, for sweet corn those were maximum at 3:1 ratio. Groundnut + sweet corn in 3:1 ratio showed its superiority in terms of Area- Time Equivalent Ratio (ATER).

From the economics of the treatments it was revealed that sweet corn was more profitable than groundnut. In case of intercropping combinations, groundnut + sweet corn in 1:1 ratio with 125% RDF recorded comparatively higher values of gross returns, cost of cultivation and net returns as well as B:C ratio.

INTRODUCTION

CHAPTER I

INTRODUCTION

Agriculture is the main source of Indian economy, accounting for 30 per cent of the country's gross domestic products. It also provides livelihood to its 70 per cent population. The grain production in India has been increased four folds from the level of 50 million tones during pre-independence to the level of 208 million tones during 2003-2004. Although today our country has achieved self-reliance in food grain production it is anticipated that during 2050 AD, we may need to double the today's production in order to meet the needs of burgeoning population (Shinde and Ghanbahadur, 2002). Horizontal expansion in food production to keep pace with the increasing demand for food grains is limited and we have to resort to vertical growth in agriculture by enhancing the productivity per unit area.

Most of the research work and approaches to develop production technologies in the past has been confined to individual crops, but now there is need to work with cropping systems that farmers can practice to exploit location specific agro-climatic conditions for enhanced production. Considering the limited net sown area, it will be necessary to raise the cropping intensity so as to grow more crops on the same piece of land. This can be achieved by identifying appropriate cropping pattern and developing short duration, high yielding varieties.

In our country, mixed cropping is in vogue over centuries. To meet the home needs, farmers practice mixing the seeds of one or more crops with main crop and sowing together. The practice is being followed to minimize the risk of failure of crops due to seasonal vagaries. Lately, this practice has been changed to sowing of crops in a set geometry. In both situations, the crops are grown at the plant density less than the optimum recommended for either of them alone. Now the concept of intercropping,

has changed to produce more in space and time. The new intercropping systems suggested are in additive series, which are more efficient in productivity per unit of resource use than earlier replacement series and mixed cropping.

In the improved intercropping systems, the plant density of the main crop is maintained at the optimum and the additional population of the intercrop is added by changing the plant geometry for better use of resources. These systems give higher output and returns, meet the multiple needs of the family, spread the labour peaks, maintain soil fertility and reduce the impact of weather aberrations.

Legumes endowed with numerous virtues like inbuilt mechanism of symbiotic nitrogen fixation, profuse and deep root system, drought tolerance and restoration of soil fertility. These virtues have remained an integral part of the mixed or inter cropping system since time immemorial. In North Indian states where maize based intercropping system is predominantly observed, groundnut is proved to be the most remunerative crop. Inclusion of groundnut as an intercrop with maize did not reduce the seed yield of maize; on the contrary, some extra yield of groundnut was obtained (Thakur and Sharma, 1988 and Jana and Saren, 1998).

India occupies a premier position in global oilseed scenario accounting for 14 per cent oilseed area and 8 per cent of oilseed production (Hegade, 1996). Oilseeds are rich sources of energy and nutrition. Edible oils and oil meals have an important role to play in relieving malnutrition and calorie nutrition of human and animal population. Edible oil consumption is continuously rising reaching almost to 12.5 kg per annum. For a projected population of 1180 million in 2010 AD, the edible oilseeds with a per capita consumption of 15 kg works out to be 17.7 MT which equivalent to 51 MT of oilseeds.

Groundnut is one of the world's staple oil, food and industrial crops. India is the third largest edible oil economy in the world after the U.S.A. and China. The impact of groundnut crop in the oilseed scenario of India and its reflection on the country's economy has been highly significant. Groundnut occupies about 8.5 million ha with a production of 8.7 million tones. It dominates other oilseeds of the country by sharing 35 to 45 of the total area under oilseeds and 45 to 55 per cent of total oilseed production. India is the largest groundnut growing country in the world and second largest producer of groundnut next to China. Recently India's contribution to world groundnut production has decreased by 5 percent. Groundnut is grown in the post-rainy season on about 1.5 m ha with an average yield of 1.5 to 2.0 t ha⁻¹. Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu account for about 89 per cent of total groundnut area of our country and contribute nearly 88 per cent of the total groundnut production. In Konkan region, groundnut is gaining popularity due to its high yield potential. Similarly this crop suits into different cropping systems also (Lad, 1986 and Sawant, 1989).

Photosynthetically maize is considered to be an efficient plant. The energy stored by maize as photosynthate is, however, only a small fraction of total incident radiation on the land surface. During the first 50 to 60 days of plant growth when the coverage by maize crop is not complete, a part of the total land as well as the radiation incident on it are wasted. In recent years, winter maize has shown great promise for increased food production in rice based cropping. Intercropping with a short duration legume or oilseed can ensure better utilization of the space and sunlight and can thereby increase the productivity in the maize canopy.

Maize is grown in 6.5 million ha in India and its 45 per cent of the total production is consumed as food. It is used as food, feed, forage and in industries. Out of various types of corns, sweet corn has a very big market potential and has a great genetic variability and scope to improve its nutritive value. This has potentiality not only in domestic market but

also in the international market. In addition to the cobs, fodder derived after harvest of sweet corn may be sold to bring additional income to the farmers.

Sweet corn (*Zea mays saccharata*) is one of the groups of corn (*Zea mays* L.) and is classified on the basis of the kernel characteristics. Sweet corn varies from normal corn essentially in terms of gene(s) that affect starch synthesis in the seed endosperm wherein one or more simple recessive alleles alter the carbohydrate content of the endosperm and elevate the level of water soluble polysaccharides (sugars) and decrease starch (Rai *et al.*, 2005). The kernel possesses a considerable amount of sugar, which absorbs water, making the cells turgid. On drying, these cells collapse making the grains shriveled and wrinkled. It is commercially cultivated for the green cobs and can be harvested within 75 to 85 days. The green cobs are eaten roasted or boiled.

Sweet corn is gaining importance particularly in star hotels for preparation of special soups, sweets, jams, cream and other delicious dishes. People living in urban areas prefer the roasted sweet corn cobs, as they are very tasty and nutritious. Most of the sweet corn produced is used in the canning industry. It is also grown as vegetable and for the production of syrup. The green plants also serve as a palatable fodder for cattles.

In India, sweet corn is cultivated on very small area by some of the farmers and private sectors to meet the demands of various industries. Similarly, there is rising demand from the urban people for sweet corn. In Konkan region, very little work has been done on sweet corn, however, the results are very promising; about 7 to 8 t ha⁻¹ of green cob yield of sweet corn can be obtained. It could be a cash crop for this region. Taking into account good yield potential and short duration, it could be very well suited either in sequential cropping or intercropping. Similarly, well irrigation is pre-dominantly observed in Konkan region. There is no

dearth of water up to March and therefore, under such situation, short duration crop like sweet corn will be more remunerative to the farmers.

People living in urban areas prefer the roasted sweet corn cobs, as they are very tasty and nutritious. Roasted green cobs provide starch, fat, protein, sugar, minerals and vitamins in palatable, wholesome, hygienic and digestible form, relatively at low cost too. The demand for eating roasted cobs in cities and towns is increasing day by day. This has resulted into opening the counters of roasted cobs in cities and towns. Number of corn clubs are also formed in big cities.

Sweet corn can be a promising cash crop of the region. It can be fitted in rice based cropping system, as it is a short duration crop maturing in 80 to 85 days. Cobs have good market potential. In addition to this, as the plants are in green stage with good vigour, it can be used as a nutritious and palatable fodder for the milch animals.

Fertilizer is one of the costliest inputs of crop production. It is therefore, very important to find out the economic ways in the use of fertilizers. In this regards, adoption of legume in cropping systems have shown promising results in the past (Balyan and Seth, 1989). The research work on fertilizer use in our country was mainly continued to individual crops and fertilizer recommendations formulated on the basis of their responses. It is well known fact that a crop is only a component of a cropping system and as such it has to be grown in some crop sequence or intercropping system. Consequently, the fertilizer needs of a crop will vary depending upon the characteristics of either preceding crop or a companion crop. For efficient fertilizer management, it appears almost obligatory to evaluate precisely the role of preceding crop or companion crop in sustaining the productivity of soils.

Corn being an exhaustive crop, its requirement for fertilizers especially for nitrogen is prominent. Nitrogen is essential constituent of chlorophyll, protoplasm and enzymes and it governs utilization of phosphorus and potassium. It is an important factor for boosting up the

yield of cereals and is very important for vegetative growth as well as higher yield (Shrivastava and Sinha, 1992). Cereal crops have been reported to deplete the soil fertility to a relatively greater extent. On the other hand, a restorative crop of legume enriches it to a considerable extent. The beneficial effects of growing legumes in intercropping system have been amply demonstrated through various experiments in our country.

Judicious use of the fertilizers is essential to ensure stable production from any intercropping system. As the nutrient needs of intercropping systems may differ from monoculture of their component crops, it is therefore, important to standardize the most profitable level of fertilization for intercropping system.

In any successful intercropping, the pattern of crop geometry should be such that it should offer maximum utilization of all the resources. Though plenty of information is available on different types of intercropping, enough information is not available on the exact proportion of two crops in a unit area. Taking into account all these points, a field trial entitled "Effect of levels of fertilizer and row proportions on sweet corn (*Zea mays saccharata*) and groundnut (*Arachis hypogaea*) intercropping," was conducted at Agronomy Farm, College of Agriculture, Dapoli with the following objectives:

1. To find out optimum level of fertilizer and sowing proportion for groundnut + sweet corn intercropping system.
2. To study the growth and yield of the component crops.
3. To study the effect of inter cropping on N, P and K uptake of the component crops.
4. To study the 'N' balance of the soil.
5. To study weed intensity under the different inter cropping treatments.
6. To study economics of the intercropping system.

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Mixed cropping is an age old practice among the traditional systems of Indian agriculture. Concentrating on the need to increase the crop production, intercropping offers a great promise in the modern agriculture, where compatible crop combinations are grown simultaneously on a unit piece of land by using high inputs.

While selecting crop combinations, one of the crops should be short term and the other long-term. They should be sown or planted at the same time, have rather similar herbicide and plant protection requirement. In addition, the short-term crop should not require mechanical harvesting.

In the present study, the efforts were made to quantify the effects of intercropping on groundnut productivity with respect to growth, yield and quality in addition to economic viability of the system. A brief review pertaining to the effect of different intercrops and land or row ratios on the growth, yield and quality of groundnut and other related crops, their fertility effects along with economy in intercropping systems is presented in this chapter under following headings:

- I. Importance of intercropping
- II. Effect of land or row proportions and plant population on the performance of the main and intercrop
- III. Effect of fertilizer levels on the performance of the main and intercrop
- IV. Effect of intercropping on weeds
- V. Effect of intercropping on nutrient uptake
- VI. Effect of intercropping on Statistical Indices or competition functions
- VII. Effect of intercropping on economics of the system

I. Importance of intercropping

Ayyangar and Aiyer (1942) stated that mixed cropping is mainly a practice to cover the risk associated with crop failures due to vagaries of weather or pest and disease incidence. In addition to this, they have also reported that protein content of cereal grain increased when mixed with pulse crop. Their findings were again confirmed by Mirchandani and Misra (1956). The system of mixed or intercropping makes a very material contribution towards remedying the lack of balance in the diet of people (Aiyer, 1949).

Dayal *et al.* (1967) showed that legume leaves make the soil richer in nitrogen in plots where legume-cereal mixtures were grown compared to plots where only cereals were grown under dry farming conditions.

Chatterjee and Maiti (1972) from IARI, New Delhi, worked out the employment potentials in sugarcane + vegetable intercropping system. They observed that there was increase in the employment potential in various intercropping systems such as sugarcane + tomato (772 man days ha^{-1})⁶³, sugarcane + brinjal (727 man days ha^{-1}) than that of sugarcane alone (350 man days ha^{-1}).

Enyi (1973) reported that intercropping in maize or sorghum with pigeon pea, cowpea or beans resulted in reduction in leaf area index, fresh weight yield at the time of anthesis, straw yield and grain yield of the cereal crops. In respect of reduction of LAI and yield in maize, beans and cowpea had greater adverse effect than pigeon pea. The reduced plant height was also recorded when maize was intercropped with legumes.

Reddy *et al.* (1977) reported that groundnut-arhar system was superior in the total protein yield quantitatively as well as in protein quality *i.e.* lysine yield demonstrating an increase of about 100 and 200 per cent, respectively over that of a pure groundnut crop.

Hegde and Saraf (1978) observed higher total nitrogen content in the soil under sorghum+pigeonpea intercropping treatments than that of pure cropping of sorghum.

Chand (1978) reported that maize did not influence the growth and development characters *viz.*, plant height, number of functional leaves per plant, days to tasseling, dry matter production, silking and maturity when intercropped with legumes. Similar results were also obtained by Singh and Guleria (1979) in an intercropping trial with maize and soybean.

Siva Kumar and Virmani (1980) found that higher dry matter production efficiency, earlier development of maximum LAI and yield in maize+pigeonpea intercropping system followed by sole maize and sole pigeonpea. There was no significant difference between growth and yield of sole maize crop and that in intercrop system.

Rao and Willey (1983) recorded maximum harvest index and decreased branch number of pigeonpea when it was intercropped with sorghum. The advantage was attributed because of the suppression of early vegetative growth and very little decrease in number of pod bearing branches of pigeon pea.

Tofinga and Tukunga (1995) observed that groundnut had greater shoot competitive ability, but a lower root competitive ability than sweet corn. The relative yield total (RYT) of groundnut and sweet corn intercrops, based on total biomass, was 1.4 when only the root systems interacted and 1.6 when only the shoot systems interacted. These RYT values did not differ significantly from 1.8 when both root and shoot systems interacted.

Das and Dutta ((1996) while studying the effect of intercropping on infestation of insect pests of green gram at Assam Agricultural University, Jorhat, concluded that intercropping *Vigna radiata* with less related crops

such as maize results in more reduced populations of pests on *V. radiata* than intercropping with leguminous plants.

Patra and Poi (1998) from Bihar reported that intercropping caused the number of nitrogen-fixing nodules on the legume crops to decrease due to shading. The highest number of nodule plant⁻¹ was observed with single cropping at 45-75 days. When legumes (green gram, black gram, soybean, groundnut, lentil, chick pea and pea) were intercropped with cereals (maize, wheat), legume nodulation was poor and less nitrogen fixation took place. Some of the N fixed may act as fertilizer for the cereal crop, increasing the shading and further reducing legume nodulation and N fixation.

Suwanarit *et al.* (1998) from Thailand found that maize+ *Mimosa invisa* intercropping system was the best and the maize+ *Cajanus cajan* and maize+ *Lablab purpureus* intercropping systems were the second best for simultaneous production of maize and green manure and for improving soil chemical properties.

Roodagi *et al.* (2000) recorded the highest tiller counts from sugarcane + sunnhemp (107, 460 ha⁻¹) and sugarcane + cowpea (102, 320 ha⁻¹) systems at 120 days after planting. The lowest number of tillers was recorded in sugarcane + maize (76 500 ha⁻¹). Cane and sugar yields in the cane + sunnhemp (111.09 and 12.49 t ha⁻¹, respectively) and cane + cowpea (109.06 and 12.28 t ha⁻¹, respectively) intercropping were significantly higher than in the cane + maize (70.82 and 7.60 t ha⁻¹, respectively) intercropping. The highest millable cane yield was recorded from cane + sunnhemp intercropping (92 080 ha⁻¹), while the lowest was from cane + maize (68 880 ha⁻¹).

Desai and Prabhakar (2001) noted significantly enhanced total dry matter production, leaf area, plant height and number of leaves in maize and groundnut crops due to addition of prunings of *Sesbania grandiflora*

coupled with RDF. The highest dry matter accumulation was observed due to addition of prunings +100 or 75% RDF, while the lowest was observed due to addition of prunings only.

Hu-Fei and Kong (2002) from south China studied allelopathic effect of the root exudates from groundnut on rice, maize, radish and ryegrass. The results showed that the groundnut root exudates promoted the seedling growth of the tested crops. Further research revealed that the root exudates were water-soluble materials, which contain triacontanol. The promoting effects on crops varied depending on the different concentrations of the groundnut root exudates.

Ramasamy *et al.* (2002) evaluated groundnut + redgram intercropping system at National Pulses Research Centre, Vamban (TN). They reported that performance of the crops *viz.* groundnut and red gram was better in sole crop than when grown in combination. Higher production efficiency in terms of $\text{kg ha}^{-1} \text{ day}^{-1}$ ($9.2 \text{ kg ha}^{-1} \text{ day}^{-1}$) and high net return^s were obtained in groundnut+ redgram under 8:1 row ratio.

Frequent occurrences of soil compaction damage resulting from high raindrop impact energy, and from human and animal trafficking during field operations pose a problem to farmers around the tropics. Anikwe *et al.* (2003) studied the effect of some crops and soil management practices on soil compactibility indices in a Typic Paleustult in South-eastern Nigeria. The dry bulk density of tilled maize and groundnut plots increased significantly by between 2 and 14% relative to no-till plots at 44 and 66 DAP. In maize + groundnut plots, dry bulk density decreased significantly in plots amended with poultry droppings+NPK relative to the control plots by 3-10% at 44 and 66 DAP.

Polthanee and Trelo-ges (2003) from Khon Kaen University, Thailand investigated the growth, yield and yield components of maize, groundnut, soybean and mung bean under intercropping and single

cropping, to assess the land use efficiency. In the legume crops, groundnut, soybean and mung bean, intercropping systems reduced the leaf area and top dry weight per plant, compared with single cropping. However, maize-legume intercropping increased land use efficiency by 48-66% depending on legume species. Maize-groundnut intercropping gave the highest land use efficiency.

Ghosh (2004) observed a significant reduction in leaf area index (LAI) and crop growth rate (CGR) due to groundnut-pearl millet system over sole groundnut. Decrease in nodule mass at pod filling stages in groundnut ranged from 3.5 to 11.0% when intercropped with cereal fodders compared to sole groundnut crop. However, maize as the associated crop produced 9.0 t ha⁻¹ of green fodder and affected the groundnut less with respect to CGR, LAI and nodule dry mass.

Parsons (2004) while studying the ways to improve the crop production capabilities of small scale sugarcane growers in South Africa, concluded that small scale cane growers wishing to produce additional crops for food security or income while waiting for their cane to mature, would benefit by planting the crops such as cabbage, sweet potato, maize, potato, groundnut, beans, cowpeas, and sweet corn in inter rows rather than cultivating them on a separate piece of land. The time and method of planting the intercrops can be manipulated to reduce the deleterious competitive effects of the food crops on cane yields.

II. Effect of land or row proportions and plant population on the

performance of the main and intercrop

Negi and Singh (1971) reported significant variation in yield of soyabean and sorghum in relation to different patterns of planting. Further, there was drastic reduction in yield of soyabean when grown with sorghum or maize. Their findings demonstrated that the 1:1

combination was significantly superior to the remaining combinations. However, the differences in maize yield were non-significant.

Koli (1973) revealed that the yields of groundnut in all treatments of mixed cropping were 1/3rd to 1/2nd than the yield of groundnut obtained from sole crops. However, the yield of maize was not reduced to that extent.

Tarhalkar and Rao (1975) reported about 140 and 144 per cent increase in total grain production of groundnut-sorghum and groundnut-pigeonpea mixed cropping systems, respectively over that of pure groundnut crop.

Nair *et al.* (1979) obtained maize yield (relative yield 1.02) similar to that of sole maize in mixed cropping with groundnut, with an additional yield of groundnut.

Das and Mathur (1980) observed increased maize grain yield in addition to the additional legume seed yield, when maize was intercropped with blackgram, cowpea, green gram and groundnut. Similar results were also obtained by Calavan and Weil (1987) while working on peanut+corn intercropping in Dhakka, Bangladesh.

Marshall and Willey (1983) from ICRISAT, Hyderabad reported that on the basis of Land Equivalent Ratio (LER) intercropping of pearl millet-groundnut gave 28 per cent more total dry matter (LER 1.28) than growing those two crops separately.

While working on effect of different intercropping on combined productivity of different crops Allan and Obura (1983) reported that intercropping of corn with cowpea and soybean resulted into greater productivity per unit of land area compared to monoculture.

Sawant (1988) reported from an intercropping experiment that the height of groundnut was more in intercropping treatments as compared to

pure groundnut. He further reported higher number of branches per plant, plant spread and dry matter production of groundnut in groundnut + cowpea intercropping system rather than growing of sole groundnut crop. He also observed that the yield increased significantly with increase in the proportion of groundnut and was the highest at 3:1 ratio.

Nagaraja (1989) in an investigation to study performance of crop mixtures (sorghum + pigeonpea, groundnut + pigeonpea, safflower + coriander and millet + cotton) in Anantpur district of Andhra Pradesh reported that all the crop mixtures produced higher yields without any adverse effects on the yield of the main crop under rainfed conditions.

Reddy and Reddy (1981) revealed highest grain yield of maize at 72 x 24 cm spacing. The yield of maize with groundnut at this spacing level exhibited considerable higher values. There was less reduction in maize yield in intercropping system with groundnut as compared to sole crop. Further, they observed the competitive effect of cowpea with maize.

Allen and Obura (1983) reported in an experiment on intercropping that the yield of maize was 46 to 90 per cent of the monoculture when intercropped with cowpea. Additionally, the seed yield of intercropped cowpea was 42 to 56 per cent of monoculture while that of soybean was 48 to 60 per cent.

Samui *et al.*, (1984) observed in the field trials that when groundnut and sunflower were grown in rows or mixtures of rows with nitrogen levels, dry matter production, LAI, CGR and NAR were the highest with groundnut + sunflower in row ratios of 1:1 and 2:1; intermediate with ratios of 1:2 or 1:3 and lowest with ratios of 1:0 or 0:1.

Patil (1984) reported that, in an intercropping with 1/3rd groundnut in 2/3rd sorghum obtained maximum grain (45.25 q ha⁻¹) and fodder (97.10 q ha⁻¹) yields. Similarly, the yield of groundnut dry pod (0.90 q ha⁻¹) and haulm were also maximum (10.65 q ha⁻¹).

Mehta *et al.* (1985) from the intercropping study with groundnut reported the highest monetary returns from groundnut + redgram grown in the ratio of 6:1. The mean LER was maximum (1.25) in groundnut + sesame grown in the ratio of 3:1.

Reddy *et al.* (1986) observed that intercropping of 2 rows of groundnuts in maize grown in rows 60 cm apart gave yields of 3.76 t maize grains and 0.99 t pods per hectare, compared with 3.86 t grain and 1.5 t pods in maize and groundnuts, respectively in pure stands.

Kulkarni and Sojitra (1986) conducted field experiments on six intercropping systems. They reported that there was decrease in nodulation, plant growth, nitrogen content and pod yields of groundnut when intercropped with pearl millet and maize. However, these values were not affected when groundnut was intercropped with sesamum, sunflower, soyabean and cowpea as compared with groundnut in pure stand.

Asokaraja *et al.*, (1987) revealed that intercropping of red gram, cotton and maize in rows, 1.5 or 2.25 m apart in irrigated groundnuts grown at a spacing of 22.5 × 15 cm had no significant adverse effect on groundnut yield. The intercrops gave additional yield and net returns.

Singh and Sharma (1987) observed no adverse effect on *rabi* maize grain yield when blackgram, groundnut or mung were intercropped with it. The intercrops gave additional yields and increased the net returns and groundnut was found to be the best among all intercrops.

Singh and Singh (1993) conducted a field experiment during the winter season of 1989-90 and 1990-91 to study the productivity of winter maize at Ghaghraghat. The grain yield of maize in both the years was the highest in paired sowing (sole), but the total grain equivalent of maize was the highest in paired-sown maize + French bean in of 1: 2 ratio. The seed

yields of French bean, wheat, lentil and linseed were reduced by intercropping.

Chittapur *et al.* (1993) conducted a field experiment during the rainy seasons of 1990 and 1991 to study the performance of maize + forage cereal intercropping on black clay-loam soils under rainfed condition. Maize grain yield decreased due to intercropping. The reduction in maize grain yield was of higher magnitude with 1: 2 proportion with forage cereal + maize intercrop. The yield components followed the similar trend. However, intercrop forage yields were higher with 1:2 proportion.

From field trials at the International Institute for Tropical Agriculture in Nigeria, Osiru and Ezumah (1994) found that the short spreading maize did not significantly affect cassava yield even at high maize population (80,000 plants ha⁻¹), whereas tall spreading maize considerably reduced cassava yield. Further it was also observed that intercropping decreased cassava root yield but the extent of reduction varied with cassava cultivar and the component species. Cultivars which gave high yields when grown alone also gave high yields when intercropped.

Singh and Singh (1994) from BHU, Varanasi reported maximum yield of pigeon pea under sole cropping, which was however, comparable to pigeonpea+blackgram and pigeonpea+sesamum intercropping systems where the yield recovery was 96.6 and 97.2% respectively. The yield recovery of sesamum in intercropping (92.5%) was more than blackgram (66. 7%), indicating the beneficial effect of legume component on oilseed crop.

Dubey *et al.* (1995) from JNKVV (MP) found that sorghum+ soybean or pigeonpea intercropped in paired rows (2:2) recorded the highest biological potential followed by their intercropping in alternate rows (1:1).

Mixed cropping of both the pulses with sorghum in uniform lines proved superior to their broadcast mixed cropping.

Singh and Arya (1995) from GBPUAT, Ranichauri (UP) conducted a field experiments on mixed cropping of finger millet with soybean, horsegram and ricebean. Grain yield of finger millet was the highest in sole crop and it was decreased in the mixed cropping pattern except finger millet + soybean (9:1). This treatment recorded higher yield attributes (number of tillers, ear weight, grain weight per ear and test weight) of finger millet.

Singh and Sarawgi (1995) studied the effect of row proportion, nitrogen and irrigation on wheat + chick pea intercropping system at Raipur (MP) and observed that dry matter accumulation in both crops was significantly higher when they were grown as pure crops.

Kalaghatgi *et al.* (1995) obtained the highest productivity with intercropping of pigeonpea with pearl millet in row proportion of 2:4 and groundnut with pearl millet in 4:2 row proportions. The productivity of pigeonpea as an intercrop was almost reduced by 50% in intercropping system. Reduction in pod yield of groundnut varied from 48 to 71% in different row proportions and maximum being at 2:1 ratio.

Kathmale *et al.* (1995) studied the intercropping of groundnut cv. JL-24 with castor, sunflower, soybean, sesame, green gram, black gram or French bean in 6:2 row ratio. The groundnut+soybean intercrop gave the highest land equivalent ratio (1.28), the highest groundnut equivalent yield and the highest net returns as compared to all the crops grown alone.

Natarajan and Zharare (1995) reported that among the intercrop row patterns evaluated, one row of maize or sunflower to two rows of groundnut was the most promising. Seed output obtained with this row pattern was considerably higher than with the sole crops in general and

groundnut in particular. The results emphasized the need for planting a higher density of maize than suggested by the intercrop row proportion, and thereby increase the total population density of the intercrop, to maximize the yield advantages from maize-groundnut combinations. Such an increase was not observed in the sunflower + groundnut combination.

Khistaria *et al.* (1996) carried out field experiment during 1988-94 in Gujarat and reported that sorghum, pigeon pea, green gram, groundnut and sesame were grown alone or sorghum was intercropped with the legumes and sesame in row ratios of 1:1 or 3:3. Sorghum + pigeonpea intercrop (1:1) produced the highest seed yield (0.49 and 0.66 t ha⁻¹, respectively).

Tiwari *et al.* (1996) reported that sesame when intercropped with groundnut, urd bean, sunflower and arhar, the best results were obtained by a 3:1 sesamum + groundnut intercrop followed by 3:1 Sesamum + urd bean intercrop.

Balyan (1997) from IARI, New Delhi reported that maize yield was increased due to intercropping with legumes as compared with maize grown alone. Yield of succeeding wheat crops was also increased when maize was intercropped. Wheat-equivalent yield of the cropping systems was highest when wheat was sown after maize intercropped with *Cyamopsis tetragonoloba* either harvested for fodder or incorporated as green manure. In the systems including grain legumes, groundnut gave the highest maize and wheat equivalent yields.

In field experiments at Ogoja, Cross River State, Nigeria, maize and groundnuts were grown alone or intercropped. Crop yield was higher in the sole plots than the intercropped plots, with maize giving higher yields on mound side than on mound top, whereas groundnut yields in the sole plots were higher on mound top than mound side. Intercropping

decreased the yields of maize and groundnuts by 25 and 22%, respectively. Monetary returns were higher with intercropping than sole cropping. The intercrop with maize grown on the mound side and groundnuts on mound top produced grain seed yields of 0.94 and 0.24 t ha⁻¹, respectively, and the highest net returns (Ibeji and Oko, 1997).

In a field experiment at Thohoyandou, South Africa, a maize cv. SNK 2147 and groundnuts cv. Natal Common were grown alone or intercropped at the maize: groundnut proportions of 75:25, 50:50 or 25:75. The 75:25 maize: groundnut intercrop was the best treatment, producing the highest maize grain yield (8 t ha⁻¹), groundnut seed yield of 0.1 t and total dry matter yield of 17.4 t. Sole maize produced a grain yield of 7 t. The positive values of aggressiveness indicated that maize was the stronger competitor when grown with groundnut (Liphadzi *et al.*, 1997).

Jana and Saren (1998) observed significantly higher Groundnut dry matter accumulation in sole crops compared with intercropping. However, in case of maize, yield and yield attributes did not differ significantly between intercrops and sole crops. Intercropping maize+groundnut at a row ratio of 1:2 showed the good results in terms of yield and yield attributes as compared to sole maize.

Lourduraj *et al.* (1998) reported that groundnut yields in the groundnut+pigeonpea, groundnut+soybean and groundnut+cowpea intercrops were equal to the yield of mono-cropped groundnut. The groundnut+pigeonpea intercropping gave the highest net returns.

Mehetre *et al.* (1997) reviewed the intercropping of soybean with reference to several intercropping systems including those with sunflower, groundnut, castor, cotton, sugarcane and maize and reported the improved performance of maize, cotton and sunflower in terms of their increased yields.

Tripathy *et al.* (1997) from OUAT, Bhubaneswar tested the performance of maize + cowpea (forage) intercropping system and revealed that maize and cowpea in sole planting and their total production in intercropping system at 1:1 row proportion were equally effective. However, maize + cowpea in 2:2 row proportion was found to be an ideal intercropping system for more yield during the lean summer months.

Dwivedi and Bajpai (1997) from IGKVV, Ambikapur (MP) observed that pigeonpea + soybean could not prove better than sole pigeonpea whereas, pigeonpea + groundnut in all row proportions (1:1, 2:2 and 2:4) proved superior to sole pigeonpea and sole groundnut crops in terms of yield performance.

Sharma and Rajput (1997) while working on pigeonpea based intercropping system observed that the pigeonpea yield in sole crop was lower than that accrued in intercropping treatments. Maximum grain yield of pigeonpea was obtained in paired planting associated with groundnut.

Sarkar *et al.* (1998) conducted a field experiment during the spring season of 1995 and 1996 at Baraipur (WB) to study the productivity and economic profitability of sunflower based intercropping systems. Intercropping of groundnut (*Arachis hypogaea* L.) with normal planting of sunflower was found beneficial and sustainable in terms of yield; over sole cropping of sunflower.

Maiti *et al.* (1998) studied the performance of groundnut cv. Girnar 1 and sesame cv. B-67 grown in pure stand or in 2:1 or 1:2 ratio with no NP fertilizers or 30:25, 60:50 or 90:75 kg N: P ha⁻¹. RYI of the intercrops and monetary returns were the highest with groundnut+ sesame (1:2) intercropping system given with 60 kg N + 50 kg P ha⁻¹.

In 2-years field study in India, rice, maize, red gram, black gram, cassava, groundnuts, soybeans and sesame were grown in pure stands or intercropped in different combinations. Yield of all the crops was decreased by intercropping. Maize-based combinations of 2 crops were less profitable than sole crops, but combination of 3 crops i.e. maize+ sesame+ red gram was the best among these systems (Nayak and Mandal, 1998).

Jana and Saren (1998) in their study on maize+groundnut intercropping systems found that dry matter accumulation in groundnut was substantially greater in sole cropping compared with intercropping. The pod yield was 34-57% more than sole cropping, this being achieved by increase in pods plant⁻¹, pod weight plant⁻¹ and 100 % kernel weight. Yield and yield attributes of intercrop maize did not differ from sole maize, but intercropping gave 16.2 and 13.8 q ha⁻¹ extra pod yield of intercrop groundnut at 1:2 and 2:3 row ratios respectively.

Kaushik *et al.* (1998) conducted an experiment during the rainy season of 1994 and 1995 to work out productive and economic association of pearl millet and groundnut on loamy sand soils of mid-western plains of Uttar Pradesh. Composite or hybrid genotype of pearl millet with groundnut in 3:1 row proportion was found better than solid crop of groundnut and farmer's practice of growing groundnut in mixed stand with pearl millet in terms of total production.

Suwanarit *et al.* (1998) from Thailand reported that grain yields of maize grown in plots intercropped with *Mimosa incisa*, *Cajanus cajan*, *Lablab purpureus*, *Canavalia gladiata*, *Vigna umbellata* and groundnut were 230, 186, 177, 131, 123 and 112% of the plots cropped with sole maize. In general, the maize+ *Mimosa incisa* intercropping system was the best and the maize+ *Cajanus cajan* and maize+ *Lablab purpureus* intercropping

systems were the second best for simultaneous production of maize and green manure.

Wu *et al.* (1998) while studying the development trends in sustainable agriculture in the sandy area of Henan Province, China reported that groundnut intercropped with wheat yielded more than intercropping with watermelon or with both maize and *Phaseolus vulgaris*. Intercropping wheat with groundnut, maize and *Phaseolus vulgaris* gave the highest yields of fodder.

Zhou-SuMei (1998) from China studied a model of maize+groundnut intercropping and observed that light reaching maize increased and its distribution was more even in intercropping systems, while light reaching groundnuts decreased. The chlorophyll content and photosynthesis of maize leaves increased, while those of groundnuts decreased, although they increased with increasing numbers of groundnut rows.

Karikari *et al.* (1999) examined the possible yield benefits of intercropping Bambara groundnut and cereals (pearl millet, sorghum and maize) under dryland conditions in Botswana and found that none of the intercropping systems was more productive in terms of grain yield than sole crops. However, among the intercrops, Bambara groundnut + sorghum was the most productive, with a yield advantage of 67%, followed by Bambara groundnut + maize with a 22% yield advantage. The Bambara groundnut + pearl millet intercrop was the least productive with only 8% yield advantage.

While studying the resource-use efficiency and production potential in summer groundnut-cereal fodder associations, Ghosh *et al.* (1999) realized the highest groundnut pod yield in sole groundnut (7.9 t ha⁻¹) followed by groundnuts with single-cut sorghum (5.5 t ha⁻¹), pearl millet (4.9 t ha⁻¹) and maize (4.5 t ha⁻¹) and double-cut sorghum (4.2 t ha⁻¹) and

pearl millet (3.8 t ha⁻¹). The reduction in groundnut yields with twice-cut sorghum and pearl millet was compensated by higher fodder yields.

Moorthy and Das (1999) studied different intercropping ratios of sesamum with the legumes like green gram and groundnut and were also grown in pure stands. The yields of green gram and groundnut were the highest when grown alone while their intercropping gave higher sesamum equivalent yields than pure sesamum.

Patra *et al.* (1999) reported that Maize-equivalent yield was generally higher in intercrops (green gram, black gram, soybean, groundnut and sesame) than from maize alone, whereas a pure stand of groundnuts outperformed most intercropping systems in case of maize-equivalent yield. Intercropping systems in 1:1 ratios gave better performance than those with 2 rows of the intercrop between 90 cm maize rows.

Sinha *et al.* (1999) from Pusa (Bihar) conducted an experiment during 1991-92 and 1992-93 to evaluate the yield and economics of winter maize (*Zea mays* L.) based intercropping systems under different fertility and weed management systems. Maize grown with potato in normal (1:1) and paired row planting (2:2) was more advantageous than French bean and significantly improved all the yield attributes as well as yield of component crops and finally recorded significantly higher maize-equivalent yield (12.30 and 12.02 t ha⁻¹) than normal (1:2) and paired planting (2:4) of maize with French bean (9.81 and 9.65 t ha⁻¹).

Khola *et al.* (1999) conducted a field experiment at CSCR Farm, Selakui, Dehra Dun, on intercropping of maize with cowpea, blackgram and soybean and observed that cowpea and blackgram in sole stands had higher canopy, followed by their intercropping with maize.

Saren and Jana (1999) conducted a field trial at Kalyani, West Bengal wherein maize cv. Hunis Composite and groundnut cv. JL 24 were grown

in pure stands or intercropped in 1:2 or 2:3 maize: groundnut row ratios. It was observed that intercropping decreased groundnut yield but not maize grain yield as compared with pure stands. Maize-equivalent yield was the highest from the 1:2 intercropping.

Prodhan (2000) studied the intercropping of green maize (a type of maize used by roasting or boiling tender ears) during autumn, winter and summer seasons at Kalyani (W.B.). Green maize + groundnut, green maize + mustard and green maize + green gram were the best systems. Intercropping did not generally decrease maize yield compared with pure stands.

Singh *et al.* (2000) from RAU, Pusa conducted a field trial for two years to study the water-use efficiency and yield of pure crops and maize based intercropping. Maize-equivalent yield was significantly highest (8.2 t ha⁻¹) with maize + turmeric compared with sole crops or with maize + groundnut in the first year. However, in the second year, the difference between maize + turmeric and maize + groundnuts was not pronounced.

Singh (2000) evaluated the planting geometry and economic harvest of maize (*Zea mays* L.) green cobs + blackgram (*Phaseolus mungo* L.) seed yield in intercropping system during the rainy season of 1991 – 94. Green cob yield remained unaffected by intercropping and planting geometry up to 80 cm row spacing. In mixed stand of maize and blackgram within 80 cm spacing (1: 2) was found superior to sole and other intercropping systems in terms of cropping system yield.

Roodagi *et al.* (2000) reported that the cane and sugar yields in the cane + sunnhemp (111.09 and 12.49 t ha⁻¹, respectively) and cane + cowpea (109.06 and 12.28 t ha⁻¹, respectively) intercrops were significantly higher than in the cane + maize (70.82 and 7.60 t ha⁻¹, respectively) intercropping. The highest millable cane yield was recorded from cane +

sunnhemp intercropping (92 080 ha⁻¹), while the lowest was from cane + maize (68 880 ha⁻¹) intercropping system.

Sarkar and Sanyal (2000) conducted a field experiment during the spring season of 1997 and 1998 at Baraipur, West Bengal, to evaluate economically and biologically sustainable intercrop association of sesamum with greengram, blackgram, groundnut and sunflower on rice fallow land. An intercropping of groundnut with sesame was found most beneficial to sole stand yield of sesame. Among the intercrop associations, sesamum + groundnut under 3:2 row proportion gave the maximum sesamum - equivalent yield. It proved the best intercrop stand among all the crop associations.

Singh and Singh (2001) evaluated different planting patterns of maize and soybean intercropping. All the intercropping patterns were superior in terms of maize - equivalent yield. Among different intercropping patterns of maize and soybean, paired maize rows (either 30/90 or 46/90 cm) + 2 rows of soybean gave the highest total yield.

Maitra *et al.* (2001) conducted a field experiment during the monsoon season of 1994 and 1995 and observed higher dry matter production, leaf area index and crop growth rate of sole groundnut at early growth stages; but sole groundnut, finger millet + pigeonpea and finger millet + groundnut intercropping recorded higher values of the above growth attributes at later stages. Sole finger millet produced more ears m⁻² but finger millet + pigeonpea intercropping recorded more fingers ear⁻¹ than other cropping systems. Among the legumes, pigeonpea recorded greater number of pods plant⁻¹, whereas green gram produced higher number of seeds pod⁻¹ and groundnut had the highest test weight. Sole groundnut produced the highest pod and chaff yield. Finger millet + groundnut, finger millet + pigeonpea and sole finger millet also gave higher yield than other cropping systems.

Chandrika *et al.* (2001) conducted a field experiment on groundnut+redgram intercropping on red sandy loam soils during 1996-97 and 1997-98 at Tirupati, to evaluate the yield and economics of different cropping systems in rainfed Alfisols. Significantly higher pod yield of groundnut was obtained in single skip row treatment. Intercropping with redgram in 7: 1 ratio significantly reduced the groundnut pod yields.

Roodagi and Itnal (2001) found that the different planting methods did not produce any significant results on growth and yield attributes of sugarcane. Further, growing of cowpea as green manure and soyabean as intercrop proved beneficial and growing maize as intercrop was detrimental.

Roodagi *et al.* (2001) studied the impact of intercropping sunnhemp, maize, cowpea, soybean, groundnut, potato and French bean on growth and yield of sugarcane. Plant height, number of internodes, total dry matter production and LAI were significantly higher in either sole crop of sugarcane than the other intercropping systems or in sugarcane+sunnhemp and sugarcane+cowpea systems (1:2 ratio). The lowest values for plant height, number of internodes, total dry matter production and LAI were recorded in sugarcane+maize (1:1ratio). The yields of cane and sugar were significantly higher in sugarcane+sunnhemp and sugarcane+cowpea than in sugarcane+maize.

The influence of intercropping groundnuts or maize on the development of sugar cane was studied by Munoz *et al.* (2001) in Cuba. It was observed that sugar cane was tallest in the association with peanut (330.69 vs. 225.99 cm). The number of tillers per cut as well as the total number of tillers for every 100 m row was also higher. The length and thickness of the internode showed higher values under peanut + maize intercropping.

Ghosh (2002) evaluated groundnut and cereal fodder intercropping during the post-rainy season at Junagadh and recorded significant reduction in yield attributes and yields of groundnut when 2 cuts of pearl millet and sorghum were planned. However, such yield reduction was nullified by high fodder yield and high net returns obtained from 2 cuts of pearl millet.

Meena and Dayanand (2002) reported that the intercropping system of groundnut + sesame in 2:1 ratio gave significantly highest oil yield than rest of the treatments.

Shivay *et al.* (2002) reported that grain yield; protein content and protein yield of maize significantly increased in intercropping with grain legume over sole maize. Significantly higher 1000-grain weight of maize was recorded under blackgram and soybean intercropping, as compared to sole maize. The maximum grain yield of maize was recorded in maize + blackgram system which was significantly higher than the sole maize but at par with maize + soybean system.

Ramasamy *et al.* (2002) conducted field experiments to evaluate the productivity and economic returns of groundnut+redgram intercropping system at National Pulses Research Centre, Vamban. As per the report, performance of the crops *viz.* groundnut and red gram was better in sole crop than when grown in combination. Among the various row combinations, groundnut+ red gram in 8: 1 row recorded the higher groundnut equivalent yield (1064 kg ha⁻¹), higher production efficiency in terms of kg ha⁻¹ day⁻¹ (9.2 kg ha⁻¹ day⁻¹) and high net returns.

Polthance and Trelo-ges (2003) from Khon Kaen University, Thailand conducted an experiment to investigate the growth, yield and yield components of maize, groundnut, soybean and mung bean under intercropping and single cropping. The yield and yield components of maize were not affected by intercropping system. The grain yield of

groundnut, soybean and mung bean was reduced by 28, 39 and 51%, respectively, compared with single cropping. The pod number per plant was most affected by intercropping amongst the yield components.

Ghosh (2004) observed lower green fodder yield and pod yield from fodder crops and groundnut respectively in intercropped condition than in monoculture plots. The highest green fodder yield in intercrops was recorded in pearl millet with two cuts (16.5 t ha⁻¹) followed by pearl millet with one cut (11.8 t ha⁻¹) and sorghum with two cuts (10.7 t ha⁻¹). Groundnut yield was reduced more due to pearl millet and sorghum with two cuts. However, maize as the associated crop produced 9.0 t green fodder ha⁻¹ and affected the groundnut less with respect to yield attributes and pod yield (5.76% reduction).

Kumar *et al.* (2005) studied the production potential and economic feasibility of maize + cowpea intercropping at IGFR, Jhansi. Intercropping of maize and cowpea in 2: 2 row ratio produced higher total green fodder yield (338.3q ha⁻¹), dry matter (83.0q ha⁻¹) and crude protein yield (10.3q ha⁻¹).

Ahlawat *et al.* (2005) reported that chickpea was adversely affected by intercropping with mustard, barley and linseed. The yield of chickpea increased as the proportion of chickpea increased in the mixture while reverse trend was noticed in the yield of intercrops. Sole mustard recorded the highest productivity in terms of chickpea – equivalent yield.

Tripathi *et al.* (2005) from CSAUAT, Kanpur found reduced values of yield attributes and seed yield of chickpea while reverse was true in case of mustard than their sole croppings respectively. Intercropping of chickpea + mustard in 8:2 row ratio recorded maximum chickpea-equivalent yield (24.31q ha⁻¹).

Adhikari *et al.* (2005) from Chotonagpur Plateau region studied maize + groundnut intercropping system and observed that sole

groundnut recorded significantly high maize equivalent yield. The yield of maize did not vary much under intercropping but the pod yield of groundnut was reduced by 52.25 and 47.7% due to intercropping with maize.

Verma *et al.* (2006) from IARI, New Delhi reported improvement in growth and yield attributes of maize *viz.* plant height, number of cobs per plant, length of cob, grains per cob, grain weight per cob and 1000-grain weight due to intercropping with mungbean either at 1:1 or 1:2 proportion.

Rana *et al.* (2006) from GBPUAT, Pantnagar studied the feasibility of various intercrops *viz.* lentil, mustard, maize, rajmash and rapeseed with autumn sugarcane with two row spacings. It was observed that all the intercrops except maize reduced number of millable canes, which further resulted into reduced cane yield.

Dutta and Bandyopadhyay (2006) conducted a field experiment at Jhargram, West Bengal to evaluate the production potential and economic feasibility of intercropping groundnut with pigeonpea and maize with various row proportions. Yield components of main and intercrops were decreased in intercropping systems. Groundnut yield was reduced by 8-35% due to intercropping and yields of pigeonpea and maize were inversely proportional to groundnut row number.

III. Effect of fertilizer levels on the performance of the main and intercrop

Anonymous (1982) revealed in an intercropping experiment conducted on moong and groundnut with Manjari composite maize, that intercropping of mung and groundnut with additional fertilizers (*i.e.* 100

per cent to intercrop), produced significantly more grain yield of maize than that of pure maize.

Samui *et al.*, (1984) observed in field trials that when groundnuts and sunflowers were grown in rows or mixtures of rows and given 0, 40 or 80 kg N ha⁻¹. Added N increased yields, with greater effect in the 0-40 than in the 40-80 kg N ha⁻¹ ranges.

Gangwar and Kalra (1988) observed that intercropping of greengram, blackgram, groundnut, soyabean or cowpea in maize slightly accelerated maize maturation, increased the protein content in maize grains and increased total protein yield from 135.1 kg ha⁻¹ under maize in pure stands to 278-321.7 kg ha⁻¹ in association with legumes. Further, the maize grain protein content and protein yield were increased due to the application of 80 and 120 kg N ha⁻¹, which were statically similar and higher than that with 40 kg N ha⁻¹.

Gupta and Rathore (1995) from RAU, Arja (Rajsthan) worked on evaluation of optimum dose of fertilizers for pigeonpea+sesame intercropping system and concluded that application of full recommended dose of fertilizer to both the component crops significantly increased the growth attributes, yield attributes, seed and stover yield of component crops than lower doses (0, 25, 50 and 75% of RDI) of fertilizer applied to them.

Singh and Sarawgi (1995) studied the effect of row proportion, nitrogen and irrigation on wheat + chick pea intercropping system at Raipur (MP) and noticed that application of 100% recommended N to the wheat crop alone gave higher dry matter of both the crops as compared with the application of 75% recommended N to wheat crop lines only.

Krishna and Raikhelkar (1997) studied the performance of maize with some legumes (red gram, black gram, green gram, ground nut and soybean) at Rudrur, Andhra Pradesh. Significantly higher maize

equivalent yield was recorded in maize+ red gram (4.88 t ha⁻¹) and maize+ black gram (4.66 t ha⁻¹) intercropping systems than the other systems. There was significant response to application of 25 kg N + 50 kg P to intercrops.

Tomar *et al.* (1997) conducted an experiment at Baraut (UP) to study the response of wheat based intercropping system to N fertilizer levels. It was observed that sole crop of wheat, lentil and chickpea produced higher dry matter (grain and straw) than intercropping systems when supplied with their 100% recommended dose of nitrogen.

Yadav *et al.* (1997) from JNKVV, Morena (MP) observed higher dry matter, yield attributes and yield of component crops in case of pigeonpea + sesame intercropping system with 100% RDF as compared to 75 and 50% RDF.

Sharma and Rajput (1997) while working on pigeonpea based intercropping system at RBS College, Agra obtained higher pod yield of groundnut under increasing fertility levels than the groundnut intercropped with base crop of pigeonpea. However, the pigeonpea yield in sole crop was lower than that accrued in intercropping treatments. Maximum grain yield of pigeonpea was obtained in paired planting associated with groundnut with 50% RDF. Application of 100 % RDF to pigeonpea + 50% RDF to groundnut, followed by 100 % NPK to wheat was the most remunerative and had greater biological efficiency.

Maiti *et al.* (1998) reported improvement in yield attributing characters, yield of component crops and RYI of the groundnut + sesame (1:2) intercropping system given with 60 kg N + 50 kg P₂O₅ ha⁻¹ as compared to control.

Mandimba *et al.* (1998) found that intercropping of maize and groundnut reduced the dry matter and grain seed¹ yields of both the crops compared with sole cropping, but overall grain seed¹ yield was

significantly higher in the intercropping systems. The grain yields of maize either supplied with 100 kg N ha⁻¹ or intercropped at the 1:4 ratio were similar. Nodule number and seeds/pod of groundnuts, and plant height, dry matter yield and grain yield of maize showed no differences between the monocropped and intercropped systems.

Barik *et al.* (1998) studied different intercropping systems of sorghum and groundnut under varying levels of nitrogen. It was observed that application of the highest dose of nitrogen (120 kg N ha⁻¹) resulted in higher green and dry forage yields of sorghum as compared with lower doses. Higher pod yield of groundnut was obtained from an application of 40 kg N ha⁻¹.

Yakadri *et al.* (1998) conducted a field experiment during the rainy season of 1991 and 1992 at New Delhi, to study the effects of intercropping of pearl millet + groundnut and fertilizer levels on the yield and gross returns. A lower dose of nitrogen and phosphorus at 20 kg N ha⁻¹ + 40 kg P₂O₅ ha⁻¹ increased the yield and gave the maximum gross returns both in pure stand of groundnut and intercrop of pearl millet + groundnut.

Sinha *et al.* (1999) studied maize based intercropping systems under different fertility and weed management systems and found that the higher level of fertilizer resulted in significant increase in all the yield attributes and yield of the component crops and ultimately the maize - equivalent yield, net returns were significantly higher with 100% fertilizer dose but the net return per rupee of investment was higher with 75% fertilizer dose.

Singh and Arya (1999) conducted a field experiment during rainy season of 1995 and 1996 under rainfed conditions to study N requirement of finger millet + pulse (soybean, rice bean and French bean) intercropping system. The highest total grain yield (28.64 q ha⁻¹) was obtained under finger millet + soybean with 75% RDN application.

Jat *et al.* (1999) conducted a field experiment on clay – loam soil of Udaipur during rainy season of 1993 and 1994, to study the response of maize + soybean intercropping system to weed management practices, fertilizer levels and *Rhizobium* inoculation. Fertilizer levels applied to soybean and inoculation of soybean seeds with *Rhizobium* did not show any effect on growth and yield of maize. While the growth and yield of soybean improved significantly by application of fertilizer levels 50% and 100% of recommended doses and *Rhizobium* (*Bradyrhizobium*) inoculation to soybean.

Zhan *et al.* (1999) from China observed that groundnut yields increased with decreasing rate of irrigation and increased from 5.35 and 6.33 t ha⁻¹ with increase in rate of N and from 6.57 to 6.78 t with increase in rate of P₂O₅. Maize yields also increased with decrease in rate of irrigation and it increased from 1.48 t ha⁻¹ with no N to 1.65 t with 450 kg N ha⁻¹ and further it was decreased to 1.45 t with 675 kg N ha⁻¹, 1.42 t with 375 kg P₂O₅ ha⁻¹ and 1.52 t with 1125 kg P₂O₅ ha⁻¹ and 1.48 t with 1500 kg P₂O₅ ha⁻¹.

Manuel *et al.* (2000) evaluated yield responses of groundnut and maize to fertilization and soil physico-chemical properties in different classes of Philippine soils. Results showed that groundnut yields were positively correlated to fertilizer nitrogen, soil nitrogen and soil extractable phosphate but negatively to soil pH. For maize, fertilizer nitrogen and phosphate and soil nitrogen contributed positively to the yield, but negatively with soil pH and exchangeable magnesium.

Singh *et al.* (2000) carried out a field experiment during winter seasons to study dry-matter production and nitrogen uptake in component crops of maize + pea and maize + lentil cropping systems with 0, 50, 100, 150 and 200 kg N ha⁻¹ applied to maize on row basis. The highest dry-matter production was recorded in maize + pea cropping system. Legumes produced less dry matter when intercropped as

compared with their sole stand. Dry matter production of component crops exhibited an increasing trend with increasing N levels.

Singh *et al.* (2000) undertook a study by introducing lentil and vegetable pea as intercrops in maize fertilized with 0, 50, 100, 150 and 200 kg N ha⁻¹. Inclusion of legumes (pea or lentil) as intercrops increased the dry matter accumulation of maize + pea cropping system. The yield attributes, viz. length and girth of cob, number and weight of grains cob⁻¹, cobs plant⁻¹ and 1,000-grain weight, were also increased by intercropping of legumes. Further pea had an edge over lentil. Respective mean maize grain yields were 46.4, 54.3 and 53.5 q ha⁻¹ when maize was grown as sole and intercropped with pea or lentil. Maize responded to N application up to 200 kg N ha⁻¹ in sole stand and up to 150 kg N ha⁻¹ when intercropped with either of legumes.

Maitra *et al.* (2001) in their experiment on intercropping of finger millet with different legumes observed that application of 60 kg N, 30 kg P₂O₅ and 30 kg K₂O ha⁻¹ resulted into more dry matter yield, leaf-area index and crop growth rate of finger millet. It helped in increasing fingers ear⁻¹ of finger millet, pods plant⁻¹ and seeds or kernels pod⁻¹ of groundnut and other legumes over the low fertility levels and resulted in higher yield of all the crops under sole than intercropping systems. Sole groundnut at high fertility levels gave the highest yield.

Desai and Prabhakar (2001) noted significant enhancement in total dry matter production, leaf area, plant height and number of leaves in maize and groundnut crops due to addition of prunings of *Sesbania grandiflora* coupled with RDF. The highest dry matter accumulation was observed in addition of prunings +100 or 75% RDF, while the lowest was observed due to addition of prunings only.

Hussaini and Mohammed (2003) from Nigeria studied the effect of different NPK rates on maize+groundnut mixture grown on a single

alternate or triple alternate row arrangement. It was observed that row arrangements had no significant effect while varying component proportions showed little effect on the system productivity. Better crop performance and higher biological energy were obtained when both crops were fertilized using the individual recommended rates of the crops (100% RDF).

Guggari and Kalaghatagi (2005) from RARS, Bijapur revealed that application of 60 kg N + 40kg P₂O₅ to pearl millet + groundnut recorded significantly higher pearl millet equivalent yield and net monetary returns over absolute control.

Tripathi *et al.* (2005) from CSAUAT, Kanpur found that chickpea and mustard in sole and intercropping systems responded favourably up to 60 kg P₂O₅ ha⁻¹ only for yield attributes and yield over no phosphorous and 30 kg P₂O₅ ha⁻¹.

Srivastava and Bohra (2006) from BIU, Varanasi found that association of wheat with mustard under 5:1 row ratio was more sustainable. However, it was further concluded that to achieve higher yield advantage and efficient resource utilization, an application of 100% RDF to both the component crops was found imperative.

Giri *et al.* (2006) studied the nutrient management of cotton based intercropping system at MAU, Parbhani and observed the enhancement in the yields of seed cotton and intercrops, with every higher fertilizer level and the highest values being at 100% RDF. The performance of cotton + blackgram (1:1) with 100% RDF was better than all the treatments for cotton equivalent yield.

IV. Effect of intercropping on weed growth

Sinha *et al.* (1999) conducted an experiment to evaluate the yield and economics of winter maize based intercropping systems under different fertility and weed management systems. Maize grown with potato in normal (1:1) and paired row planting (2:2) reduced the weed population, their dry weight and increased the weed smothering efficiency of the crop canopy (66.10 and 60.59% respectively). Weedy eco-system registered a yield reduction of 29.63, 26.79 and 38.85% in maize, potato and French bean respectively.

Munoz *et al.* (2001) from Cuba reported that a good vigour was observed in sugarcane when intercropped with peanut while adverse effects were obtained due to intercropping with maize. Area covered by weeds was 16.35% in the peanut association while with maize it was of 98.96%. Weed coverage was negatively related to plantation vigour.

Singh and Giri (2001) in their experiment on intercropping of sunflower with groundnut recorded significantly higher dry-matter accumulation of both sunflower and groundnut due to weed control measures. Combined application of pendimethalin and 1 hand weeding recorded the highest dry matter of both component crops. On an average combined application of weed-control measures showed 30.5 and 46.0% higher uptake of N and P by sunflower and 22.2 and 37.0% by groundnut respectively. Weed controlled by both pendimethalin and 1 hand weeding also enhanced the productivity and N uptake by succeeding maize.

From the field experiments conducted at two sites in western Kenya, Oswald *et al.*, (2002) concluded that intercropping maize was a better strategy to reduce *Striga* emergence and survival and improve overall farm productivity. Peanut, bean, yellow gram, bambara nut and soybean intercrops produced considerable yields and increased the overall productivity of the cropping systems. Shading, higher humidity and lower temperatures under the intercrop canopies were most likely the

mechanisms, which caused the decline of *Striga* numbers in intercropping systems. Intercropping could be an effective component of an integrated *Striga* control program compatible with the limited resources of small-scale subsistence farmers.

Musambasi *et al.*, (2002) conducted on-farm experiments in Chinyika Resettlement Area during rainy season at four sites to test the effectiveness of intercropping maize with cowpea, groundnut, field bean and bambara nut (*Vigna subterranean*) in suppressing *Striga asiatica*. Combined analysis over sites showed that the number of emerged *S. asiatica* plants in the intercropping system were similar to those in sole maize during the 1995/96 season. However, during the same season, the number of emerged *S. asiatica* plants was significantly lower in the maize/groundnut intercrop 8 weeks after crop emergence at one site but similar at the remaining sites.

Kuchinda *et al.*, (2003) evaluated use of tolerant maize varieties intercropped with some legumes in the management of the parasitic *Striga* weed. Grain yield and cob weight had significant negative correlations with *Striga* incidence. Intercropping the two improved varieties with either soyabean or groundnut was more profitable than the local cultivar grown alone.

Baldev Ram *et al.* (2005) from RAU, Jobner (Rajasthan) evaluated the effect of integrated weed management and intercropping systems on the performance of pearl millet. Pearl millet intercropped with cowpea, greengram and clusterbean being at par caused significant reduction in weed- competition index by 27.2, 25.9 and 24.3% compared to sole pearl millet.

Chalka and Nepalia (2005) from Udaipur evaluated the effect of weed control methods on production potential and economics of maize+legume intercropping systems during rainy season of 2001 and

2002 and observed that inclusion of cowpea and soybean as intercrops reduced the weed dry matter.

V. Effect of intercropping on nutrient uptake and quality aspects of intercrops

Gangwar (1976) found the association of maize with legumes such as urd, mung and cowpea favourably increased the nitrogen content in maize shoots and grains. Similarly, the protein content in maize grains was also increased by this association.

Reddy *et al.* (1977) reported that groundnut-arhar system was superior in the total protein yield quantitatively as well as in protein quality *i.e.* lysine yield demonstrating an increase of about 100 and 200 per cent, respectively over that of a pure groundnut crop.

Bandopadyay and De (1986) revealed that sorghum grown in a mixture with legumes, such as groundnut, mungbean and cowpea, took up more nitrogen than sorghum grown as a sole crop. Further, in a mixture with mungbean, the total nitrogen uptake by sorghum was 8.65 g per plant, while for sorghum alone, it was 6.79 gm. The percent nitrogen derived from fertilizer was highest with sorghum and was lowest when grown in mixture with legumes. It was mainly attributed to the fact that sorghum derived part of nitrogen from the soil pool enriched by concurrently grown legumes in the mixture.

Gangwar and Kalra (1988) observed that intercropping of greengram, blackgram, groundnut, soybean or cowpea in maize increased the nitrogen and protein content in maize grains and increased total protein yield from 135.1 kg ha⁻¹ for maize in pure stands to 278 to 321.7 kg ha⁻¹ in association with legumes.

In outdoor pot trials in ^{15}N -labelled soil in Sri Lanka, maize was intercropped with *Vigna unguiculata*, *Vigna radiata* or groundnut. Intercropped groundnut fixed the highest amount of N from the atmosphere ($552 \text{ mg plant}^{-1}$), deriving 85% of its N from the atmosphere. Intercropped *V. unguiculata* and *V. radiata* fixed 161 and 197 mg N plant^{-1} , obtaining 81% and 78% of their N content from the atmosphere, respectively. The proportion of N derived by maize from the associated legume varied from 7 to 11% for *V. radiata*, 11 to 20% for *V. unguiculata* and 12 to 26% for groundnut, which amounted to about 19-22, 20-45 and 33-60 mg N maize plant^{-1} , respectively. The high N fixation potential of intercropped groundnut and their relatively low harvest index for N appeared to contribute to the greater beneficial effect on the associated crop (Senaratne *et al.*, 1995).

Tomar *et al.* (1997) studied the response of wheat based intercropping system to N fertilizer levels. Sole lentil recorded highest N-uptake over other cropping systems followed by chickpea. Application of 90 Kg N ha^{-1} recorded higher N-uptake than 0, 30 and 60 kg N ha^{-1} .

Jana and Saren (1998) studied maize+groundnut intercropping systems and observed that oil content in groundnut remained unaffected due to intercropping systems, but increased with irrigation. Intercropping decreased oil yield, while irrigation augmented it.

Saren and Jana (1999) studied the performance of maize and groundnut in pure stands or intercropped in 1:2 or 2:3 row ratios. It was observed that intercropping decreased groundnut yield but not maize grain yield as compared with pure stands. Total NPK uptake was higher in intercropping systems than in pure stands of either crop.

Singh *et al.* (2000) studied dry-matter production and nitrogen uptake in component crops of maize + pea and maize + lentil cropping systems with 0, 50, 100, 150 and 200 kg N ha^{-1} applied to maize on row

basis. The highest N uptake was recorded in maize + pea cropping system. N content of component crops exhibited an increasing trend with increasing N levels. Total N uptake increased significantly up to 150 kg N ha⁻¹ in sole maize and up to 100 kg N ha⁻¹ in intercropping systems.

Roodagi and Itnal (2001) found that the different planting methods did not produce any significant results for nutrient uptake. However, growing of sun hemp as green manure significantly enhanced N uptake (249.30 kg ha⁻¹) of sugarcane compared to other intercrops (cowpea, soybean, groundnut and French bean). Cane and sugar yields were significantly higher with sunn hemp (111.09 and 12.49 t ha⁻¹).

Singh and Giri (2001) conducted an experiment during the spring seasons of 1996 and 1997 and revealed that sunflower grown with groundnut in 1: 2 ratio of intercropping recorded significantly higher N and P uptake than the sole crop. Intercropping suppressed dry matter accumulation and N and P uptake of groundnut. N uptake of maize was significantly higher when it was preceded by intercropping of sunflower and groundnut.

Roodagi and Itnal (2001) concluded that the Intercropping sun hemp, cowpea, soybean, groundnut, potato and French bean in sugarcane showed improvement in soil chemical properties (organic C, available N, P₂O₅ and K₂O as well as Fe and Zn) and microbial population of bacteria, fungi, actinomycetes, number of free living N₂ fixers, P solubilizers and vesicular arbuscular mycorrhizal fungal spores after harvesting of sugarcane.

Roodagi *et al.* (2001) studied the impact of intercropping sunn hemp, maize, cowpea, soybean, groundnut, potato and French bean on growth and yield of sugarcane. Among the intercropping systems, sugarcane+sunn hemp recorded the highest brix (19.86%) and sucrose

(16.68%). While, purity (85.18%) and commercial cane sugar (11.26%) were higher in sugarcane+soyabean intercropping.

Raji and Oyekan (2002) carried out the agronomic evaluation of protein, energy and some nutrient potentials/production from intercropping soybean + sorghum on flatbeds and ridges. Intercropping both crops along the same row (intracrop arrangement) resulted in greater nutrients than any other planting system. Intracrop arrangement of soybean on flatbeds resulted in higher protein, energy and nutrient production per hectare. The potential protein production per hectare of soybean was 3 to 8 times than that of sorghum.

El-Dessougi *et al.* (2003) found that maize growth and yield was strongly inhibited when intercropped with white lupine, sugar beet or oilseed rape, probably because of competition for nutrients. But with groundnut as the accompanying species, maize yield was increased by a factor of 3, mainly because of an enhanced P influx.

Odunze *et al.* (2004) from Nigeria observed that the sole legumes and legume+maize treatments generally resulted in higher organic carbon contribution than sole maize. In addition, the sole legume and legume+maize treatments improved soil N between 65.6 and 84.8%, while N under sole maize showed only 5.9% increase.

Zhang *et al.* (2004) studied rhizosphere processes related with plant nutrition in major cropping systems in China. In the peanut +maize intercropping system, maize was found to improve the Fe nutrition of peanut through influencing its rhizosphere processes, suggesting an important role of phytosiderophores released from Fe-deficient maize. Intercropping between maize and faba bean was found to improve nitrogen and phosphorus uptake in the two crops compared with corresponding sole crop. The increased yield of maize intercropped with

fabo bean resulted from an interspecific facilitation in nutrient uptake depending on interspecific root interactions of the two crops.

Giri *et al.* (2006) studied the nutrient management of cotton based intercropping system and observed that uptake of NPK by cotton was more under sole cotton and cotton intercropped with blackgram than soybean. Application of 100% RDF recorded significantly higher NPK uptake by cotton than 75% and 50% RDF.

VI. Effect of intercropping on Statistical Indices or competition functions

Marshall and Willey (1983) from ICRIISA 1, Hyderabad reported that on the basis of Land Equivalent Ratio (LER) intercropping of pearl millet+groundnut gave 28 per cent more total dry matter (LER 1.28) than growing those two crops separately.

Mehta *et al.* (1985) from the intercropping study with groundnut reported the highest mean LER (1.25) in groundnut + sesame grown in the ratio of 3:1.

Singh and Singh (1993) observed the highest total grain equivalent of maize in paired-sown maize + French bean in 1:2 ratio. However, paired-sown maize + lentil in ratio of 1: 3 had the highest land-equivalent ratio (1.77).

Natarajan and Zharare (1994) conducted a field experiment at 3 sites in Zimbabwe. Maize cv. R201, sunflower cv. Masasa and groundnut cv. Natal Common were grown alone or intercropped with maize or sunflower or groundnut with row ratio of 1:1, 1:2 or 1:3. Land equivalent ratio (LER) was more than 1 and highest in intercropping maize or sunflower+ groundnut with row ratio of 1:2.

Singh and Singh (1994) examined comparative performance of intercropping pigeonpea with black gram, cowpea, sesame, groundnut, soybean, sorghum or maize. All intercropping treatments gave higher pigeonpea equivalent yields than the sole crops. The pigeonpea+sesame intercrop gave the highest pigeonpea equivalent yield (1.97 t ha⁻¹) and the highest land equivalent ratio of 1.89.

Singh and Arya (1995) in their field experiments on mixed cropping of finger millet with soybean, horsegram and ricebean, observed that grain yield of finger millet was highest in sole crop and it was decreased in the mixed cropping pattern except fingermillet + soybean (9:1). This treatment recorded higher LER as well as finger millet equivalent yield.

Gupta and Rathore (1995) worked on evaluation of optimum dose of fertilizers for pigeonpea+sesame intercropping system and revealed maximum pigeonpea equivalent yield when full recommended doses of fertilizers were applied to each component crop.

Kalaghatgi *et al.* (1995) observed highest LER (2.02) with pearl millet + pigeonpea in 4:2 ratio followed by pearl millet + groundnut in 2:4 ratio. Kathmale *et al.* (1995) studied the intercropping of groundnut *cv.* JI 24 with castor, sunflower, soybean, sesame, green gram, black gram or French bean in 6:2 row ratio. The groundnut+soybean intercrop gave the highest land equivalent ratio (1.28) and the highest groundnut equivalent yield.

Tofinga and Tukunga (1995) observed that groundnut had greater shoot competitive ability, but a lower root competitive ability than sweet corn. The relative yield total (RYT) of groundnut and sweet corn intercrops, based on total biomass, was 1.4 when only the root systems interacted and 1.6 when only the shoot systems interacted. These RYT values did not differ significantly from 1.8 when both root and shoot systems interacted.

Khistaria *et al.* (1996) observed that sorghum +pigeonpea intercrop (1:1) produced highest seed yield (0.49 and 0.66 t ha⁻¹, respectively) and the highest sorghum grain equivalent yield of 3.99 t.

Krishna and Raikhelkar (1997) studied the performance of maize with some legumes (red gram, black gram, green gram, ground nut and soybean) at Rudrur, Andhra Pradesh. The data on relative crowding coefficient (K) showed greater intensity of competition in the *C. cajan* system, whereas the maize+soybeans system recorded lower values of the coefficient, resulting in lower competition. The aggressivity values showed that maize was vigorous in growth habit compared with the intercrops. The values of competitive ratio (CR) revealed that the competition was higher (more than double) in maize+*C. cajan*, maize+groundnut and maize+soybean intercropping systems than maize+*V. radiata* and maize+*V. mungo* systems. The land equivalent ratios showed that there was yield advantage of 84% with maize+*V. mungo* and 83% with maize+*V. radiata* when compared with sole maize.

Barik (1997) while studying Maize + legume intercropping (groundnut, black gram, green gram, soybean, pigeonpea and cowpea) for North Central Plateau of Orissa, reported that intercropping increased the area-time-equivalent-ratio compared with pure stands. The highest maize-equivalent yield was given by maize + groundnut, followed by maize + pigeon pea.

Liphadzi *et al.*(1997) reported the positive values of aggressiveness, which indicated that maize was the stronger competitor when grown with groundnut.

Balyan (1997) from IARI, New Delhi reported that maize yield was increased due to intercropping with legumes as compared with maize grown alone. Yield of succeeding wheat crops was also increased when maize was intercropped with legumes. Wheat-equivalent yield of the

cropping systems was highest when wheat was sown after maize intercropped with *Cyamopsis tetragonoloba* either harvested for fodder or incorporated as green manure. Of the systems including grain legumes, groundnut gave the highest maize and wheat equivalent yields.

Tripathy *et al.* (1997) tested the performance of maize + cowpea (forage) intercropping system and observed higher LER under 2:2 row proportions which indicated yield advantages over 1:1 row proportion and sole planting. Higher RCC of maize component of the intercropping system revealed that maize was dominant to the cowpea component. Similarly, maize showed the positive values in aggressivity whereas cowpea showed negative values.

Yadav *et al.* (1997) observed that pigeonpea + sesame with 100% RDF recorded the highest pigeonpea equivalent yield followed by pigeonpea+ black gram with 100% RDF.

Dwivedi and Bajpai (1997) from IGKVV, Ambikapur (MP) revealed maximum pigeonpea equivalent yield (2070 kg ha⁻¹) and LER (1.47) due to pigeonpea+ groundnut (1:1) intercropping system.

Sarkar *et al.* (1998) studied sunflower based intercropping systems. Among the intercrop associations, normal row planting (45 cm) of sunflower with groundnut resulted in maximum sunflower-equivalent yield (26.05 q ha⁻¹), land equivalent ratio (1.52), monetary ratio (2.36) and indicated a modest aggressivity factor (± 0.16), competitive ratio (1.23: 0.87) and gave a good value for the product of crowding coefficient (K 11.51) and area time equivalent ratio (1.37), which proved most efficient system among all the intercropping systems.

Jana and Saren (1998) studied maize+groundnut intercropping systems and on the basis of calculation of land equivalent ratio, an intercropping gave 82 and 70% more productive yield than growing these two crops separately.

Barik *et al.* (1998) studied different intercropping systems of sorghum and groundnut under varying levels of nitrogen and indicated the advantages of intercropping over sole crops from the values of land-equivalent ratio (LER), relative value total (RVT) and relative net return (RNR). With respect to crop equivalent yield (in term of groundnut yield) the intercropping combination of sorghum and groundnut in 1: 2 ratio gave the maximum return.

Sinha *et al.* (1999) conducted an experiment to evaluate the yield and economics of winter maize based intercropping systems under different fertility and weed management systems. Maize intercropped with potato (1:2 and 2:4 ratio) recorded significantly higher maize- equivalent yield (12.30 and 12.02 t ha⁻¹) than normal (1:2) and paired planting (2:4) of maize with French bean (9.81 and 9.65 t ha⁻¹). On an average, maize intercropped with potato under normal and paired planting systems, recorded 20.69 and 18.89% higher maize equivalent yield than normal and paired row maize with French bean.

Khola *et al.* (1999) reported that intercropping of cowpea and blackgram with maize gave higher maize-equivalent yields (35.28 and 33.50 q ha⁻¹, respectively) than sole maize (28.00 q ha⁻¹). Intercropping also resulted in higher maize-equivalent yields than respective sole legume stands by 125.86, 128.05 and 265.00% under maize + cowpea, maize + blackgram and maize + soybean respectively. Normal sowing gave higher maize-equivalent yield (30.10 q ha⁻¹) than early sowing (22.66 q ha⁻¹) and late sowing (18.45 q ha⁻¹).

Singh and Arya (1999) from a field experiment to study N requirement of finger millet + pulse intercropping system reported the highest land equivalent ratio (1.31) and finger millet – equivalent yield (33.71 q ha⁻¹) under finger millet + soybean intercropping system with 75% RDN (Recommended dose of nitrogen) application.

Moorthy and Das (1999) studied different intercropping ratios of sesame with the legumes like green gram and groundnut and observed higher yields of green gram and groundnut grown alone while intercrops gave higher yields than pure sesame. The LER ranged from 0.8 to 1.25.

Bora (1999) reported that in case of wheat + rapeseed intercropping system, when sowing proportion of rapeseed was more, wheat became dominant as shown by positive aggressivity values for 1:1, 1:2, 1:3 sowing proportions.

Singh (2000) evaluated maize + blackgram intercropping systems and found that in mixed stand of maize and blackgram within 80 cm spacing, land – equivalent ratio and maize – equivalent yield were superior to sole and other intercropping systems.

Adhikari and Sarkar (2000) studied the intercropping effect of pigeonpea with 2 legumes, *viz.*, greengram and groundnut under different levels of phosphate fertilizer and cropping patterns. Relative Yield Loss due to intercropping was noted maximum (8.53%) in pigeonpea paired row system.

Sarkar *et al.* (2000) reported that intercropping of chickpea and safflower in 1: 1 row ratio proved most efficient system resulting in maximum chickpea-equivalent yield (12.76 q ha⁻¹), higher land-equivalent ratio (1.12), area time equivalent ratio (0.96) and maximum product of crowding coefficient (K 1.84) with modest competition coefficient (0.31: 0.68), which proved the most efficient. Chickpea sown with barley in 1:2 row proportion proved to be inefficient intercropping system with minimum chickpea-equivalent yield (9.84 q ha⁻¹).

Singh *et al.* (2000) from RAU, Pusa conducted a field trial for two years to study the water-use efficiency and yield of pure crops in maize based intercropping. Maize-equivalent yield was significantly highest (8.2 t ha⁻¹) with maize + turmeric compared with sole crops or with maize +

groundnut in the first year. However, in the second year, the difference between maize + turmeric and maize + groundnuts was not pronounced.

Singh *et al.* (2000) from their study on intercropping of lentil and vegetable pea in maize with 0, 50, 100, 150 and 200 kg N ha⁻¹, realized mean maize equivalent yields as 47.3, 115.3 and 67.2 q ha⁻¹ under maize, maize + pea and maize + lentil intercropping respectively.

Sarkar and Sanyal (2000) reported that the intercrop association of sesame + groundnut under 3:2 row proportion gave the maximum sesame - equivalent yield (947 kg ha⁻¹), Land Equivalent Ratio (1.31), product of Relative Crowding Coefficient (K- 3.87), Income Equivalent Ratio (1.21) and also indicated a modest Competitive Ratio (0.86: 1.16) and Aggressivity factor (± 0.37). It proved the best intercrop stand among all the crop associations.

Singh and Singh (2001) evaluated different planting patterns of maize and soybean intercropping. It was observed that the intercropping patterns were superior in terms of maize - equivalent yield and income - equivalent ratio (IER) values to sole crops. Among different intercropping patterns of maize and soybean, paired maize rows (either 30/90 or 46/90 cm) + 2 rows of soybean gave the highest maize - equivalent yield and IER values. The maximum values of relative net return (RNR) over sole maize were reported under paired maize rows (45/90 cm) + 2 rows of soybean.

Ramasamy *et al.* (2002) observed that performance of the crops *etc.* groundnut and red gram was better in sole crop than when grown in combination. Among the various row combinations, groundnut+ red gram in 8: 1 row recorded the higher groundnut equivalent yield (1064 kg ha⁻¹).

Musambasi *et al.*, (2002) reported that the partial land equivalent ratios ranged from 0.8 to 1.70, indicating that intercropping maize with

legumes (cowpea, groundnut, field bean and bambara nut) had an advantage over planting sole maize in *S. asiatica* infested fields.

Satapathy *et al.* (2002) showed that maize+arhar 2: 2 ratio recorded the highest maize equivalent yield followed by maize+arhar 2: 1 ratio. Highest average land equivalent ratio of 1.30 was obtained from maize+arhar 2: 2 ratio and the lowest average land equivalent ratio of 1.08 from maize+soybean 2: 4 ratio.

Padhi (2002) Studied maize-legume intercropping systems and found that maize+blackgram at 1:1 row ratio was more productive, economically and energetically viable with the highest maize-equivalent yield, land equivalent ratio, area time equivalent ratio, relative value total, relative net return, monetary advantage index, energy output and energy use efficiently for main and total produce. This system enhanced the total maize equivalent yield by 49.9% over that of normally sown sole maize (2512.3 kg ha⁻¹) and by 109.8% over that of sole blackgram (1786.2 kg ha⁻¹). Maize+soybean at 1:1 and 2:2 row ratio closely followed this system on the above aspects.

Ghosh (2004) from NRC, Junagadh observed higher land equivalent ratio (LER) and relative crowding coefficient (RCC) value which lead to a crop yield advantage. Accordingly, yield advantage was greater in case of the groundnut+maize association. The competition ratio (CR) was a better indication of performance than RCC. The CR of pearl millet and sorghum with two cuts were greater than maize but the corresponding CR of groundnut was less in these two systems.

Kumar *et al.* (2005) studied the production potential and economic feasibility of maize + cowpea intercropping at IGFRI, Jhansi. Intercropping of maize and cowpea in 2: 2 row ratio produced higher land-equivalent ratio (1.41) and monetary advantage (Rs. 2,427 ha⁻¹).

Ahlawat *et al.* (2005) from IARI, New Delhi reported that chickpea was adversely affected by intercropping with mustard, barley and linseed. Sole mustard recorded the highest productivity in terms of chickpea - equivalent yield (CEY). Among various intercropping systems, chickpea + barley (2:1 and 3:1) showed yield advantage in terms of LER while all the sole intercrops and chickpea- based intercropping systems except chickpea + linseed (4:1) recorded higher income equivalent ratio over sole chickpea. All the intercrops were more competitive and aggressive than chickpea. Based on RCC, chickpea intercropped with barley in all row proportions and with linseed in 3:1 and 4:1 proportion were the compatible intercropping systems.

Tripathi *et al.* (2005) from CSAUAI, Kanpur found that intercropping of chickpea + mustard in 8:2 row ratio recorded maximum chickpea- equivalent yield (24.31q ha⁻¹) and LER (1.19).

Adhikari *et al.* (2005) from Chotonagpur Plateau region studied maize + groundnut intercropping system and observed that sole groundnut recorded significantly high maize equivalent yield (79.28 q ha⁻¹) followed by maize + groundnut in 2:2 ratio (62.26 q ha⁻¹).

Verma *et al.* (2005) from GBPUAT, Pantnagar concluded that intercropping of fodder sorghum in narrow row space of pigeonpea (75 cm) with a row ratio of 1:2 was the most remunerative which gave highest pigeonpea-equivalent yield (34.36 q ha⁻¹). The similar treatment also recorded highest aggressivity index (0.533), ATER (1.21), LER (1.583) and RCC (15.07).

Verma *et al.* (2006) from IARI, New Delhi reported that the maize-equivalent yield was higher in maize paired row (40/80 cm) + 2 rows of mungbean than the sole maize crop.

Rana *et al.* (2006) from GBPUAT, Pantnagar studied the feasibility of various intercrops viz. lentil, mustard, maize, rajmash and rapeseed with

autumn sugarcane. It was observed that sugarcane + maize gave the highest cane-equivalent yield (200.6 t ha⁻¹).

Dutta and Bandyopadhyay (2006) conducted a field experiment at Jhargram, West Bengal to evaluate the production potential and economic feasibility of intercropping groundnut with pigeonpea and maize with various row proportions. Groundnut + pigeonpea in 5:2 row proportion or groundnut + maize in 4:2 row proportion showed high competitive ratios, LERs and monetary advantage among all intercropping systems.

Giri *et al.* (2006) studied the nutrient management of cotton based intercropping and observed the enhancement in the cotton equivalent at 100% RDF. The performance of cotton + blackgram (1:1) with 100% RDF was better than all the treatments for cotton equivalent yield.

VII. Effect of intercropping on economics of the system

Economics of particular intercropping system is supposed to be the most important aspect from the crop production point of view. Intercropping aims at maximum production and net returns per unit of time and space. Though the yield of main crops were reduced due to inclusion of component crops in intercropping systems higher monetary returns were recorded by many research workers in India, which is attributed to the bonus obtained from component crops.

Intercropping is a profitable practice under rainfed conditions. Growing of two or more crops on the same piece of land having different rooting capacity exploit the available resources from the soil fully. Thus, increasing the overall production and monetary returns (Aiyer, 1949).

Pillai *et al.*, (1957) found that in the mixed cropping of finger millet fairly high returns were obtained in finger millet + groundnut combination. A mixed crop of finger millet + groundnut gave maximum

net returns (Rs. 666 ha⁻¹) followed by finger millet + cotton + groundnut mixture.

Narang *et al.* (1969) while working under Ludhiana conditions obtained the maximum net profit of Rs. 930/- and Rs.723/- per hectare when soyabean was sown with maize in alternate rows under irrigated conditions.

Lingegouda *et al.*(1972) in studies on mixed cropping of groundnut and hybrid sorghum found that three rows of groundnut and one row of sorghum was more profitable (Rs. 3918/- ha⁻¹) than pure groundnut (Rs. 3123/- ha⁻¹) and thus higher monetary returns were gained through mixed cropping of groundnut and sorghum in the ratio of 3 : 1.

Singh *et al.*, (1972) reported that sesamum could successfully be grown as an intercrop in high yielding maize and mung. Intercropping of mung and sesamum grown in alternate rows is preferred over pure crop of mung. Maize + Sesame gave additional net returns of 33 per cent in 1969 and 47 per cent in 1970 over pure crop of maize.

Gangwar (1976) obtained significantly higher net returns when maize was sown with legumes than pure maize. Additional returns of Rs. 1828, Rs. 1419, Rs. 1276, Rs. 1251 and Rs. 630 were obtained when it was sown mixed with groundnut, urd, moong, cowpea and soyabean, respectively.

Isgiyanto *et al.*, (1980) reported high revenue from a mixed crop of groundnut and early maturing maize cultivar.

Kalra and Gangwar (1980) revealed that intercropping systems were better in increasing the net return per rupee spent over pure crop. Inclusion of legume as an intercrop with cereals increased the net returns significantly. Groundnut maize was found to be the best combination.

Raikhelkar and Upadhyay (1980) reported that the crops *etc.*, groundnut, green gram, blackgram and cowpea could be mixed for grain as well as fodder purpose in pearl millet. Further, the economic returns from sowing of one row of any one of the companion crops between paired rows of pearl millet at 30-70 cm gave significantly higher returns from 23.11 to 38.68 per cent over monoculture of pearl millet.

Roy *et al.*, (1981) reported that the performance of pigeonpea was most profitable when grown with maize and gave a net income of Rs. 5067/- per hectare. Pigeonpea + groundnut (Rs. 4517/- ha⁻¹) and pigeonpea + ragi (Rs. 4182/- ha⁻¹), which were statistically at par among themselves and also exhibited almost equal profitability. These results were similar to that reported by Anonymous (1981, 1982 a) under Dapoli conditions.

In an experiment at Dapoli, when nagali was grown mixed with horse gram, cowpea, blackgram, sesame in the proportion of 1:1, 2:1, 3:1 (area basis), the nagli + sesamum (2 : 1) combination recorded the highest net income of Rs. 398.78 ha⁻¹. (Anonymous, 1982).

Jadhav *et al.*, (1983) recorded increase in monetary returns due to intercropping of moong and groundnut in paired planting by .91 and 13.37 per cent, respectively over their normal planting as a monoculture.

Mehta *et al.* (1985) in their intercropping study with groundnut reported highest monetary returns from groundnut + arhar grown in the ratio of 6:1.

Asokaraja *et al.*, (1987) revealed that intercropping of red gram, cotton and maize in rows 1.5 or 2.25 m apart in irrigated groundnuts grown at a spacing of 22.5 × 15 cm had no significant adverse effect on groundnut yield. The intercrops gave additional yield and increased net returns.

Singh and Sharma (1987) observed no adverse effect on maize grain yield when blackgram, groundnut or mung were intercropped in *rabi* maize. The intercrops gave additional yields and increased the net returns and groundnut was found to be the best among all intercrops.

Nagaraja (1989) reported higher gross monetary returns (Rs. 466/- ha⁻¹) from the crop mixtures (Sorghum + pigeonpeas, groundnut + pigeonpeas, safflower + coriander and millet + cotton) in Anantapur District of Andhra Pradesh under rainfed conditions. Further, net income obtained from these crop mixtures were also high over monocropping.

Sawant (1989) reported that intercropping of groundnut with cowpea in all three ratios (1 : 1, 2 : 1, 3 : 1) and groundnut + Mustard in 3 : 1 and 2 : 1 ratios was more profitable than sole crop of groundnut. In intercropping system, highest cost: benefit ratio was obtained under groundnut + mustard intercropping. Lowest cost: benefit ratio was under groundnut + maize intercropping.

Shahu (1992) studied Pigeon pea + maize intercropping at Rampur, Chitawan, Nepal and realized higher gross returns from *Cajanus cajan*+maize intercropping than from sole-cropped *C. cajan* or *C. cajan* intercropped with *Vigna unguiculata*, groundnut, soybean or *Pennisetum coracana*.

Singh and Singh (1993) reported that the paired-sown maize + French bean in ratio of 1 : 2 gave the highest net returns (Rs. 10,032 ha⁻¹) and monetary advantage (Rs. 11,941 ha⁻¹), followed by paired-sown maize + lentil in ratio of 1: 3. The latter treatment, however, had the highest benefit: cost ratio (2.37).

Chittapur *et al.* (1993) studied the performance of maize + forage cereal intercropping on black clay-loam soils under rainfed condition. Maize grain yield decreased due to intercropping. The reduction in yield was of higher magnitude with 1:2 proportion with forage maize intercrop.

The higher net returns were realized under intercropping of maize + forage pearl millet. Senthivel *et al.* (1994) from Tamil Nadu Agricultural University, Aruppukkottai realized highest mean groundnut equivalent yield and net returns from intercropping groundnut with pigeonpea as compared to sorghum or *Paspalum scrobiculatum* intercropped with pigeonpea.

Kathmale *et al.* (1995) studied the intercropping of groundnut *cc.* JL-24 with castor, sunflower, soybean, sesame, green gram, black gram or French bean in 6:2 row ratio. Among these, groundnut + soybean intercropping gave the highest groundnut equivalent yield and the highest net returns as compared to all the crops when grown alone.

Dubey *et al.* (1995) from JNKVV (MP) concluded that sorghum+soybean or pigeonpea intercropped in paired rows (2:2) fetched highest biological potential and net profit, followed by their intercropping in alternate rows (1:1).

Sharma and Sharma (1995) studied the pearl millet based crop mixtures under rainfed conditions at Durgarpura (Rajasthan) and reported that sowing with mixture of 75% of the recommended seed rate of pearl millet +25% of recommended seed rate each of green gram, cowpea and cluster bean gave the highest economic returns followed by the mixture of 50% seed rate of pearl millet + 25% seed rate each of Green gram, cowpea and cluster bean.

Gupta and Rathore (1995) recorded maximum gross returns and net returns when full recommended doses of fertilizers were applied to each component crop of pigeonpea+sesame intercropping system.

Kalaghatgi *et al.* (1995) in their experiment on intercropping of pigeonpea with pearl millet realized highest net returns with pearl millet + pigeonpea in 4:2 ratio followed by pearl millet + groundnut in 2:4 ratio.

Khistaria *et al.* (1996) reported the highest seed yields and the highest net returns due to sorghum + pigeonpea intercropping (1:1).

Balyan (1997) studied the performance of maize based intercropping systems and observed increase in net returns due to intercropping of cowpea, clusterbean or groundnut with maize than maize alone.

Yadav *et al.* (1997) from JNKVV, Morena (MP) realized the highest benefit: cost ratio (4.51) and net returns (Rs. 22,227 ha⁻¹) from pigeonpea + sesame intercropping system supplied with 100% RDF.

Dwivedi and Bajpai (1997) revealed maximum net income (Rs.13,688 ha⁻¹) and B: C ratio (4.1) due to pigeonpea + groundnut (1:1) intercropping system.

Khistaria *et al.* (1997) reported that the groundnut + sesame (6:3) row ratio recorded significantly higher groundnut equivalent yield (6.33 q ha⁻¹) and maximum gross returns (Rs. 9021 ha⁻¹), which indicated that intercropping system of groundnut + sesame (6:3) found profitable.

Lourduraj *et al.* (1998) reported that groundnut yields in the groundnut + pigeonpea, groundnut + soybean and groundnut + cowpea intercrops were equal to the yield of mono-cropped groundnut. Among all the intercropping systems, groundnut + pigeonpea gave the highest net returns.

Maiti *et al.* (1998) reported the highest monetary returns from groundnut+ sesame (1:2) intercropping system with 60 kg N + 50 kg P₂O₅ ha⁻¹.

Yakadri *et al.* (1998) studied the effects of intercropping of pearl millet + groundnut and fertilizer levels on the yield and gross returns. Highest yield in terms of pearl millet equivalent and maximum gross returns per ha were obtained by the cultivation of pure stand of

groundnut, followed by intercropping of pearl millet + groundnut in 2: 1 row ratio.

Jana and Saren (1998) studied maize + groundnut intercropping systems and found that maize + groundnut in row ratio 1:2 revealed the maximum monetary returns and those were about 6 times more than sole maize.

Kaushik *et al.* (1998) worked out productive and economic association of pearl millet and groundnut on loamy sand soils of mid western plains of Uttar Pradesh. Composite or hybrid genotype of pearl millet with groundnut in 3: 1 row proportion was found better than solid crop of groundnut both in terms of net returns while farmer's practice of growing groundnut in mixed stand with pearl millet proved uneconomical.

Moorthy and Das (1999) studied different intercropping ratios of sesame with the legumes like green gram and groundnut and were also grown in pure stands. Monetary values were highest in green gram and groundnut grown alone while intercrops gave higher yields than pure sesame.

Patra *et al.* (1999) from B.C.K.V.V., West Bengal concluded that Maize + green gram in a 1:1 row ratio was the most economically viable system with the highest land equivalent ratio (1.54), monetary advantage (Rs 5973 ha⁻¹), net return (Rs 8541) and net production value (1.83).

Singh and Rahman (1999) from B.A.U., Ranchi realized the highest pigeonpea-equivalent yield (2.34 t ha⁻¹), land equivalent ratio (1.59), net return (Rs 11 212 ha⁻¹), benefit:cost ratio (1.96) and production efficiency (Rs 59 day⁻¹ ha⁻¹) due to pigeonpea + groundnut (1:2 row ratio) intercrop. This was followed by sole cropping of groundnut (2.04 t pigeonpea-equivalent yield) and the pigeonpea + maize (1:1 row ratio) intercropping system (1.46 t).

Sinha *et al.* (1999) realized more gross returns with maize + potato intercropping system, however, the net returns and net returns per rupee investment were higher in maize + French bean. The higher level of fertilizer i.e. 100% fertilizer dose resulted in significant increase in net returns but the net returns per rupee investment were higher with 75% fertilizer dose.

Singh and Arya (1999) conducted a field experiment during rainy season of 1995 and 1996 under rainfed conditions to study N requirement of finger millet + pulse (soybean, rice bean and French bean) intercropping system. The highest net return (Rs. 6,892 ha⁻¹) and benefit: cost ratio (2.12) were obtained under finger millet + soybean with 75% RDN application.

Singh *et al.* (2000) from RAU, Pusa conducted a field trial for two years to study the water-use efficiency and yield of pure crops and maize based intercropping and observed that net returns in the first year did not differ between maize + groundnuts and maize + turmeric but in the second year maize + groundnuts gave higher returns.

Adhikari and Sarkar (2000) studied the intercropping effect of pigeonpea with 2 legumes, *viz.*, greengram and groundnut under different levels of phosphate fertilizer and cropping patterns and realized highest monetary advantage of Rs. 6,670 ha⁻¹ in pigeonpea + groundnut paired row systems.

Sarkar *et al.* (2000) studied the productivity of chickpea based intercropping system and found that intercropping of chickpea and safflower in 1: 1 row ratio proved most efficient system resulting in maximum gross (Rs. 10,846) and net (Rs. 5,346 ha⁻¹) monetary returns and benefit: cost ratio (1.97). Chickpea sown with barley in 1:2 row proportion proved to be inefficient intercropping system with minimum net monetary returns (Rs. 2,758 ha⁻¹).

Sarkar and Sanyal (2000) realized maximum monetary advantage (Rs. 2,913 ha⁻¹) and net returns (Rs. 5,321 ha⁻¹) due to intercrop association of sesame + groundnut under 3:2 row proportion. An intercropping of groundnut with sesame was found most beneficial to sole stand of sesame.

Roodagi *et al.* (2001) from Dharwad studied the Impact of intercropping sunnhemp, maize, cowpea, soybean, groundnut, potato and French bean on growth, yield and economics of sugarcane. Intercropping of sugarcane with soybean (ridge and furrow planting with paired row 60-120-60 cm) recorded the highest net income (Rs. 68 336 ha⁻¹) and B: C ratio (3.21).

Singh and Singh (2001) evaluated different planting patterns of maize and soybean intercropping. All the intercropping patterns except, 1 additional maize row after every 2 rows of soybean (1:2) recorded higher monetary returns than sole crops. Among different intercropping patterns of maize and soybean, paired maize rows (either 30/90 or 46/90 cm) 2 + rows of soybean gave the highest net return and benefits: cost ratio.

Chandrika *et al.* (2001) obtained higher net returns of Rs. 14,070 and Rs. 3,331 with groundnut + red gram intercropping (7:1) in the good and bad years i.e. 1996-97 and 1997-98 respectively. Higher total yield advantages and monetary returns were also recorded with groundnut + red gram intercropping in 7: 1 ratio.

Padhi (2002) found that maize + blackgram at 1:1 row ratio was more productive, economically and energetically viable system with the highest net returns and returns rupee⁻¹ invested. The net return realized from this system were increased by Rs 6093 and Rs 4840 ha⁻¹ and energy output by 8.14x1000 and 85.53x1000 MJ ha⁻¹ over normally sown sole maize and sole blackgram, respectively. Maize + soybean at 1:1 and 2:2 row ratio closely followed this system on the above aspects. Maize + groundnut, however, at 1:1, 2:1 and 2:2 row ratio although found

uneconomical compared to sole maize but accrued more profit compared to sole blackgram.

Ghosh (2002) from Junagadh recorded significant reduction in yield attributes and yield of groundnut when 2 cuts of pearl millet and sorghum were planned. However, such yield reduction was nullified by high fodder yield and high net returns obtained from 2 cuts of pearl millet. Thus, 2 cuts of pearl millet, one at 60 days and the other at 106 days in association with summer groundnut not only provided additional income to the farmer but also mitigated the fodder scarcity to some extent in dry season.

Satapathy *et al.* (2002) observed that maize+arhar 2: 2 ratio gave the highest gross return and net profit per hectare. The highest benefit: cost ratio was obtained from sole crop of arhar followed by maize+arhar 2: 2 ratio due to more production and higher support price of arhar, whereas the lowest under sole crop of maize.

Guggari and Kalaghatagi (2005) from RARS, Bijapur revealed significantly higher grain yield of sole pearl millet than intercropped with pigeon pea. However, pearl millet equivalent yield, net returns and benefit: cost ratio were higher with pearl millet + pigeonpea intercropping system (2:1) over sole crop of pearl millet.

Kumar *et al.* (2005) reported that intercropping of maize and cowpea in 2: 2 row ratio produced higher net returns (Rs. 8,346 ha⁻¹). Benefit: cost ratio for sole maize was higher (1.78) than other treatments except maize + cowpea at 2:2 proportions.

Tripathi *et al.* (2005) from CSAUAT, Kanpur observed that intercropping of chickpea + mustard in 8:2 row ratio recorded maximum net monetary returns (Rs.17, 101 ha⁻¹) and B: C ratio (2.11). Both chickpea and mustard in sole and intercropping systems responded favourably up

to 60 kg P₂O₅ ha⁻¹ for net monetary returns over no phosphorous and 30 kg P₂O₅ ha⁻¹.

Adhikari *et al.* (2005) from Chotonagpur Plateau region studied maize + groundnut intercropping system and observed that sole groundnut recorded significantly high net returns (Rs.23, 238 ha⁻¹) and B: C ratio (2.38), followed by maize + groundnut in 2:2 ratio (Rs.18, 595 ha⁻¹ and 2.32 respectively).

Chalka and Nepalia (2005) from Udaipur evaluated the maize+legume intercropping system during rainy season of 2001 and 2002. Introduction of rainy season legumes in maize did not affect yield attributes and yield of maize but significantly increased maize-equivalent yield. Higher net returns and B: C ratio were obtained by maize + cowpea intercropping.

Verma *et al.* (2005) from GBPUAT, Pantnagar concluded that intercropping of fodder sorghum in narrow row space of pigeonpea (75 cm) with a row ratio of 1:2 was the most remunerative which gave highest net returns (Rs. 30, 179 ha⁻¹) and B: C ratio (4.96).

Rana *et al.* (2006) from GBPUAT, Pantnagar studied the feasibility of various intercrops viz. lentil, mustard, maize, rajmash and rapeseed with autumn sugarcane. It was observed that sugarcane + maize gave the highest net returns (Rs. 124, 874 ha⁻¹).

Dutta and Bandyopadhyay (2006) conducted a field experiment to evaluate the production potential and economic feasibility of intercropping groundnut with pigeonpea and maize and it was concluded that groundnut + pigeonpea in 5:2 row proportion or groundnut + maize in 4:2 row proportion was most remunerative in respect of net returns and B: C ratio.

Srivastava and Bohra (2006) from BIU, Varanasi found that association of wheat with mustard under 5:1 row ratio was more sustainable as it accounted for higher values in terms of net returns (Rs. 28, 634 ha⁻¹).

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

The present investigation “Effect of levels of fertilizer and row proportions on sweet corn (*Zea mays saccharata*) and groundnut (*Arachis hypogaea*) intercropping” was conducted at Agronomy farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) during *rabi* season of the years 2003-04 and 2004-05. The analytical work was done in research laboratory of the Department of Agronomy. The materials used and methodology adopted during the investigation are explained in this chapter.

3.1 Experimental site

The field experiment was conducted in plot no. 42 of ‘B’ block. The site was selected on the basis of the suitability of soil for growing groundnut and maize. Topography of the plot was fairly uniform with a gradual gradient towards the south direction.

3.2 Soil

The composite soil samples from 0-30 cm. layer were taken with the help of screw auger before the layout of an experiment and after harvest of crop. Soil thus collected was air dried and preserved properly in the aluminum boxes. It was then analyzed for the various physico-chemical properties. The techniques used for determination of various properties are given in Table 1.

The soil of the experimental field was sandy clay loam in texture and slightly acidic in reaction with pH 6.73. It was high in available nitrogen, low in phosphorus and medium in potassium content.

Table 1 : Mechanical, physical and chemical composition of the soil (0-30 cm)

	Soil component analyzed	Values	Methods used and reference
A]	Mechanical analysis		
	Sand (%)	38.24	Bouyoucos Hydrometer Method (Bouyoucos, 1962)
	Silt (%)	21.75	
	Clay (%)	40.01	
Textural class	Sandy clay loam		
B]	Physical properties		
	Bulk Density (g cc ⁻¹)	1.35	Keen Rackzowski Method (Piper, 1950)
	Water Holding Capacity (%)	31.57	
	Pore space (%)	43.11	
	Particle Density (g cc ⁻¹)	2.30	
Volume Expansion (%)	6.79		
C]	Chemical properties		
	Avail. Nitrogen (kg ha ⁻¹)	327.63	Alkaline permanganate Method (Subbaiah and Asija, 1956)
	Avail. Phosphorus (kg ha ⁻¹)	14.47	Bray's Methods No. 1 (Bray and Kurtz, 1945)
	Avail. Potassium (kg ha ⁻¹)	289.16	Flame Photo meter Method (Jackson, 1973)
	Organic Carbon (%)	1.2	Walkely and Black Titration Method (Black, 1965)
	Soil pH	6.73	Beckman pH meter, (Jackson, 1973)

3.3 Climatic conditions

Agronomy farm, College of Agriculture, Dapoli is situated in the subtropical region at 17.1° North latitude and 73.1° East longitude having elevation of 250 m above the mean sea level. The climate is sub-tropical

which is characterized by warm and humid atmosphere. The data regarding different weather parameters recorded at the meteorological observatory at Agronomy farm, College of Agriculture, Dapoli during the period of experimentation are presented in Table 2a and 2b.

Table 2a : Weather data during the crop growth period, 2003-04

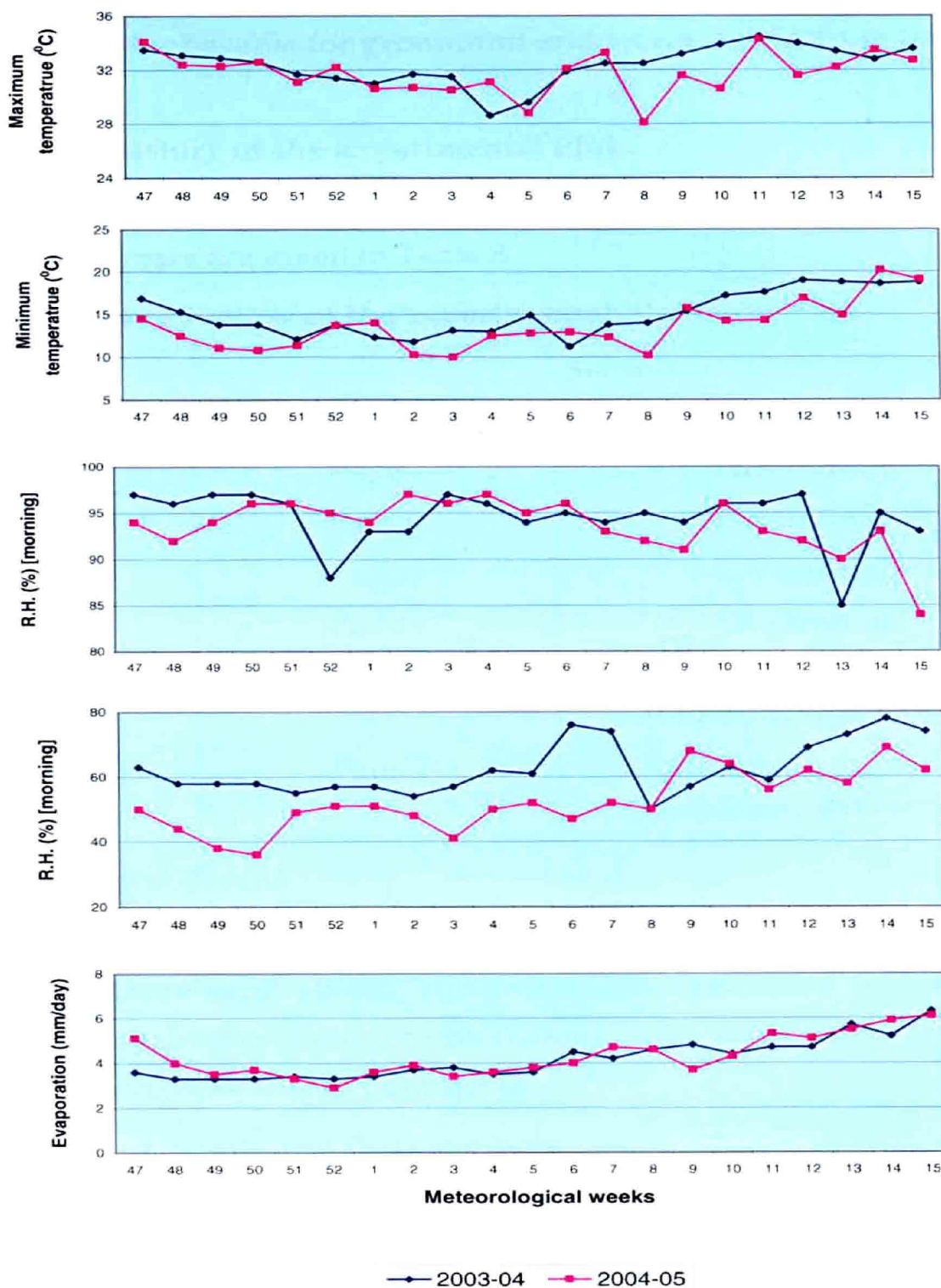
Met Wk	Period	Temp. (°C)		Relative Hum. (%)		S.H. (hrs per day)	W.S. (Km per hr)	Evap. (mm per day)
		Max.	Min.	Mor.	AN			
47	19.11 -- 25.11	33.5	16.9	97	63	8.3	3.0	3.6
48	26.11 -- 02.12	33.1	15.3	96	58	8.9	2.6	3.3
49	03.12 -- 09.12	32.9	13.8	97	58	8.4	2.5	3.3
50	10.12 -- 16.12	32.6	13.8	97	58	8.7	2.5	3.3
51	17.12 -- 23.12	31.7	12.1	96	55	8.8	2.7	3.4
52	24.12 -- 31.12	31.4	13.8	88	57	8.7	3.1	3.3
01	01.01 -- 07.01	31.0	12.3	93	57	8.2	2.6	3.4
02	08.01 -- 14.01	31.7	11.8	93	54	8.8	2.9	3.7
03	15.01 -- 21.01	31.5	13.1	97	57	9.0	2.8	3.8
04	22.01 -- 28.01	28.6	13.0	96	62	8.5	3.6	3.5
05	29.01 -- 04.02	29.6	14.9	94	61	9.0	3.9	3.6
06	05.02 -- 11.02	31.9	11.2	95	76	9.4	3.6	4.5
07	12.02 -- 18.02	32.5	13.8	94	74	9.1	3.1	4.2
08	19.02 -- 25.02	32.5	14.0	95	50	9.3	3.8	4.6
09	26.02 -- 04.03	33.2	15.4	94	57	9.2	3.8	4.8
10	05.03 -- 11.03	33.9	17.2	96	63	8.9	4.0	4.4
11	12.03 -- 18.03	34.5	17.6	96	59	9.2	4.2	4.7
12	19.03 -- 25.03	34.0	19.0	97	69	8.4	4.3	4.7
13	26.03 -- 01.04	33.4	18.8	85	73	8.8	5.6	5.7
14	02.04 -- 08.04	32.8	18.6	95	78	9.0	5.0	5.2
15	09.04 -- 15.04	33.6	18.8	93	74	9.9	5.4	6.3

Table 2b : Weather data during the crop growth period, 2004-05

Met Wk	Period	Temp. (°C)		Relative Hum. (%)		S.H. (hrs per day)	W.S. (Km per hr)	Evap. (mm per day)
		Max.	Min.	Mor.	AN			
47	19.11 -- 25.11	34.1	14.5	94	50	8.9	2.4	5.1
48	26.11 -- 02.12	32.4	12.5	92	44	8.9	2.4	4.0
49	03.12 -- 09.12	32.3	11.1	94	38	8.6	2.2	3.5
50	10.12 -- 16.12	32.6	10.8	96	36	8.2	1.9	3.7
51	17.12 -- 23.12	31.1	11.4	96	49	8.5	2.1	3.3
52	24.12 -- 31.12	32.2	13.7	95	51	7.7	2.4	2.9
01	01.01 -- 07.01	30.6	14.0	94	51	7.3	2.7	3.6
02	08.01 -- 14.01	30.7	10.3	97	48	8.2	2.7	3.9
03	15.01 -- 21.01	30.5	10.0	96	41	8.3	3.0	3.4
04	22.01 -- 28.01	31.1	12.5	97	50	7.8	2.9	3.6
05	29.01 -- 04.02	28.8	12.8	95	52	7.8	4.1	3.8
06	05.02 -- 11.02	32.1	12.9	96	47	8.6	3.4	4.0
07	12.02 -- 18.02	33.3	12.3	93	52	9.0	3.8	4.7
08	19.02 -- 25.02	28.1	10.2	92	50	9.3	4.3	4.6
09	26.02 -- 04.03	31.6	15.7	91	68	8.4	3.6	3.7
10	05.03 -- 11.03	30.6	14.2	96	64	7.9	4.8	4.3
11	12.03 -- 18.03	34.3	14.3	93	56	9.2	3.9	5.3
12	19.03 -- 25.03	31.6	16.9	92	62	8.2	4.4	5.1
13	26.03 -- 01.04	32.2	14.9	90	58	8.6	4.5	5.5
14	02.04 -- 08.04	33.5	20.2	93	69	8.5	4.5	5.9
15	09.04 -- 15.04	32.7	19.1	84	62	8.5	4.7	6.1

Data from Table 2 indicated that during the period of experimentation mean maximum temperature varied from 28.1 °C to 34.3 °C and mean minimum temperature varied from 10.0 °C to 20.2 °C. In case of relative humidity, maximum humidity varied from 84.0 per cent to 97.0 per cent and minimum humidity varied from 36 per cent to 78 per

Fig. 1. Meteorological observations during the crop growth period 2003-04 and 2004-05



cent. The sunshine hours per day varied from 7.3 hrs. to 9.9 hrs. The speed of wind ranged from 1.9 to 5.6 km per hour. The evaporation values increased with increase in daily temperature and wind speed and they were in the range of 2.9 to 6.3 mm per day. In general, the weather conditions were favourable for groundnut and sweet corn during both the years.

3.4 Cropping history of the Experimental Plot

The details of crop grown on the experimental plot during the preceding four years are given in Table 3.

Table 3 : Cropping history of the experimental plot

Year	Season	
	<i>Kharif</i>	<i>Rabi</i>
1999-2000	Paddy	Groundnut
2000-2001	Paddy	Groundnut
2001-2002	Paddy	Groundnut
2002-2003	Paddy	Groundnut
2003-2004	Paddy	Groundnut + Sweet corn (Experimental crops)
2004-2005	Paddy	Groundnut + Sweet corn (Experimental crops)

3.5 Experimental details

The experiment was carried out in 'Randomized Block Design' with three replications. The treatments comprised of two sole crops and three intercropping combinations with three NPK fertilizer levels. In all there were fifteen treatments.

3.5.1 Treatment details and their symbols

The treatment details along with their symbol are given in Table 4.

Table 4 : Treatment details

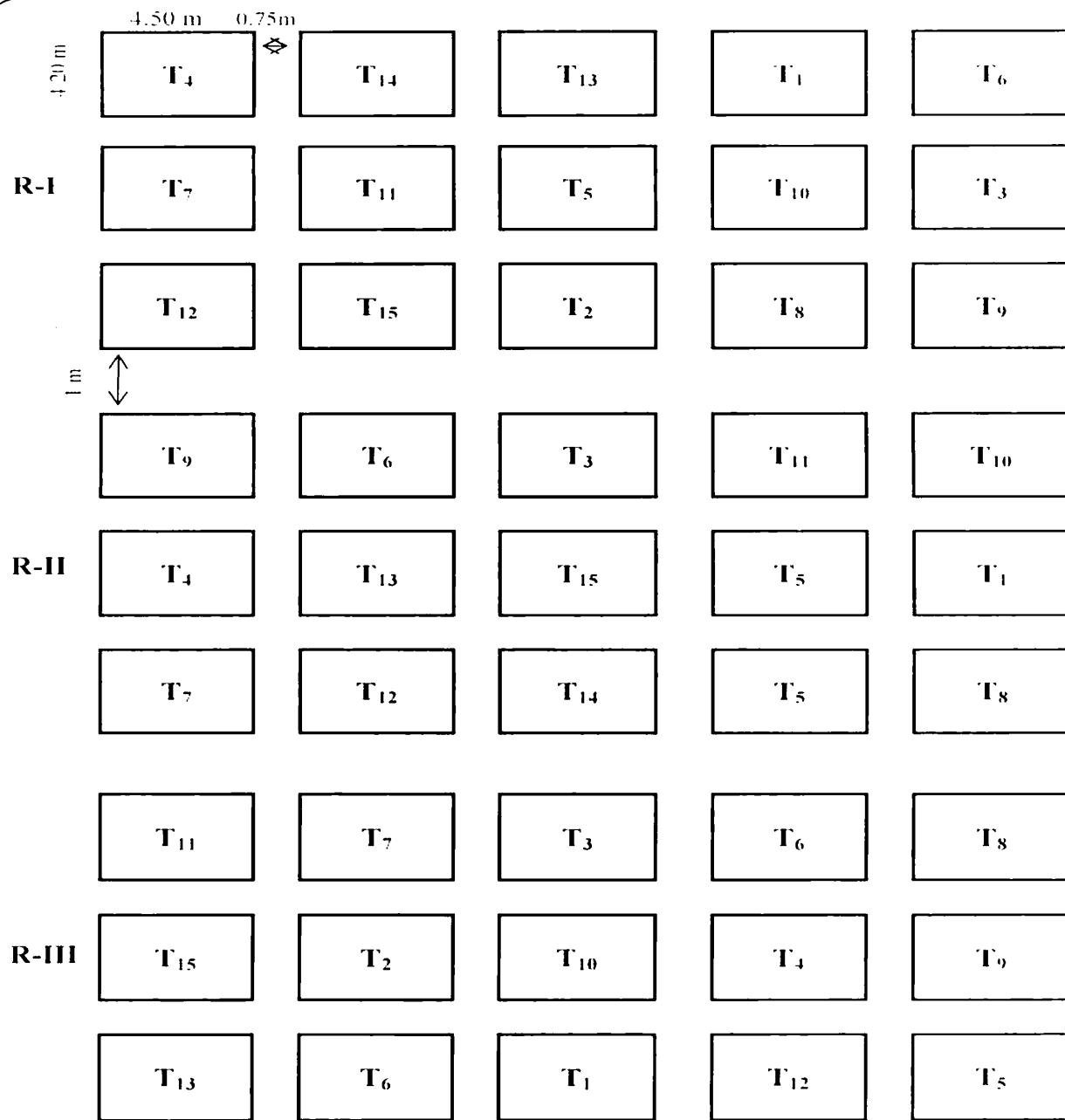
Symbol	Treatment
T ₁	Sole Groundnut with 75% RDF
T ₂	Sole Groundnut with 100% RDF
T ₃	Sole Groundnut with 125% RDF
T ₄	Sole Sweet corn with 75% RDF
T ₅	Sole Sweet corn with 100% RDF
T ₆	Sole Sweet corn with 125% RDF
T ₇	Groundnut + Sweet corn, 1:1 proportion with 75% RDF
T ₈	Groundnut + Sweet corn, 1:1 proportion with 100% RDF
T ₉	Groundnut + Sweet corn, 1:1 proportion with 125% RDF
T ₁₀	Groundnut + Sweet corn, 2:1 proportion with 75% RDF
T ₁₁	Groundnut + Sweet corn, 2:1 proportion with 100% RDF
T ₁₂	Groundnut + Sweet corn, 2:1 proportion with 125% RDF
T ₁₃	Groundnut + Sweet corn, 3:1 proportion with 75% RDF
T ₁₄	Groundnut + Sweet corn, 3:1 proportion with 100% RDF
T ₁₅	Groundnut + Sweet corn, 3:1 proportion with 125% RDF

3.5.2 Plot size

- Gross plot : 4.50x 4.20m
- Net plot : 3.90x 4.00m – Groundnut
3.60x 3.80m – Sweet corn
- Design : Randomized block design
- No. of treatments : 15
- Replications : Three
- Total plots : 45
- Cultivars : TG-26 (Groundnut)
Sumadhur (Sweet corn)

3.6 Cultural operations

Details of the cultural operations followed during the course of



Treatment details

- T₁ - Sole groundnut with 75% RDF
- T₂ - Sole groundnut with 100% RDF
- T₃ - Sole groundnut with 125% RDF
- T₄ - Sole sweet corn with 75% RDF
- T₅ - Sole sweet corn with 100% RDF
- T₆ - Sole sweet corn with 125% RDF
- T₇ - Groundnut + Sweet corn (1:1) with 75% RDF
- T₈ - Groundnut + Sweet corn (1:1) with 100% RDF
- T₉ - Groundnut + Sweet corn (1:1) with 125% RDF
- T₁₀ - Groundnut + Sweet corn (2:1) with 75% RDF
- T₁₁ - Groundnut + Sweet corn (2:1) with 100% RDF
- T₁₂ - Groundnut + Sweet corn (2:1) with 125% RDF
- T₁₃ - Groundnut + Sweet corn (3:1) with 75% RDF
- T₁₄ - Groundnut + Sweet corn (3:1) with 100% RDF
- T₁₅ - Groundnut + Sweet corn (3:1) with 125% RDF

Fig. 2. Plan of layout of the experiment



Plate I. General view of the experimental plot

Table 5 : Schedule of field operations

Sr. No.	Field operations	Date of operation	
		2003-04	2004-05
1.	Preparatory tillage		
	a. Ploughing by Tractor	15.11.03	10.11.04
	b. Clod crushing	18.11.03	14.11.04
	c. Stubble collection	20.11.03	16.11.04
	d. Planking and Leveling	21.11.03	17.11.04
	e. Layout of plot	22.11.03	17.11.04
	f. Preparation of flat beds	24.11.03	18.11.04
	g. Marking with marker	25.11.03	19.11.04
2.	Sowing by dibbling	26.11.03	20.11.04
3.	Gap filling	04.12.03	28.11.04
4.	Thinning	11.12.03	05.12.04
5.	Fertilizer application		
	I. For groundnut		
	a. 100% N, P and K	26.11.03	20.11.04
	II. For sweet corn		
	a. Basal dose (40 % N) and full P and K	26.11.03	20.11.04
	b. Band placement (40% N)	21.12.03	15.12.04
	c. Band placement (20% N)	10.01.04	04.01.05
6.	Weed control		
	Hand weeding	25.12.03	20.12.04
7.	Irrigations	14.01.04	09.01.05
		26.11.03	20.11.04
		07.12.03	03.12.04
		24.12.03	21.12.04
		10.01.04	09.01.05
		26.01.04	25.01.05
		10.02.04	11.02.05
		24.02.04	26.02.05
		10.03.04	13.03.05
		23.03.04	26.03.05
9.	Plant protection		
	a. Application of Phorate	26.12.03	20.12.04
	b. Spray of Endosulfan and Bavistin	10.01.04	04.01.05
	c. Spray of Monochrotophos and Kawach	25.01.04	19.01.05
		02.03.04	28.02.05
	d. Spray of Dichlorovas (Nuvon)	04.01.04	29.01.05
		14.02.04	08.02.05
10.	Picking of cobs and cutting of stover	21.02.04	15.02.05
		23.02.04	18.02.05
		27.02.04	22.02.05
11.	Harvesting of groundnut	07.04.04	10.04.05
		08.04.04	11.04.05

3.6.1 Preparatory tillage

Ploughing of the experimental field was done with a tractor-operated plough, followed by harrowing with spring tooth harrow. After that, clods were crushed by using tractor-operated rotavator. Then planking was done to level the field and to bring it in good tilth.

3.6.2 Layout of the field

Layout was done after planking the field, according to the randomized block design. In all there were 45 plots and 15 plots in each replication. The experiment was replicated thrice.

3.6.3 Seed material

Groundnut cultivar, TG-26 and sweet corn cultivar, 'Sumadhur' were used in the present investigation. The seed material of groundnut and sweet corn were obtained from A.R.S. Digraj, Dist. Sangli (M.S.) and Mahyco Seeds Ltd. respectively. The germination was 91 per cent, which resulted in good crop stand in the field.

The sweet corn cultivar, 'Sumadhur' was used in the present investigation. The seeds were obtained from Mahyco Seeds Ltd. The germination was 89 per cent, which resulted in good crop stand in the field. The germination was 91 per cent, which resulted in good crop stand in the field.

3.6.4 Seed treatment

Seeds of groundnut were treated with Thirum @ 3 g kg⁻¹ of seed, before sowing in order to protect them against fungal diseases. On the other hand sweet corn seeds were treated by the manufacturer with fungicide.

3.6.5 Sowing of seeds

Seeds of groundnut and sweet corn were sown at the different spacing and row proportions as per the intercropping treatments. Two seeds were dibbled at each spot at about 5 cm depth. After sowing seeds

were covered with soil. Spacing adopted for groundnut was 30 x 10 cm. While, in case of sweet corn it was 45 x 20 cm. The distance between two consecutive rows of groundnut and sweet corn was 37.5 cm.

3.7 Other details

3.7.1 Application of Manures and Fertilizers

Well decomposed poultry manure @ 5 t ha⁻¹ was uniformly applied in each gross plot and mixed thoroughly into the soil at the time of land preparation.

Nitrogen, Phosphorus and Potash were applied in the form of urea (46.4 % N), single super phosphate (16 % P₂O₅) and muriate of potash (60 % K₂O) respectively. For groundnut and sweet corn, the recommended doses 25 : 50 : 50 and 150 : 50 : 50 kg NPK ha⁻¹ were applied. The recommended dose of each crop was applied in their respective rows as per the proportion in intercropping.

Nitrogen, Phosphorus and Potassium were applied as per the treatments. Full dose of nitrogen, phosphorus and potash was applied to groundnut at the time of sowing. For sweet corn, uniform dose of phosphorus and potassium @ 50 kg ha⁻¹ each along with 40% N were applied as a basal dose at the time of sowing. Remaining 40 % N was applied at 25 DAS and 20 % at 45 DAS or at pre-tasseling stage.

3.7.2 Gap filling and thinning

Gap filling was undertaken 8 DAS to maintain uniform plant population of groundnut and sweet corn wherever necessary. Similarly, thinning was carried out at 15 DAS in order to maintain one plant of sweet corn per hill.

3.7.3 Weed control

Hand weeding was undertaken twice i.e. 30 and 50 DAS to keep the weed population under control.

3.7.4 Irrigation

The irrigations were given after 70 mm CPE. First irrigation was given immediately after sowing. In all 9 irrigations were required for the crops.

3.7.5 Plant protection measures

To control stem borer, Phorate 10 G granules @ 10 kg per ha were applied 30 DAS. For controlling the sucking pests and leaf blight disease, sprays of Endosulfan @ 1.7 ml per liter of water and Bavistin 2.0 g per liter of water were taken 45 DAS. At 60 DAS spray of Monochrotophos 2 ml and Kawach 1.0 g per liter of water were taken for controlling cob borer and leaf blight. Same sprays were repeated for groundnut during pod development stage to control sucking pests and to prevent rust disease. Sprays of Dichlorovas (Nuvon) 1 ml per liter of water was taken at 70 and 80 DAS to control cob borer on sweet corn.

3.7.6 Harvesting

The cobs were picked at green stage i.e. early dough stage from the standing crop. The cobs from ring line were removed separately to remove the border effect. The weight of green cobs and other observations of green cobs were recorded from the net plot. After removing the green cobs from the plants, the fodder was harvested and green biomass weight was also recorded from the net plot.

The groundnut crop was harvested when the pods were matured fully. Harvesting was carried out manually by uprooting the plants. Five observation plants were harvested separately for recording the observations. The plants from net plot were harvested after removing the ring lines.

3.8 Growth Studies in groundnut

For assessing the effect of different treatments on the growth and development of groundnut crop, periodical biometric observations were

recorded. First periodical observation was recorded at 30 DAS. Then after they were recorded at 60, 90, 120 DAS and at harvest. Particulars of the observations recorded in respect of the experimental crop are mentioned in Table 6.

Table 6 : Details of biometric and other observations of groundnut

Sr. No.	Particulars	Frequency	DAS
A.	Pre harvest studies		
	1. Height of plant (cm)	5	30,60,90,120
	2. Number of functional leaves per plant	5	DAS and at harvest
	3. Number of branches per plant	5	
	4. Dry matter production (g plant ⁻¹)	5	
	Post harvest studies		
	1. Number of pods per plant	1	At harvest
	2. Weight of pods per plant (g)	1	
	3. Weight of kernels per plant (g)	1	
	4. 100 kernel weight (g)	1	
	5. Pod yield (q ha ⁻¹)	1	
	6. Kernel yield (q ha ⁻¹)	1	
	7. Haulm yield (q ha ⁻¹)	1	
C.	Soil analysis		
	1. Available nitrogen (kg ha ⁻¹)	2	Before
	2. Available phosphorus (kg ha ⁻¹)	2	sowing and
	3. Available potassium (kg ha ⁻¹)	2	at harvest
D.	Plant analysis		
	1. Nitrogen content in the kernel, shell and haulm	1	At harvest
	2. Phosphorus content in the kernel, shell and haulm	1	
	3. Potassium content in the kernel, shell and haulm	1	
E.	Quality studies		
	1. Protein content of the kernel (%)	1	At harvest
	2. Oil content of the kernel (%)	1	

3.8.1 Pre harvest Studies

3.8.1.1 Height of plant

The height of five randomly selected and marked plants in each plot was measured from the ground level to the collar of the upper most fully opened leaf. Average of five plants was worked out to get the mean height per plant.

3.8.1.2 Number of functional leaves per plant

The number of functional leaves per plant was recorded in order to get the idea of growth and vigour of the plants in various treatments and the average was worked out. A leaf with all leaflets intact and having dark green colour was considered as functional leaf.

3.8.1.3 Number of branches per plant

The number of branches per plant was worked out by counting the lateral branches of five observation plants and average number of branches was recorded.

3.8.1.4 Dry matter per plant (g)

For dry matter, one plant was randomly selected from each treatment plot at the time of every observation. Plant was uprooted and its roots were removed from the collar. The plant was chopped into small pieces, kept in a labeled brown paper bag and dried first in the sunlight and then in thermostatically controlled oven at 50-60°C temperature till there was no loss in weight. The weight of dried plant was recorded as dry matter.

3.8.2 Post-harvest study

3.8.2.1 Number of pods per plant

The number of mature pods from five representative plants was counted and average was worked out.

3.8.2.2 Weight of pods per plant (g)

The total weight of mature pods from five representative plants was recorded and average was worked out.

3.8.2.3 Weight of kernels per plant (g)

Pods from the five representative plants were shelled and total weight of kernels was measured and then it was divided by five to record the weight of kernels per plant.

3.8.2.4 100-kernel weight (g)

A random sample of 100 kernels was taken from the total kernels obtained by shelling of 250 g pods from each net plot. Their weight was recorded as 100-kernel weight.

3.8.2.5 Pod yield (q ha⁻¹)

Pod yield obtained from each net plot was measured after thorough drying and converted to per ha dry pod yield.

3.8.2.6 Kernel yield (q ha⁻¹)

The kernel yield for each treatment was obtained based on shelling percentage and dry pod yield per ha.

3.8.2.7 Haulm yield (q ha⁻¹)

After separation of pods, plot wise aerial parts were sun dried for seven days. Air dry weight of this produce was taken as haulm yield per net plot and expressed on hectare basis.

3.8.3 Soil Analysis

The soil analysis was carried out from the samples drawn from the each net plot after harvest of the crops and a composite soil sample taken before sowing of crops, for available nitrogen, available phosphorus and exchangeable potash.

3.8.4 Plant analysis

The plants samples after harvesting were utilized for chemical analysis. The plant parts were separated into kernels, shells and haulm. Treatmentwise dried samples of the kernels, shells and haulm were powdered (100 mesh) separately and used for analysis.

3.8.4.1 Nitrogen content in the kernels, shells and haulm (%)

Treatmentwise nitrogen content in the kernels, shells and haulm of groundnut was determined separately by micro-Kjeldahl method.

3.8.4.2 Phosphorus content in kernels, shells and haulm (%)

Treatmentwise samples of the kernels, shells and haulm were digested according to procedure of Jackson (1973) and the digested samples were subjected to analysis for phosphorus by Vanadomolybdate yellow colour method.

3.8.4.3 Potassium content in the kernels, shells and haulm (%)

The extract prepared for phosphorus determination from the plant samples was used for determination of total potassium by Flame photometer as suggested by Jackson (1973).

3.8.5 Quality studies

3.8.5.1 Protein content of the kernels (%)

Total N content was determined from the kernels of each treatment by modified micro-Kjedahl method. Then to get the protein percentage from the kernel following formula was used.

$$\text{Per cent protein} = \% \text{ N} \times 6.25$$

3.8.5.2 Oil content of the kernels (%)

Oil content in the groundnut kernels was estimated by using Soxhlet apparatus and percent oil content was multiplied by kernel yield to get total oil yield.

3.9 Growth Studies in sweet corn

In order to assess the effect of different treatments on the growth and development of the experimental crop, periodical observations were recorded. First periodical observation was recorded at 30 DAS. Then after they were recorded at 60 DAS and at harvest. Particulars of the important observations recorded in respect of the experimental crop are mentioned in Table 7.

Table 7: Details of biometric and other observations of sweet corn

Sr. No.	Particulars	Frequency	Days after sowing
A.	Pre harvest studies		
	1. Height of plant (cm)	3	30, 60 and
	2. Number of functional leaves per plant	3	at harvest
	3. Dry matter production (g plant ⁻¹)	3	
B.	Post harvest studies		
	1. Length of cob (cm)	1	At harvest
	2. Girth of cob (cm)	1	
	3. Average weight of cob (g)	1	
	4. No. of grain row per cob	1	
	5. No. of grains per cob	1	
	6. Weight of grains per cob	1	
	7. Green cobs yield (q ha ⁻¹)	1	
	8. Green stover yield (q ha ⁻¹)	1	
	9. Total biomass production (q ha ⁻¹)	1	
	10. Harvest index	1	
	11. 1000 grain weight	1	
C.	Soil analysis		
	1. Available nitrogen in soil	2	Before
	2. Available phosphorus in soil	2	sowing and
	3. Available potassium in soil	2	at harvest
D.	Plant analysis		
	1. Nitrogen content in the grains, cob sheath, cob axis, leaves and stem	1	At harvest
	2. Phosphorus content in the grains, cob sheath, cob axis, leaves and stem	1	
	3. Potassium content in the grains, cob sheath, cob axis, leaves and stem plant	1	
E.	Quality studies		
	1. Sucrose content (%) in grains	1	At harvest
	2. Protein content in dry grains (%)	1	

3.9.1 Pre harvest Studies

3.9.1.1 Height of Plant

Height of the five randomly selected and marked plants in each plot was measured from the ground level up to the collar of the upper most fully opened leaf up to the pre-tasseling stage. After tasseling it was measured from ground level up to the base of tassel. Average of five plants was worked out to get the mean height per plant.

3.9.1.2 Number of functional leaves

The number of functional leaves per plant was recorded by counting the fully opened functional green leaves of five observation plants and the average was worked out.

3.9.1.3 Dry matter per plant (g)

For dry matter, one plant was randomly selected from each treatment (plot) at the time of every observation. The plant was uprooted and its roots were cut. The plant was chopped into small pieces, kept in the labeled brown paper bag and dried first in sunlight followed by thermostatically controlled oven at 50-60 °C temperature till complete drying. The weight of fully dried plant was recorded as dry matter.

3.9.2 Post-harvest study

3.9.2.1 Length of cob (cm)

After harvesting, the length of green cobs from the five observation plants was measured from each treatment (plot) and then mean was worked out. The length was measured from the lower most row of the kernels on the cob up to the tip of the cob. Then the average was worked out.

3.9.2.2 Girth of cob (cm)

Girth of cobs from the five observation plants was measured from each treatment (plot) and then the mean was worked out. The measurements were recorded at 1/3 portion from the base of the cob.

3.9.2.3 Average weight of cob (g)

Weight of the cobs from the five observation plants was taken along with the sheath and then the average weight per cob was worked out.

3.9.2.4 Number of kernel rows per cob

Number of kernel rows from the cobs of five observation plants was counted individually and then average number of row per cob was worked out.

3.9.2.5 Number of kernels per cob

The kernels from the cobs of five observation plants were counted for recording the observation. After counting the total kernels, average of the kernels per cob was worked out.

3.9.2.6 Weight of kernels per cob (g)

All the kernels from the green cobs of five observation plants were separated and their weight was recorded. Then average weight of kernels per cob for each treatment was worked out.

3.9.3 Yield Parameters

3.9.3.1 Green cob yield ($q\ ha^{-1}$)

The cobs picked at green stage (along with sheath) from each net plot were weighed in kg. Then the weight was converted on hectare basis.

3.9.3.2 Green stover yield ($q\ ha^{-1}$)

After removing the green cobs, the plants were immediately cut close to the ground at green stage from each net plot and their fresh weight was recorded in kg and finally it was converted on hectare basis.

3.9.3.3 Total biomass production ($q\ ha^{-1}$)

The fresh weight of green cobs and green stover recovered from each net plot were summed to get total biomass production per net plot. This was converted on hectare basis

3.9.4 Chemical Analysis

3.9.4.1 Soil Analysis

Soil analysis was carried out from the composite sample collected from each net plot at the harvest. It was analyzed for available nitrogen, available phosphorus and exchangeable potash.

3.9.4.2. Plant analysis

The plants sampled for dry matter determination at harvest were utilized for chemical analysis. The plant parts were separated into leaves, stock, kernels, sheath and axis of cob. The dried samples of leaves, stock, grains, sheath and axis of cob were powdered (100 mesh) separately and used for analysis.

3.9.4.3 Nitrogen content in the kernels, sheath, cob axis, leaves and stock of the plant (%)

Nitrogen content in the kernels, sheath, cob axis, leaves and stock of sweet corn was determined separately by micro-Kjeldahl's method.

3.9.4.4 Phosphorus content in the kernels, sheath, cob axis, leaves and stock of the plant (%)

The samples of kernels, sheath, cob axis, leaves and stock were digested separately according to the procedure of Jackson (1973) and digested samples were subjected to analysis for phosphorus by Vanadomolybdate yellow colour method.

3.9.4.5 Potassium content in the kernels, sheath, cob axis, leaves and stock of the plant (%)

The same extract prepared for phosphorus estimation from the plant samples was used for determination of total potassium by Flame photometer as suggested by Jackson (1973).

3.9.5 Quality studies

3.9.5.1 Sucrose content in the kernels at green stage

The fresh kernels from each treatment plot were separated and crushed into mortar and then the juice was extracted from the kernels. About 25 ml juice was taken and sucrose content (%) was estimated by the Lane and Eynon method using Fehling solution.

3.9.5.2 Protein content in the kernels (%)

Total N content was determined from the kernels of each treatment plot by modified micro-Kjedahl method. Then to get protein percentage from the kernels following formula was used.

$$\text{Per cent protein} = \% \text{ N} \times 6.25$$

3.10 Economics

The gross monetary returns in rupees per hectare were worked out on the basis of pod and haulm yield of groundnut and cob and green biomass yield of sweet corn. The prevailing market prices of groundnut pods and sweet corn cobs were considered. Similarly, the cost of cultivation of the crop crops¹ under the individual treatment was worked out by taking into account the cost of all the inputs and operations from preparatory tillage to harvest. The net returns per hectare were calculated by deducting the cost of cultivation per hectare from the gross returns per hectare. Cost: Benefit ratio for each treatment was calculated by dividing gross returns by cost of cultivation.

3.11 Statistical Analysis

Statistical analysis of the data related to the characters of groundnut and sweet corn, studied during the course of investigation was carried out through the procedure appropriate to the randomized block design described by Panse and Sukhatme (1967). Significance of the treatments was tested by 'F' test at 5 per cent level. The critical differences were

calculated when differences among the treatments were found significant by 'F' test. The results are given in tables and depicted by diagram and figures whenever necessary.

The data on intercropping experiments consists of yields of at least two crops, which differ, in all respects like growth habits, nutrient content, yield potential, etc. These two crops grown together may have different types of relationship due to which one crop has effect on other or vice versa. Therefore, two crops need to be evaluated relative to their response in monoculture and mixture. The response of each crop is to be evaluated by some measure of their joint response and effect of each crop in response of other in the mixture needs to be assessed. Therefore Bivariate Method of analysis suggested by Pearce and Gilliver (1978) was applied to the yield data recorded on groundnut and sweet corn.

For assessment of intercropping experiment different indices were worked out to determine advantages of the intercropping system over mono-cropping system. The following symbols have been used in the formulae of these indices :

y_{ii} - Sole crop (pure stand) yield of crop A.

y_{jj} - Sole crop (pure stand) yield of crop B.

y_{ij} - Intercrop yield of crop A, when grown with crop B as intercrop.

y_{ji} - Intercrop yield of crop B when grown with crop A as intercrop.

a_{ij} - Proportion of area allotted to crop A in intercropping.

a_{ji} - Proportion of area allotted to crop B in intercropping.

P_i - Unit price of crop A.

P_j - Unit price of crop B.

Different indices worked out for this replacement series are given below:

1) Relative Crowding Coefficient (RCC)

This coefficient was proposed by de Wit (1960) and examined by Hall (1974). The RCC is useful for replacement series of intercropping experiments. RCC for each crop gives a measure of whether that crop has produced more or less yield than expected yield. For example, RCC for crop A is,

$$K_{ij} = \frac{\text{Inter crop yield of crop A} \times \text{Proportion of area under crop B in intercropping}}{(\text{Yield of sole crop A} - \text{Intercrop yield of crop A}) \times \text{Proportion of area under crop A in intercropping}}$$

$$K_{ij} = \frac{y_{ij} \cdot a_{ji}}{(y_{ii} - y_{ij}) \times a_{ij}}$$

If $k_{ij} > 1$, then there is yield advantage of crop A in intercropping. If there is no effect of intercropping on the yield of crop A, then $k_{ij} = 1$; $k_{ij} < 1$ indicates the yield disadvantage due to intercropping. Similarly one can compute k_{ji} , the RCC for crop B. The component crop with higher relative crowding coefficient is the dominant one and is more competitive than the associated crop.

2) Relative Yield Total (RYT)

Relative yield total was proposed by de Wit and Van den Bergh (1965). The relative yield total of two crops is equal to the mean of the relative yields and is given by,

$$RYT = \frac{1}{2} \left(\frac{y_{ij}}{y_{ii}} + \frac{y_{ji}}{y_{jj}} \right)$$

3) Aggressivity (A)

Aggressivity was proposed by McGillchrist and Trenbath (1971), who extended the work of Williams (1962) and McGillchrist (1965). Aggressivity of crop A with crop B gives the simple difference between the expected relative yields only. Aggressivity of crop A with crop B is given by,

$$\begin{aligned}
 \Lambda_{ij} &= \frac{\text{Intercrop yield of crop A}}{\text{Expected yield of crop A}} - \frac{\text{Intercrop yield of crop B}}{\text{Expected yield of crop B}} \\
 &= \text{Expected relative yield of crop A} - \text{Expected relative yield of crop B} \\
 &= \frac{y_{ij}}{y_{ii} \cdot a_{ij}} - \frac{y_{ji}}{y_{jj} \cdot a_{ji}}
 \end{aligned}$$

If the aggressivity value of a component crop with other component crop is zero, then the two component crops are said to be equally competitive. Aggressivity values of greater than zero indicate that one crop is dominating over the other. As it is based on a sample difference, the interpretation of intercropping treatments may become difficult if the values are identical in different treatments.

4) Competitive Ratio (CR)

Willey and Rao (1980) proposed another index i.e. competitive ratio. The competitive ratio of two crops is given by the ratio of their respective expected relative yields. The competitive ratio of crop A with crop B is given by,

$$CR = \frac{y_{ij}}{y_{ii} \cdot a_{ij}} \bigg/ \frac{y_{ji}}{y_{jj} \cdot a_{ji}}$$

5) Crop Performance Ratio (CPR)

Azam Ali *et al.* (1990) defined crop performance ratio as the productivity of an intercrop per unit area of groundnut compared with that of expected productivity from sole crops sown in same proportional area. The crop productivity in the intercrop can be expressed as partial CPR.

$$CPR_i = \frac{Q_{ij}}{P_{ij} \cdot Q_{si}} = \frac{y_{ij}}{a_{ij} \cdot y_{si}}$$

Where Q_{ij} and Q_{si} are productivity of crop A in intercrop and sole crop, respectively and P_{ij} is proportion of crop A in intercropping. As sole crop yields are multiplied by their sown proportions in the intercrop, CPR

provides expected productivity in intercrop. CPR for both crops A and B is defined as,

$$\text{CPR} = \frac{Q_{ii} + Q_{ij}}{P_{ii} \cdot Q_{si} + P_{ij} \cdot Q_{sj}}$$

The particular CPR always compares the performance of each species with unity and the departure from unity is a measure of fractional advantage or disadvantage of the crop, when grown as an intercrop. It may be noted here that

$$\text{CPR} = \text{CPR}_i + \text{CPR}_j$$

6) Crop Equivalent Yield (CEY)

Lal and Ray (1976), Verma and Modgal (1983) proposed economics of crops by converting grain seed⁻¹ fodder⁻¹ etc. in terms of gross returns for valid comparison and obtained wheat equivalent yields as,

$$\text{CEY} = c_i y_{ij} + c_j y_{ji}$$

Where, $c_i = P_{ci}/P_w$

P_{ci} and P_w are per unit prices of i^{th} crop and wheat, respectively.

7) Land Equivalent Ratio (LER)

Willey and Osiru (1972) defined LER as relative area of the some crop that would be required to produce the equivalent yield achieved by intercropping and is given by,

$$\text{LER} = \frac{y_{ij}}{y_{ii}} + \frac{y_{ji}}{y_{jj}} = L_{ij} + L_{ji}$$

Where, L_i and L_j are known as component LERs or partial LERs.

8) Relative Yield Loss (RYL)

Banik and Bagchi (1996) proposed relative yield loss for component crop A as,

$$\text{RYL} (\%) = \left[\frac{y'_{ij}}{y'_{ii}} - 1 \right] \times 100$$

Where, $y_{ij} = y_{ij}/a$ and $y'_{ii} = y_{ii}/a$ are yields per hectare (unit area) of intercrop and sole crop A when 'a' is the area under crop A (either in intercropped or monocrop situation). This index is nothing but the deviation of the ratio of productivity of intercrop and sole crop from unity and it gives whether per cent productivity in intercrop is more than sole crop, which gives per cent loss or gain in yields of crop A due to intercropping.

9) Area Time Equivalent Ratio

Jagannath and Sunderaraj (1987) proposed Area Time Equivalent Ratio

$$ATER = (L_i.t_i + L_j.t_j) / T$$

Where, L_i and L_j - Partial LERs

t_i and t_j - duration of crop i and j

T - Duration of whole intercropping system

ATER > 1 - Intercropping system is more advantageous than monocropping.

EXPERIMENTAL RESULTS

CHAPTER IV

EXPERIMENTAL RESULTS

Results of the experiment entitled "Effect of levels of fertilizer and row proportions on sweet corn (*Zea mays saccharata*) and groundnut (*Arachis hypogaea*) intercropping," obtained during 2003-04, 2004-05 and in the mean of two years are presented in this chapter. The experimental findings are explained under the following headings.

- 4.1. Seasonal effects
- 4.2. Plant population
- 4.3. Growth studies in groundnut
- 4.4. Yield attributes and yield of groundnut
- 4.5. Quality studies of groundnut
- 4.6. Nutrient uptake by groundnut
- 4.7. Growth studies in sweet corn
- 4.8. Yield attributes and yield of sweet corn
- 4.9. Quality studies of sweet corn
- 4.10. Nutrient uptake by sweet corn
- 4.11. Available N, P and K in soil after harvest of the crops
- 4.12. Weed Studies
- 4.13. Bivariate Analysis
- 4.14. Statistical Indices
- 4.15. Economics

4.1 Seasonal effects

The observations on weather parameters during the crop growth period are presented in Table 8.



Plate II. Sole groundnut

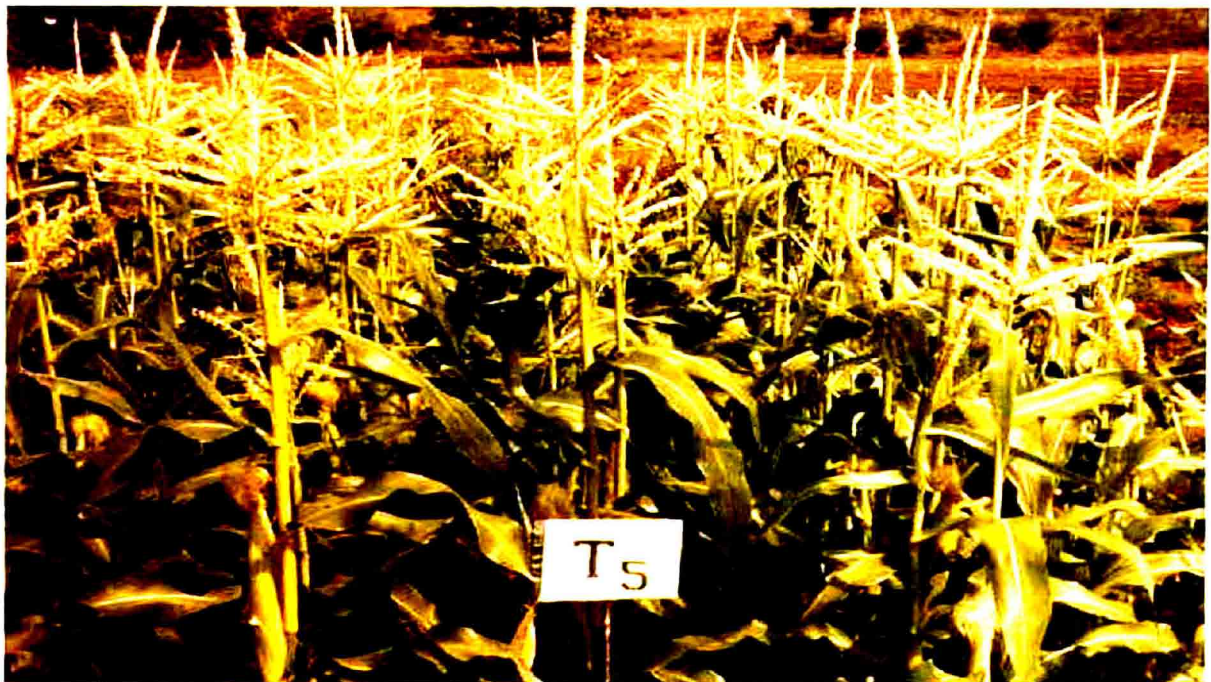


Plate III. Sole Sweet corn

Table 8 : Mean plant population of groundnut and sweet corn as influenced by different treatments

Sym.	Treatment	Plant population/Net plot					
		2003-04		2004-05		Mean	
		Gn	Sc	Gn	Sc	Gn	Sc
T ₁	Gn with 75% RDF	624.6	--	622.6	--	622.6	--
T ₂	Gn with 100% RDF	625.0	--	621.3	--	623.2	--
T ₃	Gn with 125% RDF	624.3	--	621.3	--	622.8	--
T ₄	Sc with 75% RDF	--	204.0	--	205.6	--	204.8
T ₅	Sc with 100% RDF	--	203.0	--	206.6	--	204.8
T ₆	Sc with 125% RDF	--	205.6	--	204.6	--	205.1
T ₇	G + S (1 : 1), 75%RDF	307.6	102.0	309.0	99.6	308.3	100.8
T ₈	G + S (1 : 1), 100%RDF	308.0	103.0	308.3	98.3	308.2	100.7
T ₉	G + S (1 : 1), 125%RDF	310.0	102.3	304.3	101.0	307.2	101.7
T ₁₀	G + S (2 : 1), 75%RDF	414.0	65.6	410.6	63.6	412.3	64.6
T ₁₁	G + S (2 : 1), 100%RDF	413.3	64.3	410.6	64.0	412.0	64.2
T ₁₂	G + S (2 : 1), 125%RDF	412.6	63.3	412.0	64.0	412.3	63.7
T ₁₃	G + S (3 : 1), 75% RDF	464.3	44.0	460.0	46.3	462.2	45.2
T ₁₄	G + S (3 : 1), 100%RDF	462.3	45.6	461.0	46.0	461.7	45.8
T ₁₅	G + S (3 : 1), 125%RDF	462.0	45.3	465.3	45.0	463.7	45.2

In general, the climatic conditions were congenial and favourable for growth and development of *rabi* groundnut during both the years of experimentation. Data revealed that the mean maximum temperature was slightly higher during 2003-04 than 2004-05. The higher temperature and comparatively less humidity during 2003-04 resulted in to higher evaporation as compared to 2004-05. Similarly, the bright sunshine hours (days) and wind speed were also slightly higher during 2003-04 than 2004-05. Higher temperature and higher heat unit during 2003-04 resulted in



Plate IV. Groundnut + Sweet corn in 1 : 1 ratio



Plate V. Groundnut + Sweet corn in 2 : 1 ratio



Plate VI. Groundnut + Sweet corn in 3 : 1 ratio



Plate VII. Groundnut + Sweet corn in 1 : 1 ratio

early maturity and harvest of groundnut by about 9 days as compared to 2004-05.

4.2 Plant population studies

Data regarding the plant population per net plot recorded at the harvest during 2003-04 and 2004-05 are presented in Table 8. During both the years, the plant population of groundnut and sweet corn was affected due to different row proportions adopted for intercropping treatments. The plant population of groundnut and sweet corn was the highest under sole cropping. The population of groundnut increased proportionately with increase in the proportion of groundnut in the intercropping from 1 : 1 to 3 : 1. On the contrary, population of sweet corn decreased proportionately with decrease in the proportion of sweet corn in the intercropping systems.

4.3 Growth studies in groundnut

Growth parameters namely plant height, number of branches per plant, number of leaves per plant and dry matter accumulation per plant of groundnut were studied periodically at 30 days interval during 2003-04 and 2004-05.

4.3.1 Mean height of groundnut (cm)

Data pertaining to the height of groundnut plant as influenced by different treatments are presented in Table 9. It was noticed that the mean plant height was more during 2003-04 as compared to 2004-05.

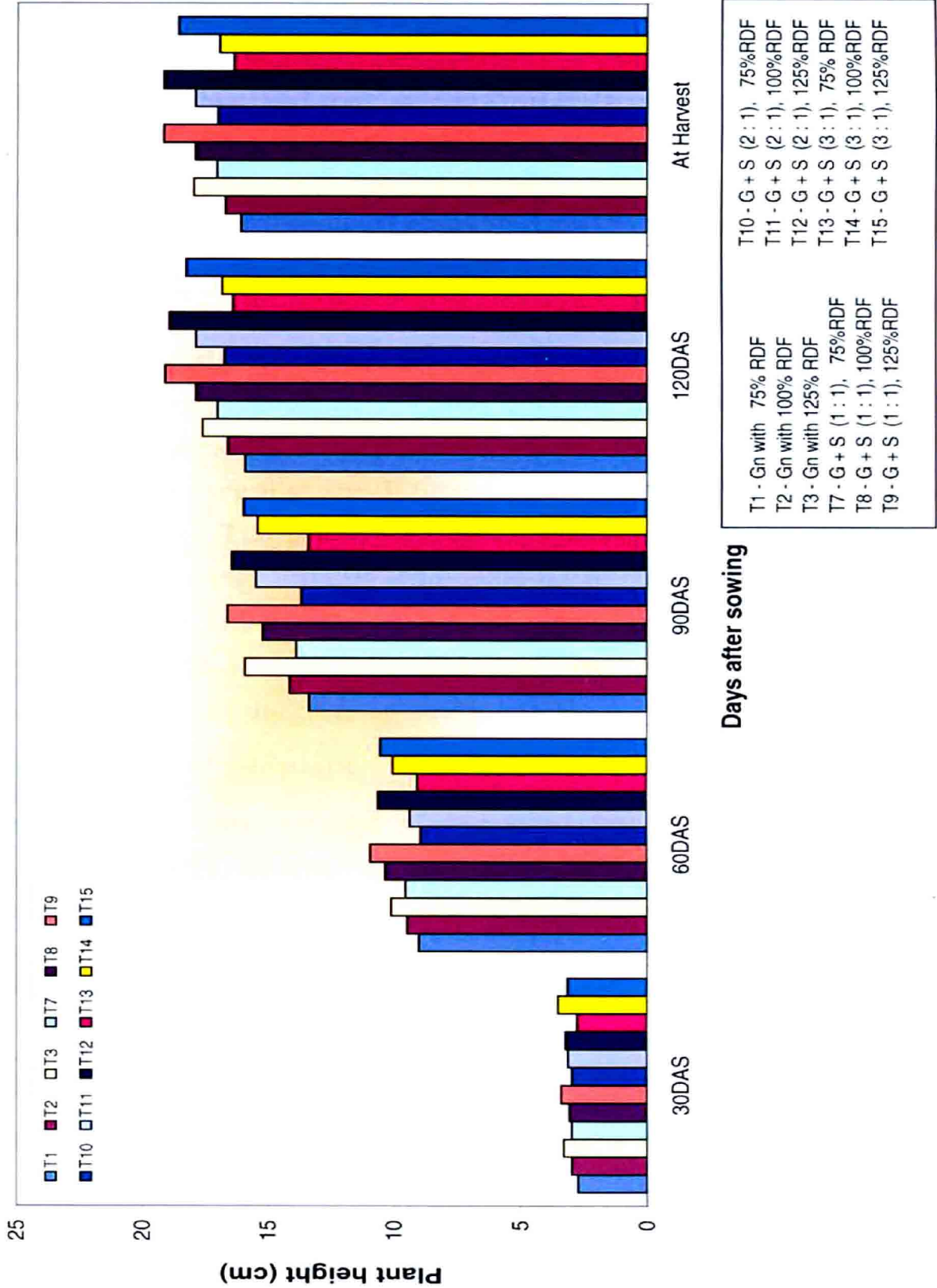
Plant height was not influenced significantly due to various treatments at 30DAS during both the years and in the pooled data. Similarly, at 60 DAS it was not affected significantly during 2003-04.

At 90, 120 DAS and at harvest, in respect of sole crop of groundnut, 125% RDF (T_3) recorded significantly taller plants than the lower doses of fertilizer i.e. 100% RDF (T_2) and 75% RDF (T_1) during 2003-04 and in the

Table 9 : Mean plant height (cm) of groundnut as affected periodically by different treatments

Sym	Treatment	30DAS			60DAS			90DAS			120DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
F ₁	Gn with 75% RDF	2.87	2.60	2.73	9.53	8.53	9.03	13.73	13.07	13.40	16.47	15.40	15.93	16.57	15.67	16.12
F ₂	Gn with 100% RDF	3.00	2.93	2.97	9.73	9.27	9.50	14.20	14.13	14.17	16.93	16.33	16.63	17.00	16.47	16.74
F ₃	Gn with 125% RDF	3.47	3.13	3.30	10.47	9.80	10.13	16.40	14.47	15.93	18.13	17.13	17.63	18.10	17.87	17.99
F ₄	G + S (1:1), 75% RDF	2.93	3.00	2.97	10.33	8.80	9.57	14.00	13.80	13.90	17.53	16.53	17.03	17.60	16.53	17.07
F ₅	G + S (1:1), 100% RDF	3.07	3.07	3.07	10.67	10.07	10.37	15.53	14.93	15.23	18.40	17.40	17.90	18.39	17.47	17.93
F ₆	G + S (1:1), 125% RDF	3.67	3.13	3.40	11.47	10.47	10.97	17.20	16.07	16.63	19.80	18.47	19.13	19.80	18.80	19.30
F ₇	G + S (2:1), 75% RDF	3.20	2.73	2.97	9.33	8.60	8.97	13.20	14.20	13.70	17.27	16.27	16.77	17.53	16.57	17.05
F ₈	G + S (2:1), 100% RDF	3.13	3.13	3.13	9.67	9.13	9.40	15.93	15.07	15.50	18.40	17.40	17.90	18.40	17.47	17.94
F ₉	G + S (2:1), 125% RDF	3.47	3.00	3.23	10.53	10.80	10.67	16.93	16.00	16.47	19.53	18.40	18.97	19.60	18.60	19.10
F ₁₀	G + S (3:1), 75% RDF	2.73	2.80	2.77	9.87	8.33	9.10	13.47	13.40	13.43	16.87	16.00	16.43	16.87	15.93	16.40
F ₁₁	G + S (3:1), 100% RDF	3.87	3.20	3.53	10.47	9.67	10.07	15.60	15.27	15.43	17.33	16.40	16.87	17.37	16.57	16.97
F ₁₂	G + S (3:1), 125% RDF	3.27	3.07	3.17	11.07	10.07	10.57	16.20	15.80	16.00	18.80	17.80	18.30	18.97	18.27	18.62
S.E.D		0.18	0.13	0.13	0.34	0.29	0.21	0.40	0.35	0.30	0.57	0.35	0.21	0.27	0.26	0.17
C.D.5%		NS	NS	NS	NS	0.85	0.62	1.17	1.03	0.87	1.08	1.02	0.62	0.79	0.76	0.30
Mean		3.22	2.98	3.10	10.26	9.46	9.86	15.20	14.77	14.98	17.96	16.96	17.46	18.01	17.19	17.60

Fig. 3. Mean plant height (cm) of groundnut as affected periodically by different treatments



pooled data. However, during 2004-05, 125% RDF (T₃) was at par with 100% RDF (T₂) and significantly superior than 75% RDF (T₁) at 60, 90 and 120 DAS. However, at harvest, 125% RDF (T₃) was significantly superior over 100% RDF (T₂) and 75% RDF (T₁). Further, in case of intercropping with sweet corn, it was observed that, groundnut + sweet corn in 2:1 ratio with 125% RDF (T₁₂) recorded significantly more plant height of groundnut than most of the treatments and it (T₁₂) was at par with groundnut + sweet corn in 1:1 ratio with 100% and 125% RDF (T₈ and T₉) and groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₃) at 60 DAS during 2004-05 and in the mean of two years. However, at 90, 120 DAS and at harvest, during all the three observations (2003-04, 2004-05 and mean) groundnut under groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) recorded significantly taller plants than the remaining treatments including sole cropping except groundnut + sweet corn in 2:1 and 3:1 ratio with 100% RDF (T₁₁ and T₁₄) during 2003-04, 2004-05 and in the pooled data at 90 DAS and during 2003-04 and 2004-05 at 120DAS as well as groundnut + sweet corn at 2:1 ratio with 125% RDF (T₁₂) in the mean of two years at 120 DAS and at all the three observations at harvest; all these treatments were at par with the former treatment T₆.

4.3.2 Number of branches per plant

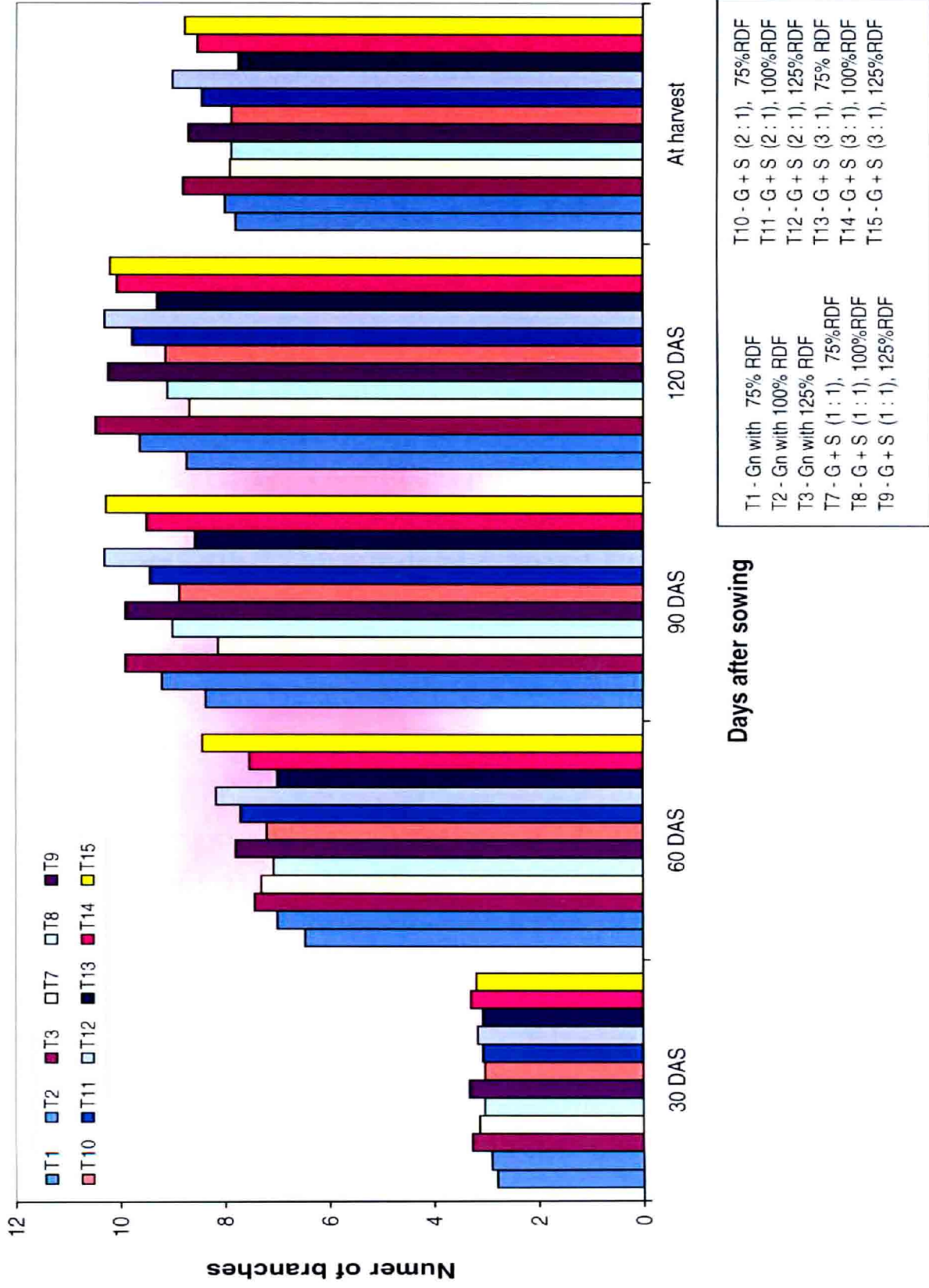
Data regarding mean number of branches per plant as affected periodically by different treatments are presented in Table 10 and graphically presented in Fig. 4. It is evident that the number of branches went on increasing with the advancement in the age up to 120 DAS; thereafter it reduced slightly at harvest. It was further noticed that mean number of branches was more or less similar during both years of experimentation.

At 30 DAS, mean number of branches per plant was not influenced significantly due to the treatments during both the years and in the mean of two years. Similar trend was observed at 60 DAS during 2003-04.

Table 10: Mean number of branches of groundnut per hill as affected periodically by different treatments

Svm	Treatment	30DAS			60DAS			90DAS			120DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
F ₁	Gn with 75% RDF	3.00	2.60	2.80	6.73	6.20	6.47	8.93	7.80	8.37	9.07	8.40	8.73	7.87	7.73	7.80
F ₂	Gn with 100% RDF	2.93	2.87	2.90	7.33	6.67	7.00	10.07	8.33	9.20	10.47	8.80	9.63	8.33	7.67	8.00
F ₃	Gn with 125% RDF	3.13	3.40	3.27	7.93	6.93	7.43	10.33	9.47	9.90	11.13	9.80	10.47	9.07	8.53	8.80
F ₄	G+S (1:1), 75% RDF	3.07	3.20	3.13	7.80	6.80	7.30	8.20	8.07	8.13	8.33	9.00	8.67	7.87	7.93	7.90
F ₅	G+S (1:1), 100% RDF	3.13	2.93	3.03	6.93	7.20	7.07	8.67	9.33	9.00	9.07	9.13	9.10	7.67	8.07	7.87
F ₆	G+S (1:1), 125% RDF	3.60	3.07	3.33	8.13	7.47	7.80	9.60	10.20	9.90	10.20	10.27	10.23	8.47	8.93	8.70
F ₁₀	G+S (2:1), 75% RDF	3.07	3.00	3.03	7.60	6.80	7.20	9.07	8.67	8.87	9.00	9.27	9.13	7.67	8.07	7.87
F ₁₁	G+S (2:1), 100% RDF	3.20	2.93	3.07	8.20	7.20	7.70	9.47	9.40	9.43	9.60	9.93	9.77	8.07	8.80	8.44
F ₁₂	G+S (2:1), 125% RDF	3.20	3.13	3.17	8.33	8.00	8.17	10.33	10.27	10.30	10.20	10.40	10.30	8.87	9.13	9.00
F ₁₃	G+S (3:1), 75% RDF	2.93	3.20	3.07	7.33	6.67	7.00	8.80	8.33	8.57	9.93	8.67	9.30	7.80	7.67	7.74
F ₁₄	G+S (3:1), 100% RDF	3.87	2.73	3.30	8.00	7.07	7.53	9.60	9.40	9.50	10.40	9.73	10.07	8.53	8.53	8.53
F ₁₅	G+S (3:1), 125% RDF	3.27	3.13	3.20	8.67	8.20	8.43	10.60	9.93	10.27	10.60	9.80	10.20	8.93	8.60	8.77
S.E. +/-		0.16	0.11	0.10	0.37	0.20	0.19	0.26	0.21	0.19	0.30	0.15	0.18	0.15	0.11	0.12
C.D. 5%		Ns	Ns	Ns	Ns	0.60	0.57	0.75	0.63	0.54	0.87	0.44	0.52	0.44	0.33	0.35
Mean		3.20	3.02	3.11	7.75	7.10	7.43	9.47	9.10	9.29	9.83	9.43	9.63	8.26	8.31	8.28

Fig. 4. Mean number of branches of groundnut per hill as affected periodically by different treatments



Days after sowing

T1 - Gn with 75% RDF
T2 - Gn with 100% RDF
T3 - Gn with 125% RDF
T7 - G + S (1 : 1), 75% RDF
T8 - G + S (1 : 1), 100% RDF
T9 - G + S (1 : 1), 125% RDF
T10 - G + S (2 : 1), 75% RDF
T11 - G + S (2 : 1), 100% RDF
T12 - G + S (2 : 1), 125% RDF
T13 - G + S (3 : 1), 75% RDF
T14 - G + S (3 : 1), 100% RDF
T15 - G + S (3 : 1), 125% RDF

At 60 DAS, during 2004-05 and in the mean of two years and at 90 DAS during 2003-04, treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded the maximum mean number of branches per plant which was significantly superior over all the remaining treatments except T₁₂ i.e. groundnut + sweet corn in 2:1 ratio with 125% RDF, which was at par the former treatment i.e. T₁₅.

At 90 DAS, during the year 2004-05 and in the mean of two years treatment T₁₂ was at par with T₉, T₁₅ and T₃, T₉ and T₁₅ respectively and significantly superior to the remaining treatments.

At 120 DAS, the maximum mean number of branches per plant was recorded with treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) and it was significantly superior to the remaining treatments except treatments T₂, T₃, T₉, T₁₂, T₁₃ and T₁₄ during the year 2003-04. While during 2004-05, treatment T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) was at par with T₆ (groundnut + sweet corn in 1:1 ratio with 125% RDF) and significantly superior over the remaining treatments. Further, in the mean of two years, treatment T₁₂ was at par with T₆, T₃ (sole groundnut with 125% RDF), T₁₁ (groundnut + sweet corn in 3:1 ratio with 100% RDF) and T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) and it was significantly superior over the remaining treatments.

At harvest, the maximum mean number of branches per plant was recorded with treatment T₁₅ (Groundnut + Sweet corn in 3:1 ratio with 125% RDF) and it was significantly superior to the remaining treatments except treatments T₁₂ and T₁₄ during the year 2003-04, while during the year 2004-05, treatment T₁₂ was at par with T₆ and T₁₁ and it was significantly superior over the remaining treatments. Further, in the mean of two years, treatment T₁₂ was at par with treatment T₃ (sole groundnut with 125% RDF), T₆ and T₁₅ and it was significantly superior than the remaining treatments.

4.3.3 Number of functional leaves per plant

Data pertaining to the number of functional leaves per plant of groundnut periodically influenced by different treatments are presented in Table 11 and depicted in Fig. 5. Data on general mean indicated that the number of functional leaves per plant increased up to 90 DAS. At 120 DAS and at harvest, there was reduction in the functional leaves because of shedding of leaves due to senescence.

Application of different nutrient treatments to groundnut significantly influenced the mean number of functional leaves per hill throughout the growth period of crop except 30 DAS during 2003-04 and in the mean of two years. Treatment T₃ (sole groundnut with 125% RDF) was prominent resulting in highest number of functional leaves per hill as compared to the remaining treatments. The same treatment recorded significantly more number of functional leaves per hill over other treatments except treatments T₀ (Groundnut + Sweet corn in 1:1 ratio with 125% RDF), T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) and T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF), which were at par with the former treatment (T₃) at 30 DAS.

Similar trend was also recorded at 60 DAS and 90 DAS during all the three observations except at 60 DAS during 2004-05, where treatment T₁₅ recorded significantly more number of leaves per plant than most of the other treatments and it was at par with T₀, T₉ and T₁₂ treatments.

At 120 DAS and at harvest, number of functional leaves per hill was influenced significantly due to different treatments. Treatment T₀ (groundnut + sweet corn in 1:1 ratio with 125% RDF) recorded significantly higher number of functional leaves over the remaining treatments except treatment T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) during both the years and in the mean of two.

Table 11 : Mean number of leaves of groundnut per hill as affected periodically by different treatments

Sym	Treatment	30DAS			60DAS			90DAS			120DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Gn with 75% RDF	11.20	10.93	11.07	38.60	36.27	37.43	67.73	65.33	66.53	62.00	60.80	61.40	53.20	51.53	52.37
T ₂	Gn with 100% RDF	13.33	11.87	12.60	41.87	39.07	40.47	72.60	70.20	71.40	68.07	66.67	67.47	59.27	57.73	58.50
T ₃	Gn with 125% RDF	15.67	14.63	15.15	48.27	44.40	46.33	78.47	76.07	77.27	70.20	69.00	69.60	61.40	59.67	60.54
T ₄	G + S (1:1), 75% RDF	11.27	10.27	10.77	39.00	34.80	36.90	67.60	65.20	66.40	63.27	62.07	62.67	54.47	53.07	53.77
T ₅	G + S (1:1), 100% RDF	13.33	12.33	12.83	41.13	38.33	39.73	71.00	68.60	69.80	69.80	68.60	69.20	61.00	59.73	60.37
T ₆	G + S (1:1), 125% RDF	13.80	13.87	13.83	47.27	43.47	45.37	76.20	73.80	75.00	74.00	72.80	73.40	65.20	63.53	64.37
T ₇	G + S (2:1), 75% RDF	12.53	11.53	12.03	37.93	35.13	36.53	68.80	66.40	67.60	64.53	63.33	63.93	55.73	55.27	55.50
T ₈	G + S (2:1), 100% RDF	13.00	11.20	12.10	42.67	39.67	41.27	71.60	69.20	70.40	68.20	67.00	67.60	59.40	59.07	59.24
T ₉	G + S (2:1), 125% RDF	13.60	13.67	13.63	47.27	43.41	45.37	77.40	75.00	76.20	72.40	71.20	71.80	63.60	62.87	63.24
T ₁₀	G + S (3:1), 75% RDF	11.53	10.53	11.03	37.60	36.20	36.90	68.67	66.27	67.47	62.33	61.13	61.73	53.53	52.87	53.20
T ₁₁	G + S (3:1), 100% RDF	12.33	12.33	12.33	43.27	40.47	41.87	72.27	69.87	71.07	66.20	65.00	65.60	57.40	56.73	57.07
T ₁₂	G + S (3:1), 125% RDF	14.33	13.40	13.87	47.33	44.53	45.93	77.00	75.40	76.20	70.80	69.60	70.20	62.00	61.27	61.64
	S.E. +/-	0.69	0.54	0.58	1.33	1.14	1.19	1.40	1.38	1.39	0.76	0.75	0.75	0.72	0.71	0.57
	C.D. 5%	NS	1.58	NS	3.90	3.35	3.49	4.12	4.05	4.08	2.24	2.20	2.20	2.12	2.08	1.68
	Mean	12.99	12.21	12.60	42.68	39.67	41.18	72.44	70.11	71.28	67.65	66.45	67.05	58.85	57.78	58.31

4.3.4 Dry matter accumulation per plant (g)

Data pertaining to the periodical dry matter accumulation per plant of groundnut are presented in Table 12 and depicted in Fig. 6. In general, the dry matter accumulation per plant increased with increase in the age of the crop and it was maximum at 120 DAS. During all the growth stages, as well as at harvest dry matter production was slightly higher during 2003-04 than 2004-05 under all the treatments. The magnitude of dry matter accumulation was higher during 60 to 120 DAS.

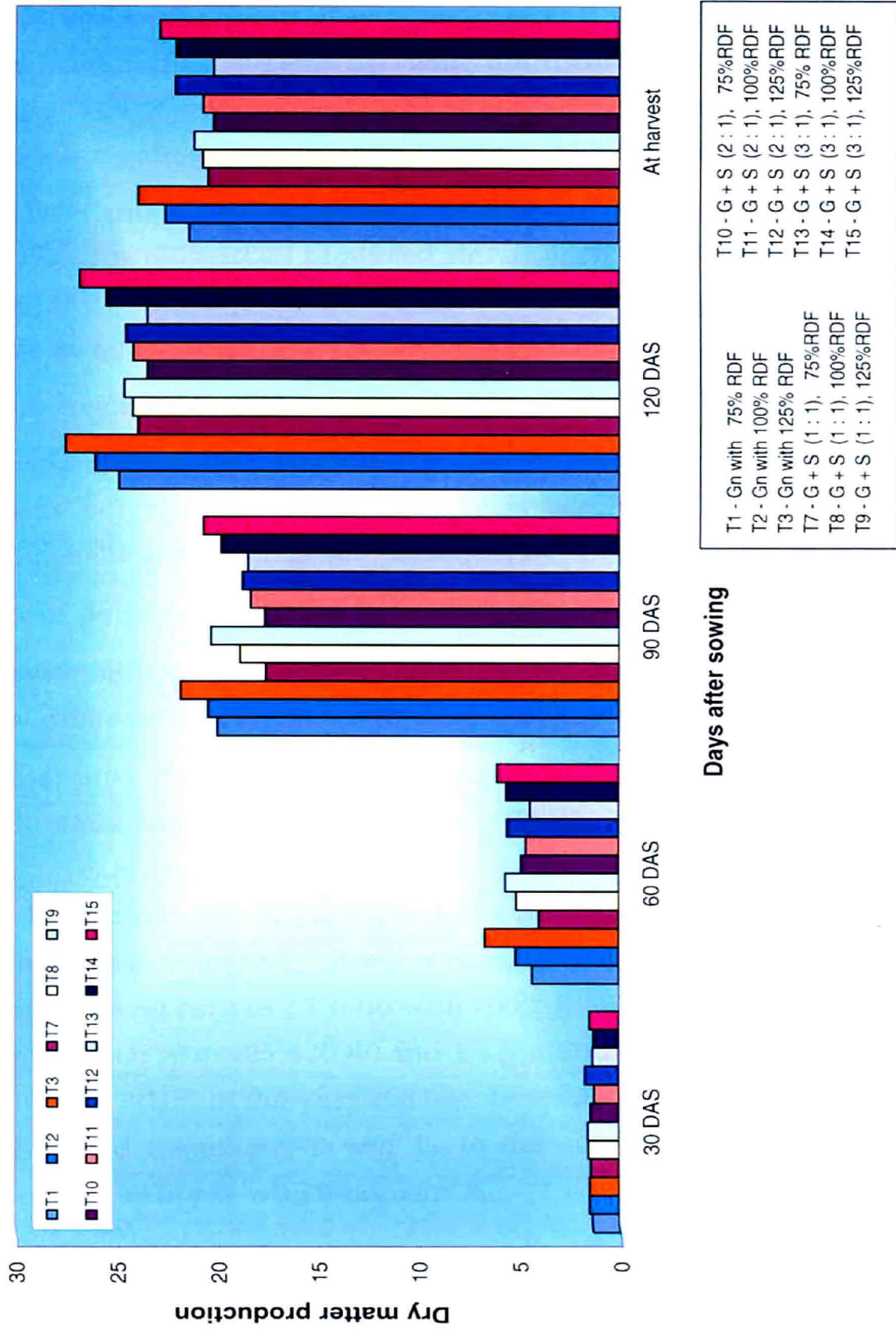
In general, it was revealed from the data presented in table that dry matter accumulation per plant was not influenced significantly due to the different treatments at 30 DAS. However, from 60 DAS till harvesting treatment T₃ (sole groundnut with 125% RDF) accumulated significantly more dry matter per plant than the remaining treatments during all the three observations, except treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) during 2003-04 at 60, 90, 120 DAS and at harvest and during 2004-05 at 120 DAS; which was at par with the former treatment (T₃).

It was further observed that among the intercropping treatments at 60 DAS, treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded statistically similar dry matter per hill in comparison with groundnut + sweet corn 1:1 ratio with 125% RDF (T₉), groundnut + sweet corn 2:1 ratio with 125% RDF (T₁₂) and groundnut + sweet corn 3:1 ratio with 100% RDF (T₁₁) during 2003-04 and in the mean of two years and groundnut + sweet corn 1:1 ratio with 100% RDF (T₈), T₅ and T₁₂ during 2004-05 and it (T₁₅) was significantly superior to the remaining treatments.

Table 12: Dry matter production of groundnut per plant (g) as affected periodically by different treatments

Sym	Treatment	30DAS			60DAS			90DAS			120DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
F ₁	Gn with 75% RDF	1.35	1.28	1.32	4.36	4.26	4.31	20.32	19.65	19.98	26.12	23.58	24.85	23.02	19.78	21.40
F ₂	Gn with 100% RDF	1.49	1.43	1.46	5.19	5.09	5.14	21.00	19.89	20.45	26.80	25.26	26.03	23.70	21.46	22.58
F ₃	Gn with 125% RDF	1.47	1.42	1.45	6.73	6.63	6.68	22.36	21.24	21.80	28.25	26.72	27.49	25.06	22.82	23.94
F ₄	G+S (1:1), 75% RDF	1.43	1.36	1.40	4.13	3.86	3.99	18.88	16.24	17.56	24.68	23.15	23.92	21.58	19.34	20.46
F ₅	G+S (1:1), 100% RDF	1.54	1.48	1.51	5.15	5.05	5.10	19.48	18.20	18.84	24.94	23.41	24.18	21.84	19.60	20.72
F ₆	G+S (1:1), 125% RDF	1.69	1.36	1.53	5.70	5.60	5.65	20.57	20.01	20.29	25.37	23.84	24.60	22.27	20.03	21.15
F ₇	G+S (2:1), 75% RDF	1.44	1.37	1.41	4.92	4.82	4.87	18.44	16.79	17.62	24.24	22.71	23.47	21.14	19.23	20.19
F ₈	G+S (2:1), 100% RDF	1.26	1.20	1.23	4.67	4.57	4.62	19.13	17.51	18.32	24.93	23.39	24.16	21.83	19.59	20.71
F ₉	G+S (2:1), 125% RDF	1.71	1.64	1.68	5.62	5.52	5.57	19.51	17.95	18.73	25.31	23.78	24.54	23.21	20.97	22.09
F ₁₀	G+S (3:1), 75% RDF	1.34	1.27	1.31	4.47	4.37	4.42	19.44	17.46	18.45	24.23	22.71	23.47	21.17	19.23	20.20
F ₁₁	G+S (3:1), 100% RDF	1.30	1.23	1.26	5.66	5.56	5.61	20.46	19.10	19.78	26.26	24.73	25.50	23.16	20.92	22.04
F ₁₂	G+S (3:1), 125% RDF	1.66	1.26	1.46	6.31	5.81	6.06	21.78	19.55	20.66	27.58	26.04	26.81	24.48	21.24	22.86
	SE ± S.E.	0.17	0.14	0.11	0.28	0.26	0.14	0.45	0.34	0.20	0.47	0.44	0.21	0.43	0.42	0.19
	C.D. (%)	NS	NS	NS	0.82	0.77	0.42	1.31	1.00	0.59	1.37	1.29	0.61	1.25	1.22	0.56
	Mean	1.47	1.36	1.42	5.24	5.10	5.17	20.11	18.63	19.37	25.73	24.11	24.92	22.71	20.35	21.53

Fig. 6. Dry matter production of groundnut per plant (g) as affected periodically by different treatments



At 90 DAS, again treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was significantly superior over the remaining treatments during 2003-04 and in the mean of two years except treatment T₉ in the mean of two years, which was at par with the former treatment (T₁₅). Further, during 2004-05, treatment T₉ was at par with the treatments T₁₅ and T₁₄ and it was significantly superior over the remaining treatments.

At 120 DAS and at harvest, again treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) produced significantly higher dry matter per plant than the remaining treatments except treatment T₁₁, which was at par with the former treatment at 120 DAS during 2003-04.

4.4 Yield attributes and yield of groundnut

Data pertaining to yield attributes namely number of pods per hill, weight of pods per hill (g), Weight of kernels per hill (g), 100-kernel weight (g) and shelling percentage are presented in Table 13A and 13B.

4.4.1 Number of pods per hill

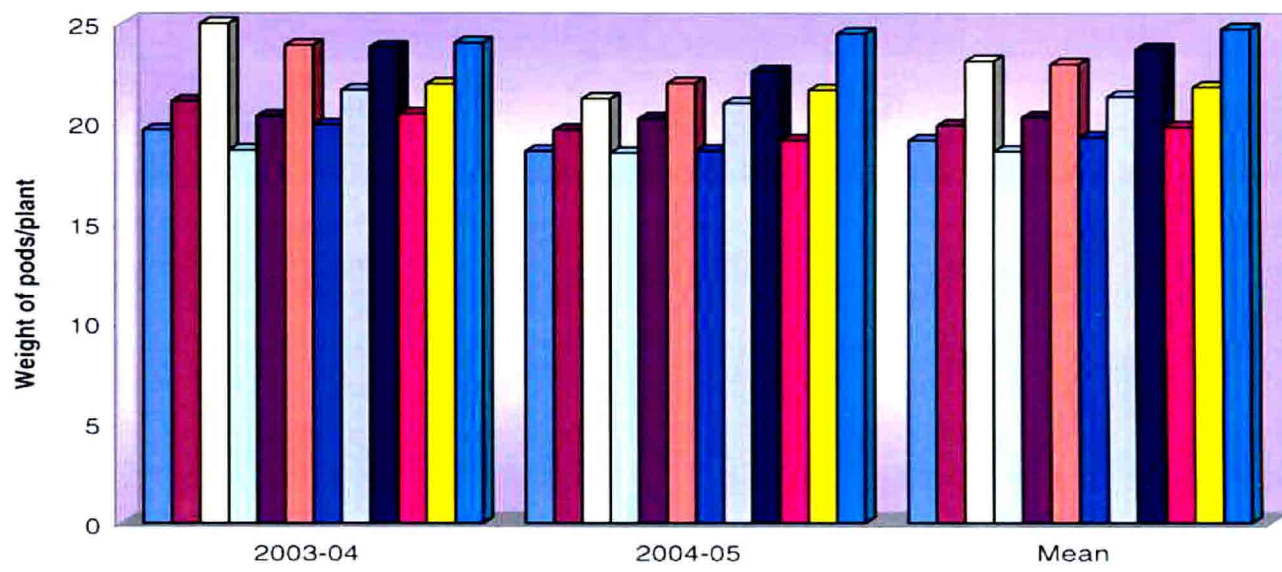
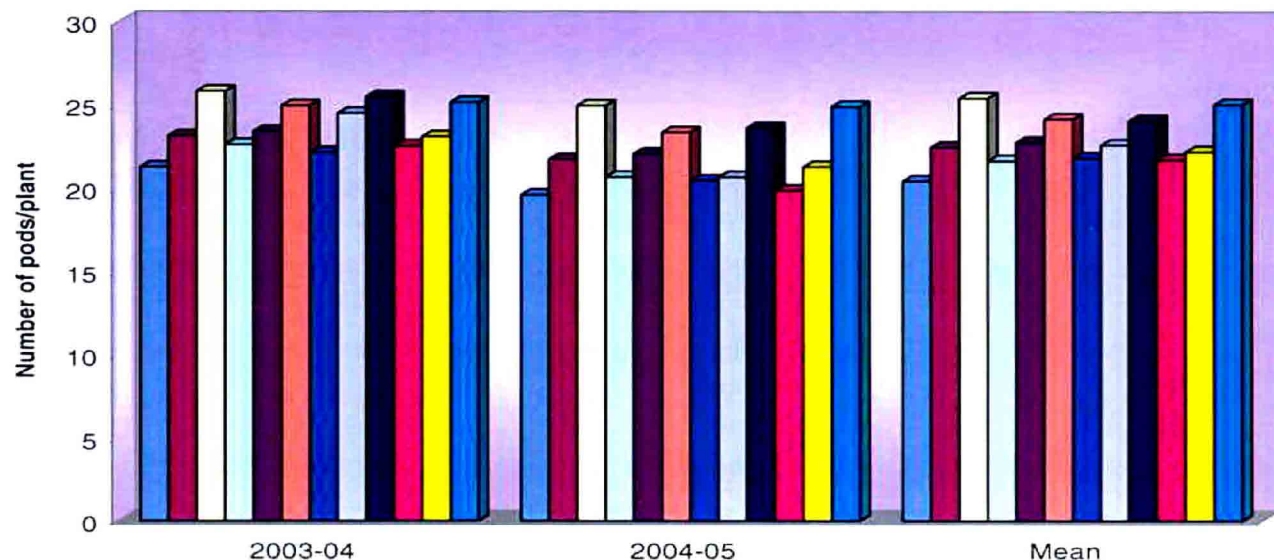
Data pertaining to total number of pods per hill of groundnut as influenced by different treatments are presented in Table 13A and Fig. 7.

Data indicated that different treatments influenced the number of pods per hill significantly during the year 2003-04, 2004-05 and in the mean of two years. Sole groundnut with 125% RDF (T₃) produced significantly higher number of pods per hill over rest of the treatments except treatments T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF), T₁₁ (groundnut + sweet corn in 2:1 ratio with 100% RDF), T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) and T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) in the year 2003-04; treatments T₉, T₁₂ and T₁₃ in the year 2004-05 and treatments T₉ and T₁₅ in the mean of two years; all these treatments were at par with treatment T₃.

Table 13A: Mean yield attributing characters of groundnut as affected by different treatments at harvest

Sym.	Treatment	No. of pods/hill			Wt. of pods/hill (g)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	21.27	19.60	20.43	19.61	18.56	19.09
T ₂	Sole Groundnut with 100% RDF	23.13	21.73	22.43	21.07	19.61	20.34
T ₃	Sole Groundnut with 125% RDF	25.80	24.93	25.37	24.97	24.69	24.83
T ₇	Groundnut + Sweet corn (1 : 1), 75%RDF	22.60	20.67	21.63	18.61	18.46	18.54
T ₈	Groundnut + Sweet corn (1 : 1),100%RDF	23.40	22.07	22.73	20.32	20.18	20.25
T ₉	Groundnut + Sweet corn (1 : 1),125%RDF	24.93	23.33	24.13	23.88	21.95	22.92
T ₁₀	Groundnut + Sweet corn (2 : 1), 75%RDF	22.13	20.47	21.80	19.89	18.58	19.24
T ₁₁	Groundnut + Sweet corn (2 : 1),100%RDF	24.47	20.67	22.57	21.63	20.95	21.29
T ₁₂	Groundnut + Sweet corn (2 : 1),125%RDF	25.47	23.60	24.03	23.80	21.18	22.49
T ₁₃	Groundnut + Sweet corn (3 : 1), 75% RDF	22.53	19.87	21.70	20.43	19.09	19.76
T ₁₄	Groundnut + Sweet corn (3 : 1),100%RDF	23.07	21.27	22.17	21.92	21.61	21.76
T ₁₅	Groundnut + Sweet corn (3 : 1),125%RDF	25.13	24.87	25.00	24.47	22.56	23.52
	S.F. +/-	0.67	0.69	0.43	0.76	0.67	0.54
	C.D. 5%	1.97	2.04	1.26	2.24	1.97	1.59
	Mean	24.58	21.59	23.08	21.59	20.60	21.09

Fig. 7. Yield attributing characters of groundnut as affected by different treatments at harvest



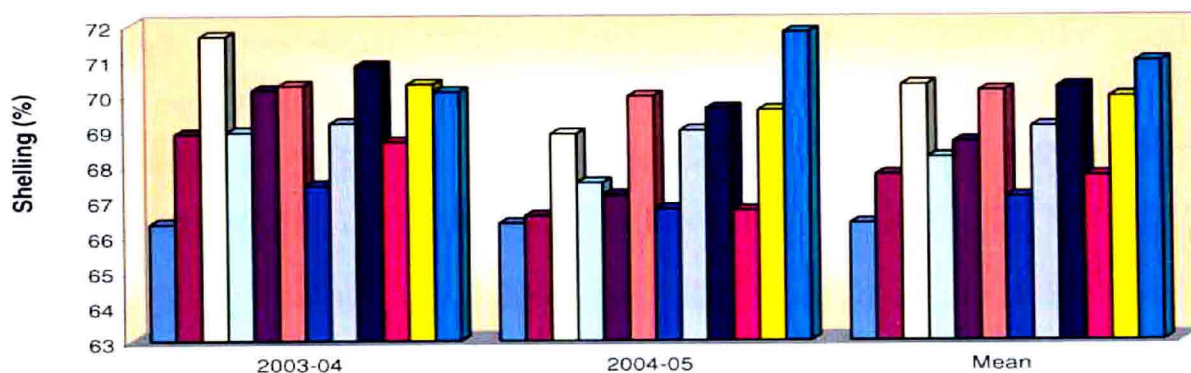
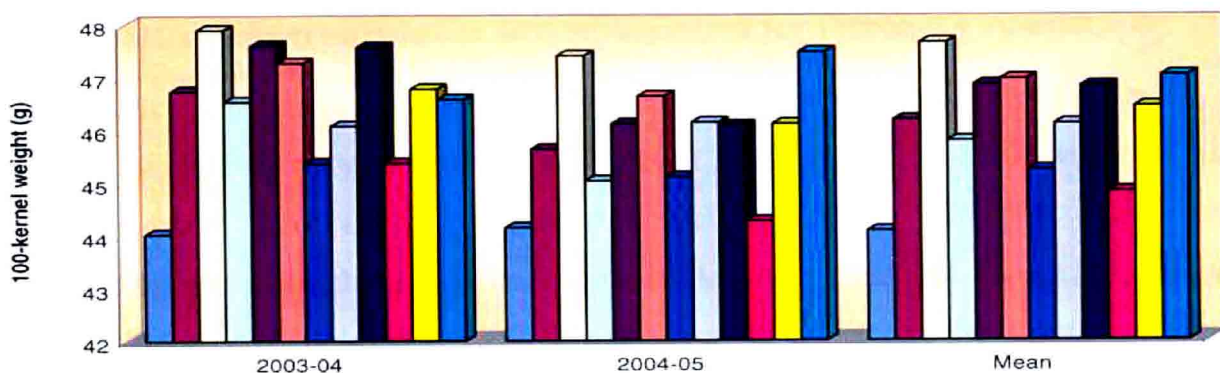
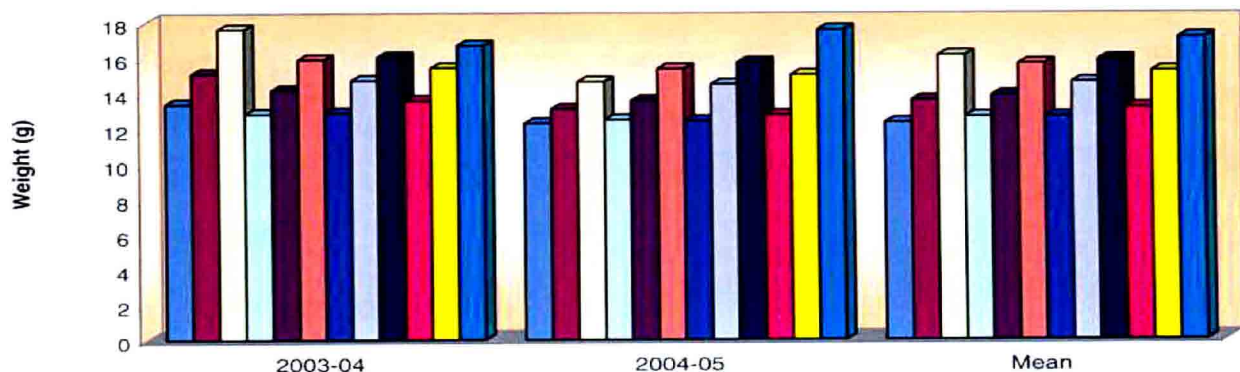
T1 - Gn with 75% RDF	T10 - G + S (2 : 1), 75%RDF
T2 - Gn with 100% RDF	T11 - G + S (2 : 1), 100%RDF
T3 - Gn with 125% RDF	T12 - G + S (2 : 1), 125%RDF
T7 - G + S (1 : 1), 75%RDF	T13 - G + S (3 : 1), 75% RDF
T8 - G + S (1 : 1), 100%RDF	T14 - G + S (3 : 1), 100%RDF
T9 - G + S (1 : 1), 125%RDF	T15 - G + S (3 : 1), 125%RDF



Table 13B : Mean yield attributing characters of groundnut as affected by different treatments at harvest

Sym.	Treatment	Wt. of kernels/ hill (g)			100-kernel Wt.(g)			Shelling (%)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Groundnut with 75% RDF	13.37	12.28	12.32	44.03	44.15	44.09	66.33
T ₂	Sole Groundnut with 100% RDF	15.09	13.08	13.58	46.73	45.63	46.18	68.87	66.56	67.72
T ₃	Sole Groundnut with 125% RDF	17.61	17.57	17.59	47.90	47.40	47.65	71.67	71.79	71.73
T ₄	Groundnut + Sweet corn (1 : 1), 75%RDF	12.81	12.47	12.64	46.53	45.03	45.78	68.92	67.49	68.20
T ₅	Groundnut + Sweet corn (1 : 1),100%RDF	14.16	13.55	13.85	47.60	46.10	46.85	70.13	67.14	68.64
T ₆	Groundnut + Sweet corn (1 : 1),125%RDF	15.90	15.35	15.63	47.27	46.63	46.95	70.25	69.95	70.10
T ₇	Groundnut + Sweet corn (2 : 1), 75%RDF	12.87	12.40	12.64	45.37	45.10	45.23	67.41	66.74	67.08
T ₈	Groundnut + Sweet corn (2 : 1),100%RDF	14.70	14.47	14.59	46.07	46.13	46.10	69.17	68.97	69.07
T ₉	Groundnut + Sweet corn (2 : 1),125%RDF	16.04	15.71	15.87	47.57	46.07	46.82	70.82	69.60	70.21
T ₁₀	Groundnut + Sweet corn (3 : 1), 75% RDF	13.56	12.74	13.15	45.37	44.27	44.82	68.64	66.70	67.67
T ₁₁	Groundnut + Sweet corn (3 : 1),100%RDF	15.41	15.01	15.21	46.77	46.10	46.43	70.29	69.55	69.92
T ₁₂	Groundnut + Sweet corn (3 : 1),125%RDF	16.68	14.61	15.64	46.57	47.47	47.02	70.08	68.87	69.48
S.E. +/-		0.52	0.50	0.43	1.10	0.79	0.73	0.53	0.63	0.46
C.D.5%		1.53	1.47	1.25	NS	NS	NS	1.54	1.86	1.34
Mean		14.52	14.10	14.31	46.48	45.76	46.12	70.10	68.31	69.20

Fig. 8. Yield attributing characters of groundnut as affected by different treatments at harvest



T1 - Gn with 75% RDF	T10 - G + S (2 : 1), 75%RDF
T2 - Gn with 100% RDF	T11 - G + S (2 : 1), 100%RDF
T3 - Gn with 125% RDF	T12 - G + S (2 : 1), 125%RDF
T7 - G + S (1 : 1), 75%RDF	T13 - G + S (3 : 1), 75% RDF
T8 - G + S (1 : 1), 100%RDF	T14 - G + S (3 : 1), 100%RDF
T9 - G + S (1 : 1), 125%RDF	T15 - G + S (3 : 1), 125%RDF



Among the intercropping treatments, groundnut + sweet corn in 2:1 ratio with 125% RDF (T₁₂), groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅), groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) and groundnut + sweet corn in 2:1 ratio with 100% RDF (T₁₁) were at par with each other and T₁₂ was significantly superior over the remaining treatments during 2003-04. However, during 2004-05 and in the mean of two years, treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with T₁₂ and T₉ and it was significantly superior over the remaining treatments.

4.4.2 Weight of pods per plant (g)

Data pertaining to weight of pods per plant of groundnut as influenced by different treatments are presented in Table 13 A and Fig. 7.

Data indicated that different treatments influenced the weight of pods per hill significantly during the year 2003-04, 2004-05 and in the mean of two years. The sole groundnut with 125% RDF (T₃) produced significantly higher weight of pods per hill over rest of the treatments except T₉, T₁₁, T₁₂ and T₁₅ in the year 2003-04 and all these treatments were at par with the former treatment (T₃). While treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) produced significantly higher weight of pods per hill over rest of the treatments except treatment T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) which was at par with the former treatment (T₁₅) during the year 2004-05 and in the mean of two years.

Further, in respect of sole crops, treatment T₃ (sole groundnut with 125% RDF) was at par with T₂ (sole groundnut with 100% RDF) and significantly superior over T₁ (sole groundnut with 75% RDF) during 2004-05. While in the mean of two years, treatment T₃ was significantly superior over the remaining treatments of sole cropping i.e. T₁ and T₂.

4.4.3 Weight of kernels per plant (g)

Data on weight of kernels per plant as affected by different treatments are presented in Table 13B and Fig. 8. Mean weight of kernels per hill was 14.52, 14.10 and 14.31 g during the year 2003-04, 2004-04 and in the mean of two years respectively. Weight of kernels per hill was significantly influenced by different treatments during both the years of experimentation and in the mean of two years.

During 2003-04, sole groundnut with 125% RDF (T_3) was at par with of groundnut intercropped with sweet corn in 3:1 ratio and supplied with 125% RDF (T_{15}) and registered significantly higher weight of kernels per hill than the remaining treatments. Further, treatment T_{15} was at par with treatments T_9 , T_{12} and T_{14} and significantly superior over the remaining treatments.

During 2004-05, groundnut intercropped with sweet corn in 3:1 ratio and supplied with 125% RDF (T_{15}) recorded significantly higher weight of kernels per hill than the remaining treatments. In the mean of two years, the same treatment i.e. T_{15} was at par with sole groundnut with 125% RDF (T_3) and groundnut + sweet corn in 2:1 ratio with 125% RDF (T_{12}) and it (T_{15}) produced significantly higher weight of kernels per hill than the remaining treatments. In case of sole groundnut, 125% RDF (T_3) was significantly superior over the lower levels of fertilizers (T_1 and T_2).

4.4.4 100-kernel weight (g)

Data pertaining to 100-kernel weight of groundnut as influenced by different treatments are presented in Table 13B and depicted in Fig. 8.

It could be seen from the data that different treatments applied to sole groundnut and groundnut + sweet corn intercropping did not show any significant effect on 100-kernel weight of groundnut during both the years and in the mean of two years. Mean 100-kernel weight of groundnut

46.45, 45.76 and 46.12 g was recorded in 2003-04, 2004-05 and in the mean of two years, respectively.

4.4.5 Shelling percentage (%)

Data pertaining to mean shelling percentage of groundnut as influenced by different treatments are presented in Table 13B and depicted in Fig. 8.

It was revealed from the data that different treatments applied to groundnut and groundnut + sweet corn intercropping caused significant effects on shelling percentage of groundnut during both the years of experimentation and in the mean of two years. Mean shelling percentage of groundnut was 70.10, 68.31 and 69.20 % that was recorded in 2003-04, 2004-05 and in the mean of two years respectively.

During the year 2003-04 sole groundnut with 125% RDF (T₃) recorded significantly higher shelling percentage of groundnut than the remaining treatments except treatment T₈, T₉, T₁₂, and T₁₁; and all these treatments were at par with T₃. During 2004-05 and in the mean of two years, treatment T₆ (groundnut + sweet corn in 1:1 ratio with 125% RDF) recorded significantly higher shelling percentage of groundnut, however, it was statistically similar to the treatment T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) and the treatments where groundnut + sweet corn intercropping was done with the ratio 3:1 and supplied with 125% RDF as well 100% RDF (T₁₅ and T₁₄ respectively) and sole groundnut with 125% RDF (T₃) in case of mean of two years.

4.4.6 Yield per hectare

Data pertaining to the dry pod yield, haulm yield and kernel yield per hectare of groundnut as influenced by the different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 14 and graphically presented in Fig. 9.

4.4.6.1 Dry pod yield per hectare (q)

Data showed that sole groundnut with 125% RDF produced highest dry pod yield during both the years as well as in the mean of two years.

During 2003-04, sole groundnut with 125% RDF (T_3) produced maximum dry pod yield of groundnut which was significantly greater over rest of the treatments except sole groundnut supplemented with either 75% or 100% RDF i.e. treatments T_1 and T_2 respectively, which were at par with the former treatment. Similarly, among the intercropping treatments, 100% and 125% RDF given to groundnut + sweet corn intercropping system at 3:1 proportion (T_{14} and T_{15}) recorded significantly higher dry pod yield of groundnut than the remaining intercropping treatments while the former two treatments were at par with each other.

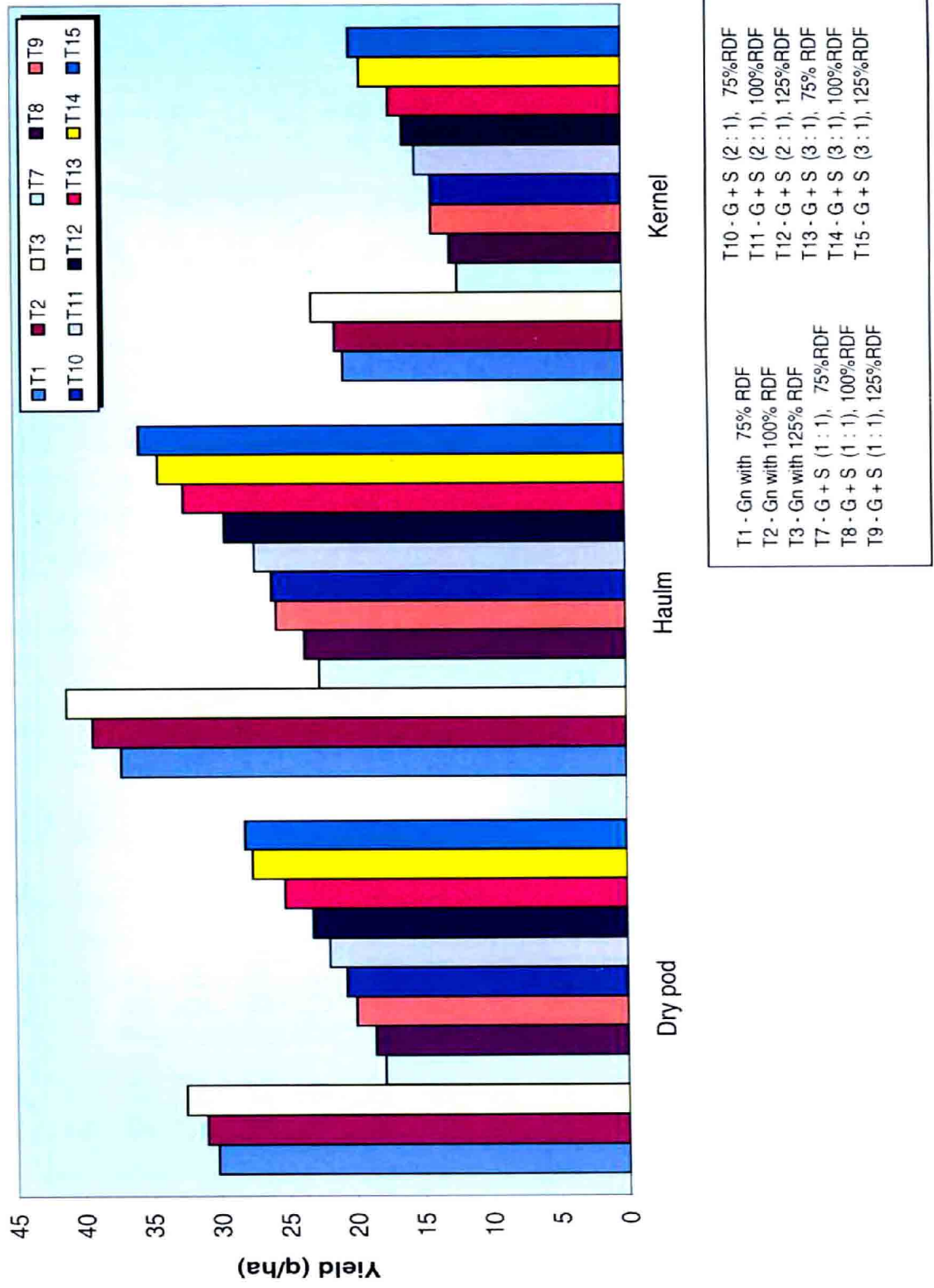
During 2004-05, sole groundnut with 125% RDF (T_3) produced maximum dry pod yield of groundnut which was significantly higher over rest of the treatments including treatment T_1 and T_2 . Similarly, among the intercropping treatments, 75%, 100% or 125% RDF given to groundnut + sweet corn intercropping system at 3:1 proportion (T_{13} , T_{14} and T_{15}) recorded significantly higher dry pod yield of groundnut than the remaining intercropping treatments while the former three treatments were at par with each other.

In the mean of two years, sole groundnut with 125% RDF (T_3) produced maximum dry pod yield of groundnut which was significantly superior over rest of the treatments except sole groundnut supplemented with 100% RDF i.e. treatment T_2 which was at par with T_3 . In case of intercropping treatments, 100% and 125% RDF given to groundnut + sweet corn intercropping system at 3:1 proportion (T_{14} and T_{15}) recorded significantly higher dry pod yield of groundnut than the remaining intercropping treatments, while the former two treatments were at par with each other.

Table 14 A: Dry pod yield, haulm yield and kernel yield of groundnut as affected by different treatments

Sym.	Treatment	Dry pod yield (q/ha)		Haulm yield (q/ha)		Kernel yield (q/ha)				
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	32.27	28.22	30.25	38.34	36.09	37.21	22.57	18.72	20.65
T ₂	Sole Groundnut with 100% RDF	33.33	28.74	31.04	41.19	37.38	39.29	23.40	19.11	21.26
T ₃	Sole Groundnut with 125% RDF	34.09	31.04	32.56	43.49	38.93	41.21	24.53	21.36	22.95
T ₄	Groundnut+Sweet corn (1: 1), 75%RDF	19.40	16.40	17.90	24.86	20.28	22.57	13.39	11.07	12.23
T ₅	Groundnut+Sweet corn (1: 1),100%RDF	19.93	17.29	18.61	25.15	22.14	23.65	13.90	11.62	12.76
T ₆	Groundnut + Sweet corn (1:1),125%RDF	21.34	18.69	20.02	27.52	23.89	25.71	15.09	13.15	14.12
T ₇	Groundnut+Sweet corn (2: 1), 75%RDF	22.34	19.11	20.72	27.07	25.07	26.07	15.48	12.75	14.12
T ₈	Groundnut + Sweet corn (2:1),100%RDF	23.86	20.05	21.96	28.56	26.02	27.29	16.75	13.81	15.28
T ₉	Groundnut +Sweet corn (2:1),125%RDF	24.39	21.95	23.17	30.79	28.22	29.50	17.11	15.27	16.19
T ₁₀	Groundnut+ Sweet corn (3:1), 75% RDF	25.04	25.40	25.22	32.87	32.12	32.50	17.41	16.94	17.17
T ₁₁	Groundnut+ Sweet corn (3:1),100%RDF	28.92	26.28	27.60	35.07	33.63	34.35	20.34	18.29	19.31
T ₁₂	Groundnut + Sweet corn (3:1),125%RDF	29.98	26.34	28.16	36.52	34.96	35.74	21.25	18.90	20.08
	S.E. +/-	0.92	0.73	0.57	0.87	0.69	0.51	0.66	0.51	0.42
	C.D. 5%	2.69	2.15	1.68	2.56	2.03	1.49	1.94	1.51	1.25

Fig. 9. Dry pod yield (q/ha) and haulm yield (q/ha) of groundnut as affected by different treatments



T1 - Gn with 75% RDF
 T2 - Gn with 100% RDF
 T3 - Gn with 125% RDF
 T7 - G + S (1 : 1), 75% RDF
 T8 - G + S (1 : 1), 100% RDF
 T9 - G + S (1 : 1), 125% RDF
 T10 - G + S (2 : 1), 75% RDF
 T11 - G + S (2 : 1), 100% RDF
 T12 - G + S (2 : 1), 125% RDF
 T13 - G + S (3 : 1), 75% RDF
 T14 - G + S (3 : 1), 100% RDF
 T15 - G + S (3 : 1), 125% RDF

Table 14B: Actual, expected and per cent increase or decrease dry pod yield of groundnut

Treatments	Pod yield (q ha ⁻¹) 2003-04			Pod yield (q ha ⁻¹) 2004-05			Treatments	Mean pod yield (q ha ⁻¹)		
	Expected	Actual	% Inc./dec.	Expected	Actual	% Inc./dec.		Expected	Actual	% Inc./dec.
T ₁	32.27	32.27	---	28.22	28.22	---	T ₁	30.25	30.25	---
T ₂	33.33	33.33	---	28.74	28.74	---	T ₂	31.04	31.04	---
T ₃	34.09	34.09	---	31.04	31.04	---	T ₃	32.56	32.56	---
T ₇	16.14	19.40	20.22	14.11	16.40	16.27	T ₇	15.12	17.90	18.38
T ₈	16.67	19.93	19.59	14.37	17.29	20.28	T ₈	15.52	18.61	19.91
T ₉	17.05	21.34	25.20	15.52	18.69	20.46	T ₉	16.28	20.02	22.94
T ₁₀	21.52	22.34	3.82	18.81	19.11	1.59	T ₁₀	20.16	20.72	2.78
T ₁₁	22.22	23.86	7.40	19.16	20.05	4.62	T ₁₁	20.69	21.96	6.11
T ₁₂	22.73	24.39	7.33	20.69	21.95	6.07	T ₁₂	21.71	23.17	6.73
T ₁₃	24.21	25.04	3.45	21.16	25.40	20.02	T ₁₃	22.68	25.22	11.18
T ₁₄	25.00	28.92	15.70	21.56	26.28	21.91	T ₁₄	23.28	27.60	18.58
T ₁₅	25.57	29.98	17.26	23.28	26.34	13.14	T ₁₅	24.42	28.16	15.30

During 2003-04 and 2004-05, dry pod yield produced under T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was statistically similar to that of T₁ i.e. sole groundnut with 75% RDF.

It was observed that the actual yield of groundnut was increased than expected during both the years of experimentation and in the mean of two years. The per cent increase in dry pod yield over expected yield was more in 1 : 1 ratio of intercropping as compared to other ratios and was the highest when 125 % RDF was applied.

4.4.6.2 Haulm yield per hectare (q)

It could be seen from the data presented in Table 14 that sole groundnut with 125% RDF (T₃) proved significantly superior in haulm yield production of groundnut during both the years as well as in the mean of two years.

During 2003-04 and 2004-05, sole groundnut with 125% RDF (T₃) produced maximum haulm yield of groundnut which was significantly superior over rest of the treatments except sole groundnut supplemented with 100% RDF i.e. treatment T₂ which was at par with the former treatment i.e. T₃. Similarly, in respect of intercropping, 125% RDF given to groundnut + sweet corn intercropping system at 3:1 proportion (T₁₃) recorded significantly higher haulm yield of groundnut than the remaining intercropping treatments except T₁₄ (groundnut + sweet corn in 3:1 ratio with 100% RDF) which was at par with the former treatment.

In the mean of two years, sole groundnut with 125% RDF (T₃) produced maximum haulm yield of groundnut that was significantly superior over rest of the treatments. The response of the sole groundnut treatments supplemented with 75, 100 and 125 % RDF in term of haulm yield was graded and significant. Similarly, in case of intercropping, 125% RDF given to groundnut+sweet corn intercropping system at 3:1 proportion (T₁₃) recorded significantly higher haulm yield than the remaining intercropping treatments except groundnut + sweet corn at 3:1 proportion and supplied with 100% RDF (T₁₄) which was at par with the former treatment.

During all the three observations, haulm yield produced under groundnut + sweet corn intercropping in 3:1 ratio with 125% RDF (T₁₅) and sole crop of groundnut with 75% RDF (T₁) was not influenced significantly.

4.4.6.3 Kernel yield per hectare (q)

Data indicated that application of different treatments influenced kernel yield per hectare significantly. During 2003-04, sole groundnut with 125% RDF (T₃) produced maximum kernel yield of groundnut which was significantly superior over rest of the treatments except sole groundnut supplemented with 100% RDF i.e. treatment T₂. Similarly, 100% and 125% RDF given to groundnut + sweet corn intercropping system at 3:1 proportion (T₁₄ and T₁₅) recorded significantly higher kernel yield of groundnut than the remaining intercropping treatments while the difference these two treatments was of similar magnitude. Further, treatments T₁₅ and T₁ (sole crop of groundnut with 75% RDF) were at par.

During the year 2004-05 and in the mean of two years, sole groundnut with 125% RDF (T₃) produced maximum kernel yield of groundnut and it was significantly higher over rest of the treatments including treatment T₁ and T₂. Similarly, among the intercropping treatments, 125% RDF given to groundnut + sweet corn intercropping system at 3:1 proportion (T₁₅) recorded significantly higher kernel yield than the remaining intercropping treatments except groundnut + sweet corn intercropping system at 3:1 proportion and supplied with 100% RDF (T₁₄) which was at par with the former treatment. Further, treatment T₁₅ was at par with T₁ and T₂ (sole groundnut with 75% and 100% RDF respectively) in respect of kernel yield per hectare.

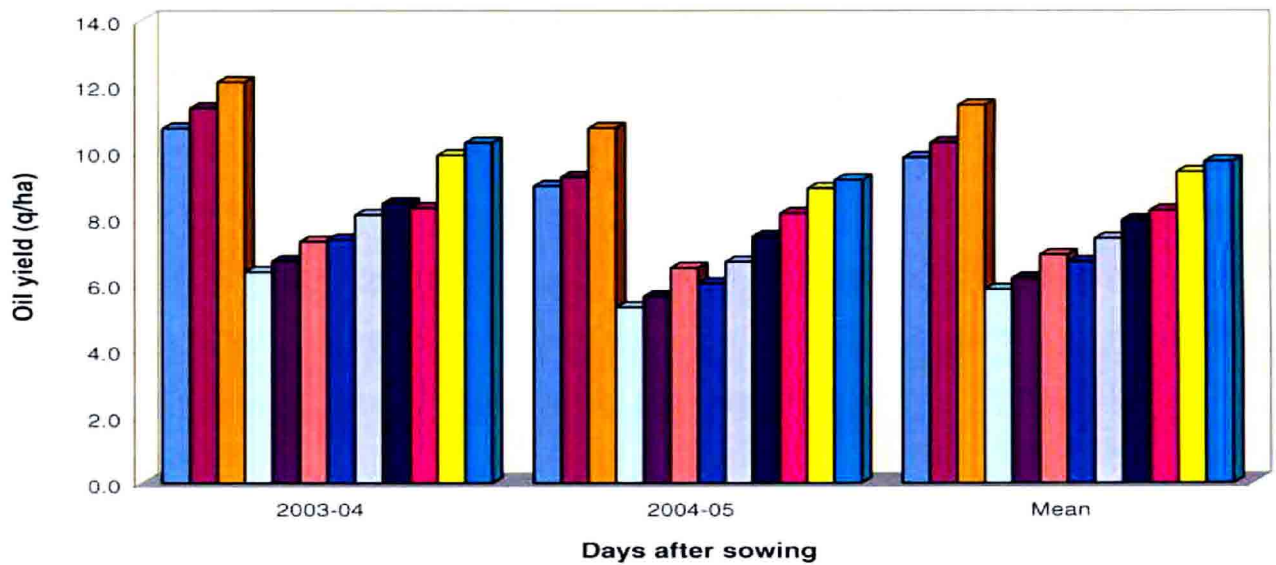
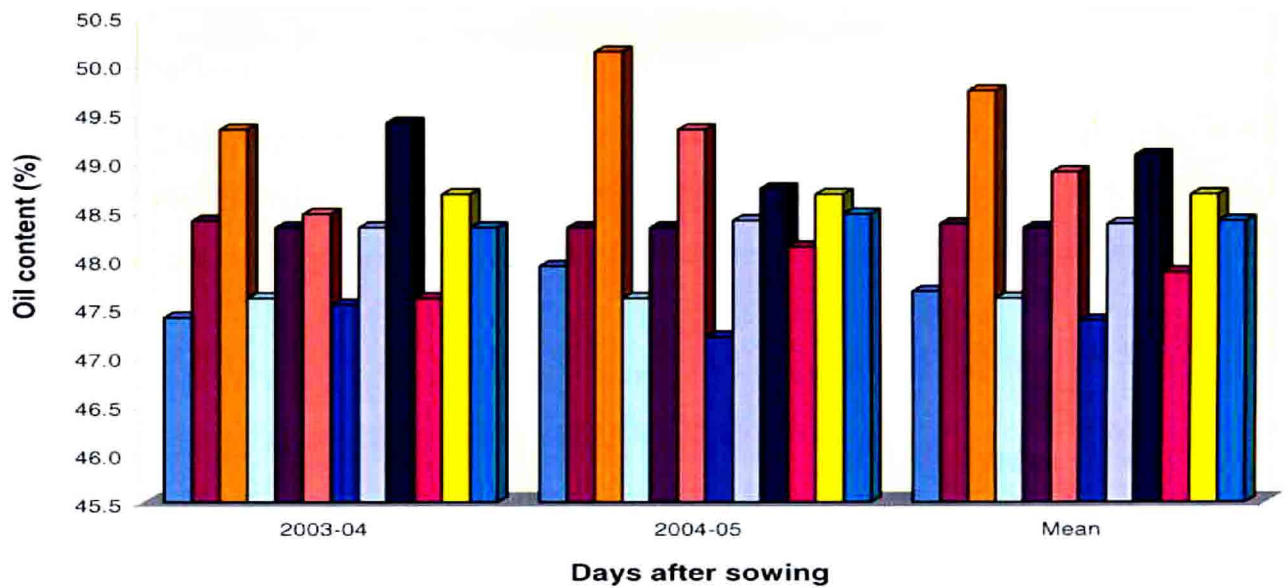
4.5 Quality parameters of groundnut

The quality in terms of oil content in kernel, oil yield, protein content in kernel and protein yield as influenced by different treatments was studied during both the years. The data are presented in Table 15.

Table 15 : Oil content (%) and oil yield (q/ha) of groundnut as affected by different treatments

Sym	Treatment	Oil content (%)			Oil yield (q/ha)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	47.40	47.93	47.67	10.70	8.97	9.83
T ₂	Sole Groundnut with 100% RDF	48.40	48.33	48.37	11.32	9.24	10.28
T ₃	Sole Groundnut with 125% RDF	49.33	50.13	49.73	12.11	10.71	11.41
T ₄	Groundnut+ Sweet corn (1 : 1), 75%RDF	47.60	47.60	47.60	6.37	5.29	5.83
T ₈	Groundnut+ Sweet corn (1 : 1),100%RDF	48.33	48.33	48.33	6.71	5.62	6.17
T ₉	Groundnut+ Sweet corn (1 : 1),125%RDF	48.47	49.33	48.90	7.29	6.49	6.89
T ₁₀	Groundnut+ Sweet corn (2 : 1), 75%RDF	47.53	47.20	47.37	7.35	6.02	6.68
T ₁₁	Groundnut+ Sweet corn (2 : 1),100%RDF	48.33	48.40	48.37	8.10	6.68	7.39
T ₁₂	Groundnut+ Sweet corn (2 : 1),125%RDF	49.40	48.73	49.07	8.45	7.45	7.95
T ₁₃	Groundnut+ Sweet corn (3 : 1), 75% RDF	47.60	48.13	47.87	8.30	8.15	8.23
T ₁₄	Groundnut+ Sweet corn (3 : 1),100%RDF	48.67	48.67	48.67	9.89	8.90	9.39
T ₁₅	Groundnut+ Sweet corn (3 : 1),125%RDF	48.33	48.47	48.40	10.27	9.16	9.71
	S.E. +/-	0.43	0.41	0.42	0.32	0.27	0.28
	C.D. 5%	NS	NS	NS	0.94	0.78	0.81
	Mean	48.28	48.44	48.36	-	-	-

Fig. 10. Oil content (%) and oil yield (q/ha) of groundnut as affected by different treatments



T1 - Gn with 75% RDF	T10 - G + S (2 : 1), 75%RDF
T2 - Gn with 100% RDF	T11 - G + S (2 : 1), 100%RDF
T3 - Gn with 125% RDF	T12 - G + S (2 : 1), 125%RDF
T7 - G + S (1 : 1), 75%RDF	T13 - G + S (3 : 1), 75% RDF
T8 - G + S (1 : 1), 100%RDF	T14 - G + S (3 : 1), 100%RDF
T9 - G + S (1 : 1), 125%RDF	T15 - G + S (3 : 1), 125%RDF



4.5.1 Oil content in kernel (%)

The oil content in groundnut kernels was not influenced significantly due to the different treatments studied during both the years as well as in the mean of two years (Table 15 and Fig. 10).

4.5.2 Oil yield (q/ha)

During both the years and in the mean of two years, irrespective to the row proportion adopted for intercropping treatments and sole crop treatments of groundnut, increasing fertilizer levels resulted into increased oil yield (Fig. 10). Amongst the different treatments, application of 125% RDF to sole groundnut (T₃) recorded the maximum oil yield. During the year 2003-04, sole groundnut with 125% RDF (T₃) recorded significantly higher oil yield than the rest of the treatments except the treatment sole groundnut supplied with 100% RDF (T₂), which was at par with the former treatment. Further, treatments T₁ and T₂ were at par. In case of intercropping systems, groundnut + sweet corn in 3:1 ratio and supplied with 100 or 125% RDF (T₁₄ and T₁₅) proved significantly superior to other intercropping systems. Further, treatments T₁₅ and T₁ were statistically at par with each other.

During the year 2004-05 and in the mean of two years, sole groundnut with 125% RDF (T₃) recorded significantly higher oil yield than rest of the treatments. However, sole groundnut with 75 or 100% RDF behaved statistically similar in case of oil yield of groundnut. In case of intercropping systems, groundnut + sweet corn in 3:1 ratio supplied with 125% RDF (T₁₅) proved significantly superior to other intercropping systems except the similar intercropping system with 100% RDF (T₁₄) which was at par with T₁₅. Further, treatments T₁₅ and T₁₄ were at par with T₁ and T₂ i.e. sole groundnut with 75 and 100% RDF, respectively.

4.5.3 Protein content in kernel (%)

Data presented in Table 16 and Fig. 11 revealed that the protein content in groundnut kernel was not influenced significantly due to the different treatments studied during both the years as well as in the mean of two years.

4.5.4 Protein yield (q/ha)

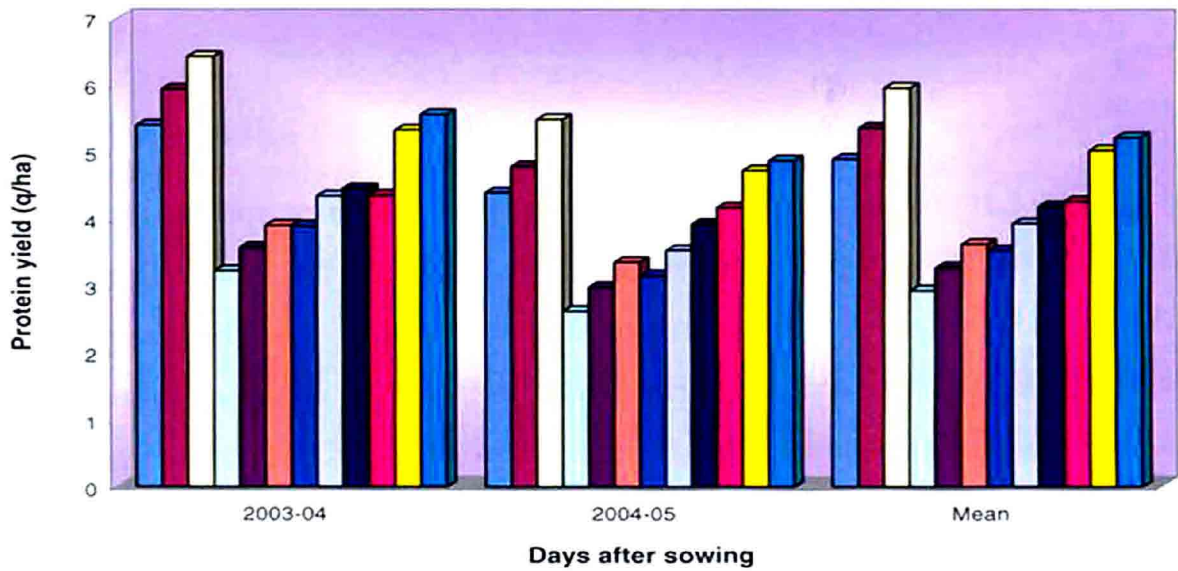
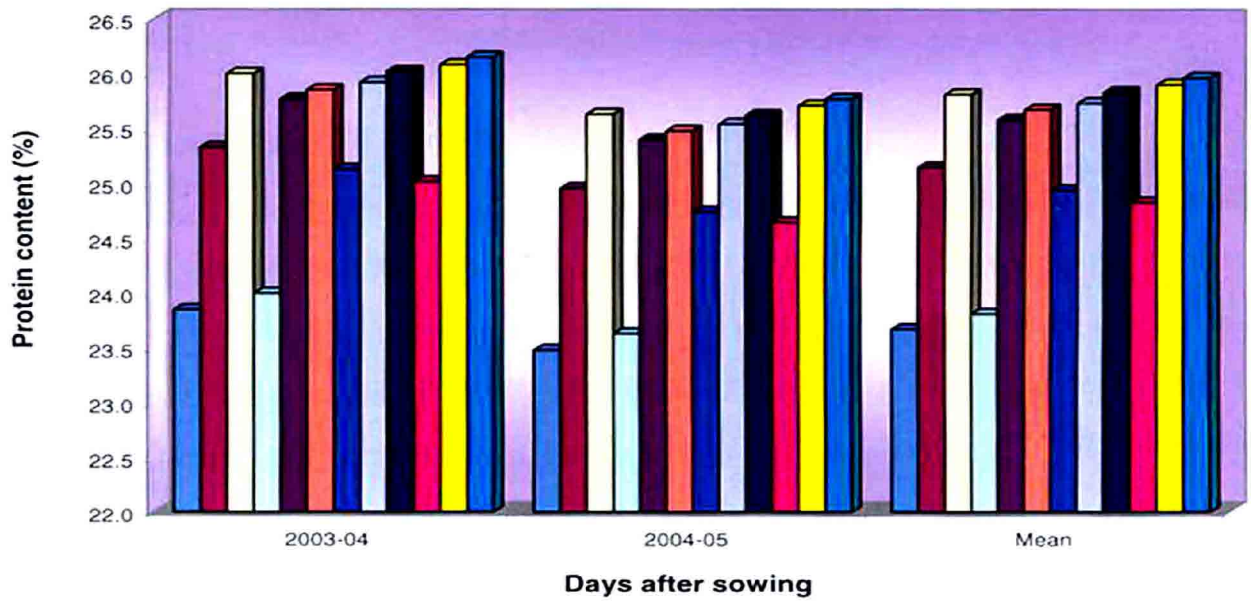
During both the years and in the mean of two years, irrespective to the row proportion adopted for intercropping treatments and sole crop treatments of groundnut, increasing fertilizer levels resulted into increased protein yield (Table 16 and Fig. 11). Amongst the different treatments, application of 125% RDF to sole groundnut (T_3) recorded the maximum protein yield. During the year 2003-04, sole groundnut with 125% RDF (T_3) recorded significantly higher protein yield than rest of the treatments except the treatment sole groundnut supplied with 100% RDF (T_2) which was at par with T_3 . However, treatments T_1 and T_2 were equally effective. In case of intercropping systems, groundnut + sweet corn in 3:1 ratio and supplied with 100% (T_{14}) or 125% RDF (T_{15}) proved significantly superior to other intercropping systems. Both these treatments were also at par with T_1 and T_2 i.e. sole groundnut with 75 and 100% RDF respectively.

During the year 2004-05 and in the mean of two years, sole groundnut with 125% RDF (T_3) recorded significantly higher protein yield of groundnut than the rest of the treatments. However, sole groundnut with 75 or 100% RDF were statistically similar in case of protein yield of groundnut. In case of intercropping systems, groundnut + sweet corn in 3:1 ratio supplied with 100 or 125% RDF (T_{14} and T_{15}) proved significantly superior to other intercropping systems, however, these two treatments were at par with each other. Similarly, T_{14} and T_{15} treatments were at par with T_1 and T_2 treatments i.e. sole groundnut with 75 and 100% RDF, respectively.

Table 16 : Protein content (%) and protein yield (q/ha) of groundnut as affected by different treatments

Sym	Treatment	Protein content (%)			Protein yield (q/ha)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Groundnut with 75% RDF	23.85	23.48	23.67	5.39
T ₂	Sole Groundnut with 100% RDF	25.33	24.96	25.15	5.93	4.78	5.35
T ₃	Sole Groundnut with 125% RDF	26.00	25.63	25.81	6.42	5.48	5.95
T ₇	Groundnut+ Sweet corn (1 : 1), 75%RDF	24.00	23.63	23.81	3.22	2.61	2.92
T ₈	Groundnut+ Sweet corn (1 : 1),100%RDF	25.77	25.40	25.58	3.57	2.97	3.27
T ₉	Groundnut+ Sweet corn (1 : 1),125%RDF	25.85	25.48	25.67	3.90	3.35	3.62
T ₁₀	Groundnut+ Sweet corn (2 : 1), 75%RDF	25.13	24.75	24.94	3.89	3.15	3.52
T ₁₁	Groundnut+ Sweet corn (2 : 1),100%RDF	25.92	25.54	25.73	4.34	3.53	3.93
T ₁₂	Groundnut+ Sweet corn (2 : 1),125%RDF	26.02	25.62	25.83	4.45	3.92	4.18
T ₁₃	Groundnut+ Sweet corn (3 : 1), 75% RDF	25.02	24.65	24.83	4.35	4.17	4.26
T ₁₄	Groundnut+ Sweet corn (3 : 1),100%RDF	26.08	25.71	25.90	5.32	4.72	5.02
T ₁₅	Groundnut+ Sweet corn (3 : 1),125%RDF	26.15	25.77	25.96	5.55	4.87	5.21
S.E. +/-		0.42	0.41	0.41	0.21	0.16	0.15
C.D. 5%		NS	NS	NS	0.61	0.46	0.44
Mean		25.43	25.05	25.24	-	-	-

Fig. 11. Protein content (%) and protein yield (q/ha) of groundnut as affected by different treatments



T1 - Gn with 75% RDF	T10 - G + S (2 : 1), 75%RDF
T2 - Gn with 100% RDF	T11 - G + S (2 : 1), 100%RDF
T3 - Gn with 125% RDF	T12 - G + S (2 : 1), 125%RDF
T7 - G + S (1 : 1), 75%RDF	T13 - G + S (3 : 1), 75% RDF
T8 - G + S (1 : 1), 100%RDF	T14 - G + S (3 : 1), 100%RDF
T9 - G + S (1 : 1), 125%RDF	T15 - G + S (3 : 1), 125%RDF



4.6 Nutrient content and uptake by groundnut crop

4.6.1 Studies on nitrogen content

Data regarding mean percent nitrogen content in groundnut kernel, shell and haulm as influenced by different treatments are presented in Table 17.

4.6.1.1 Nitrogen content in kernel, shell and haulm

It could be seen from the data that mean nitrogen content in kernel was 4.07, 4.01 and 4.04% during 2003-04, 2004-05 and in the mean of two years, respectively. While, nitrogen content in shell was 0.94, 0.93 and 0.94 per cent respectively during 2003-04, 2004-05 and in the mean of two years. Further, nitrogen content in haulm during 2003-04, 2004-05 and in the mean of two years was 1.61, 1.63 and 1.62% respectively.

However, all these three observations i.e. nitrogen content in kernel, shell and haulm were not influenced significantly due to the different treatments.

4.6.1.2 Nitrogen uptake

Data pertaining to mean nitrogen uptake by groundnut kernel, shell and haulm as influenced by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 17 and Fig. 12. In *general, nitrogen uptake by kernel, shell and haulm during 2003-04 was higher as compared to 2004-05 and was significantly influenced due to different treatments during both the years as well as in the mean of two years. In case of sole cropping of groundnut, N uptake by kernel, shell and haulm increased with increase in the level of fertilizers while in case of intercropped conditions, N uptake by kernel, shell and haulm increased with increase in the level of fertilizer and proportion of groundnut in intercropping.*

Table 17: Effect of different treatments on nitrogen content (%) of groundnut

Sym.	Treatment	Kernel			Shell			Haulm		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	3.82	3.76	3.79	0.89	0.87	0.88	1.55	1.58
T ₂	4.05	3.99	4.02	0.96	0.94	0.95	1.59	1.62	1.61	
T ₃	4.16	4.10	4.13	0.97	0.95	0.96	1.62	1.65	1.64	
T ₇	3.84	3.78	3.81	0.93	0.91	0.92	1.57	1.60	1.59	
T ₈	4.12	4.06	4.09	0.94	0.92	0.93	1.64	1.64	1.63	
T ₉	4.14	4.08	4.11	0.95	0.93	0.94	1.66	1.69	1.68	
T ₁₀	4.02	3.96	3.99	0.93	0.91	0.92	1.56	1.59	1.58	
T ₁₁	4.15	4.09	4.12	0.97	0.95	0.96	1.60	1.63	1.61	
T ₁₂	4.16	4.10	4.13	0.96	0.94	0.95	1.65	1.68	1.66	
T ₁₃	4.00	3.94	3.97	0.91	0.89	0.90	1.57	1.60	1.58	
T ₁₄	4.17	4.11	4.14	0.96	0.94	0.95	1.60	1.63	1.62	
T ₁₅	4.18	4.12	4.15	0.98	0.96	0.97	1.67	1.70	1.69	
S.E. +/-		0.076	0.072	0.070	0.036	0.031	0.017	0.047	0.043	0.021
C.D. 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean		4.07	4.01	4.04	0.94	0.93	0.94	1.61	1.63	1.62

4.6.1.3 Nitrogen uptake by kernel

In both the years of experimentation and in the mean of two years, sole cropping of groundnut fertilized with 125% RDF (T₃) recorded significantly higher N uptake by kernels (Table 18) than the intercropping treatments and T₁ i.e. sole groundnut with 75% RDF during 2004-05. However, T₃ was at par with T₂ i.e. sole groundnut with 100% RDF during all the three observations.

Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) and sole groundnut with 100% RDF (T₂) and 75% RDF (T₁) and significantly superior over the remaining intercropping treatments during all the three observations.

4.6.1.4 Nitrogen uptake by shell

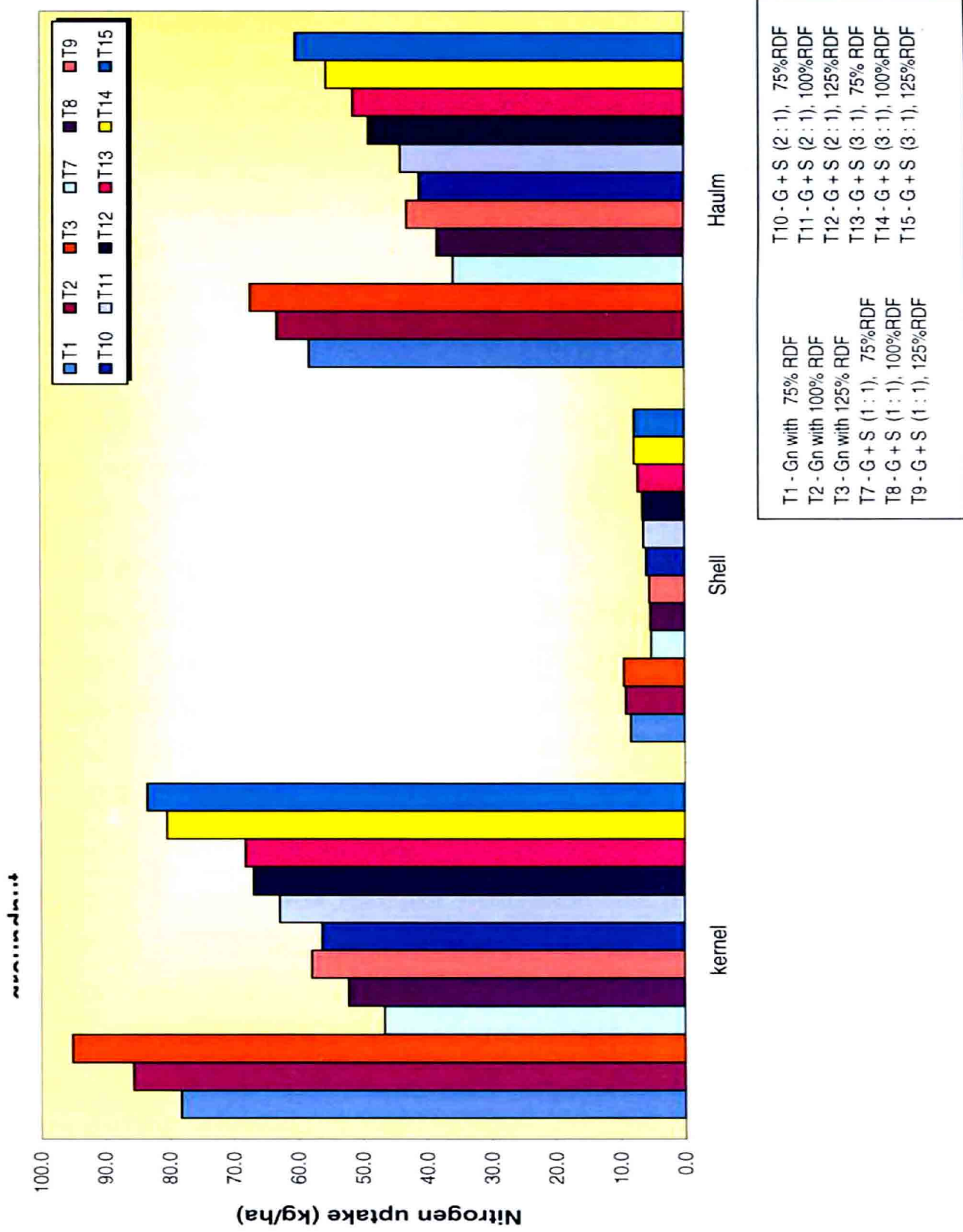
Sole crop of groundnut fertilized with 125% RDF (T₃) recorded significantly higher N uptake by the shell than the remaining treatments except treatment T₂ (sole groundnut fertilized with 100% RDF) during both the years of experimentation and in the mean of two years. At the same time, the difference between the treatments T₁ and T₂ was not significant during 2003-04 and 2004-05.

Regarding the intercropping treatments, it was observed that groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) during 2003-04 and T₁₄ and T₁₃ (groundnut + sweet corn in 3:1 ratio with 75% RDF) during 2004-05 and in the mean of two years. Further, T₁₅ was also at par with T₁ and T₂ i.e. sole groundnut with 75 and 100% RDF during 2003-04 and T₁ in the mean of two years.

Table 18 : Effect of different treatments on nitrogen uptake (kg/ha) of groundnut

Sym.	Treatment	Kernel			Shell			Haulm		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	86.26	70.20	78.23	8.60	8.26	8.43	59.55	56.99
T ₂	94.82	76.46	85.64	9.24	9.15	9.20	65.77	60.80	63.29	
T ₃	102.65	87.61	95.13	9.56	9.36	9.46	70.46	64.27	67.37	
T ₄	51.59	41.78	46.68	5.61	4.91	5.26	39.15	32.59	35.87	
T ₈	57.07	47.48	52.27	5.62	5.18	5.40	40.48	36.15	38.32	
T ₉	62.39	53.54	57.96	5.90	5.19	5.54	45.65	40.48	43.06	
T ₁₀	62.27	50.45	56.36	6.30	5.76	6.03	42.32	39.99	41.15	
T ₁₁	69.46	56.40	62.93	6.94	5.92	6.43	45.70	42.40	44.05	
T ₁₂	71.26	62.64	66.95	6.90	6.22	6.56	50.69	47.37	49.03	
T ₁₃	69.67	66.76	68.21	6.94	7.55	7.25	51.54	51.39	51.46	
T ₁₄	65.19	75.51	80.35	8.22	7.44	7.83	56.09	55.06	55.57	
T ₁₅	88.83	77.93	83.38	8.57	7.11	7.84	61.12	59.53	60.32	
	S.E. +/-	3.43	2.49	2.48	0.33	0.37	0.25	2.14	2.02	0.95
	C.D. 5%	10.07	7.31	7.27	0.96	1.09	0.74	6.27	5.92	2.78

Fig. 12. Effect of different treatments on nitrogen uptake (kg/ha) of



4.6.1.5 Nitrogen uptake by haulm

Data indicated that, during 2003-04 and 2004-05 sole crop of groundnut supplied with 125% RDF (T₃) recorded significantly higher N uptake by haulm than the remaining treatments except treatment T₂ (sole groundnut fertilized with 100% RDF). However, in the mean of two years, sole crop of groundnut supplied with 125% RDF (T₃) remained superior to rest of the treatments.

Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) and significantly superior over the remaining treatments during 2003-04 and 2004-05. During this period, T₁₅ was also at par with T₁ and T₂ i.e. sole groundnut with 75 and 100% RDF. However, in the mean of two years, T₁₅ was significantly superior over all the intercropping treatments and it was at par with sole groundnut with 75% RDF (T₁) in respect of nitrogen uptake in the haulm.

4.6.2 Studies on phosphorus content

Data pertaining to mean percent phosphorus content in groundnut kernel, shell and haulm as affected by different treatments are presented in Table 19. The mean phosphorus content in kernel, shell and haulm was 0.577, 0.108 and 0.188 % during 2003-04; 0.548, 0.112 and 0.182 % during 2004-05 and 0.562, 0.112 and 0.185 % in the mean of two years respectively.

4.6.2.1 Phosphorus content in kernel, shell and haulm

The different treatments did not influence the phosphorus content in groundnut kernel, shell and haulm during both the years of experimentation and in the mean of two years. In general, phosphorus content in kernel and haulm was slightly higher during 2003-04 as compared to 2004-05. However, phosphorus content in the shell was slightly more during 2004-05 than 2003-04.

Table 19: Effect of different treatments on phosphorous content (%) of groundnut

Sym.	Treatment	Kernel			Shell			Haulm		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	0.564	0.546	0.555	0.106	0.116	0.111	0.173	0.161
T ₂	0.567	0.548	0.557	0.108	0.118	0.113	0.184	0.172	0.178	
T ₃	0.582	0.567	0.575	0.110	0.119	0.115	0.193	0.191	0.192	
T ₇	0.570	0.545	0.557	0.106	0.116	0.111	0.185	0.173	0.179	
T ₈	0.576	0.561	0.563	0.107	0.117	0.112	0.187	0.185	0.186	
T ₉	0.585	0.546	0.565	0.111	0.118	0.114	0.198	0.196	0.197	
T ₁₀	0.572	0.547	0.559	0.104	0.113	0.108	0.178	0.167	0.172	
T ₁₁	0.576	0.538	0.557	0.108	0.117	0.112	0.182	0.180	0.181	
T ₁₂	0.591	0.552	0.572	0.110	0.120	0.115	0.200	0.198	0.199	
T ₁₃	0.568	0.536	0.552	0.105	0.114	0.110	0.185	0.173	0.179	
T ₁₄	0.583	0.547	0.565	0.107	0.117	0.112	0.191	0.189	0.190	
T ₁₅	0.592	0.560	0.571	0.112	0.118	0.115	0.203	0.201	0.202	
S.E. +/-		0.006	0.008	0.006	0.004	0.004	0.006	0.005	0.005	
C.D. 5%		NS	NS	NS	NS	NS	NS	NS	NS	
Mean		0.577	0.548	0.562	0.108	0.117	0.112	0.188	0.182	0.185

4.6.2.2 Phosphorus uptake

Data regarding the phosphorus uptake by kernel, shell and haulm of groundnut as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 20 and Fig. 13. In general, phosphorus uptake by kernel and haulm in 2003-04 was higher as compared to 2004-05 and was significantly influenced due to different treatments during both the years as well as in the mean of two years. In case of sole cropping of groundnut, P uptake by kernel, shell and haulm increased with increase in the level of fertilizers while in case of intercropped conditions, P uptake by kernel, shell and haulm increased with increase in the level of fertilizer and increased proportion of groundnut in intercropping.

4.6.2.3 Phosphorus uptake by kernel

During both the years of experimentation and in the mean of two years, sole crop of groundnut fertilized with 125% RDF (T_3) recorded significantly higher P uptake in the kernels than the remaining treatments except groundnut fertilized with 100% RDF (T_2), which was at par with the former treatment. Further, among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T_{15}) and groundnut + sweet corn in 3:1 ratio with 100% RDF (T_{14}) were at par and were significantly superior over the remaining intercropping treatments during both the years of experimentation and in the mean of two years. Further, T_{15} was at par with the treatments T_1 and T_2 i.e. sole groundnut with 75 and 100% RDF respectively.

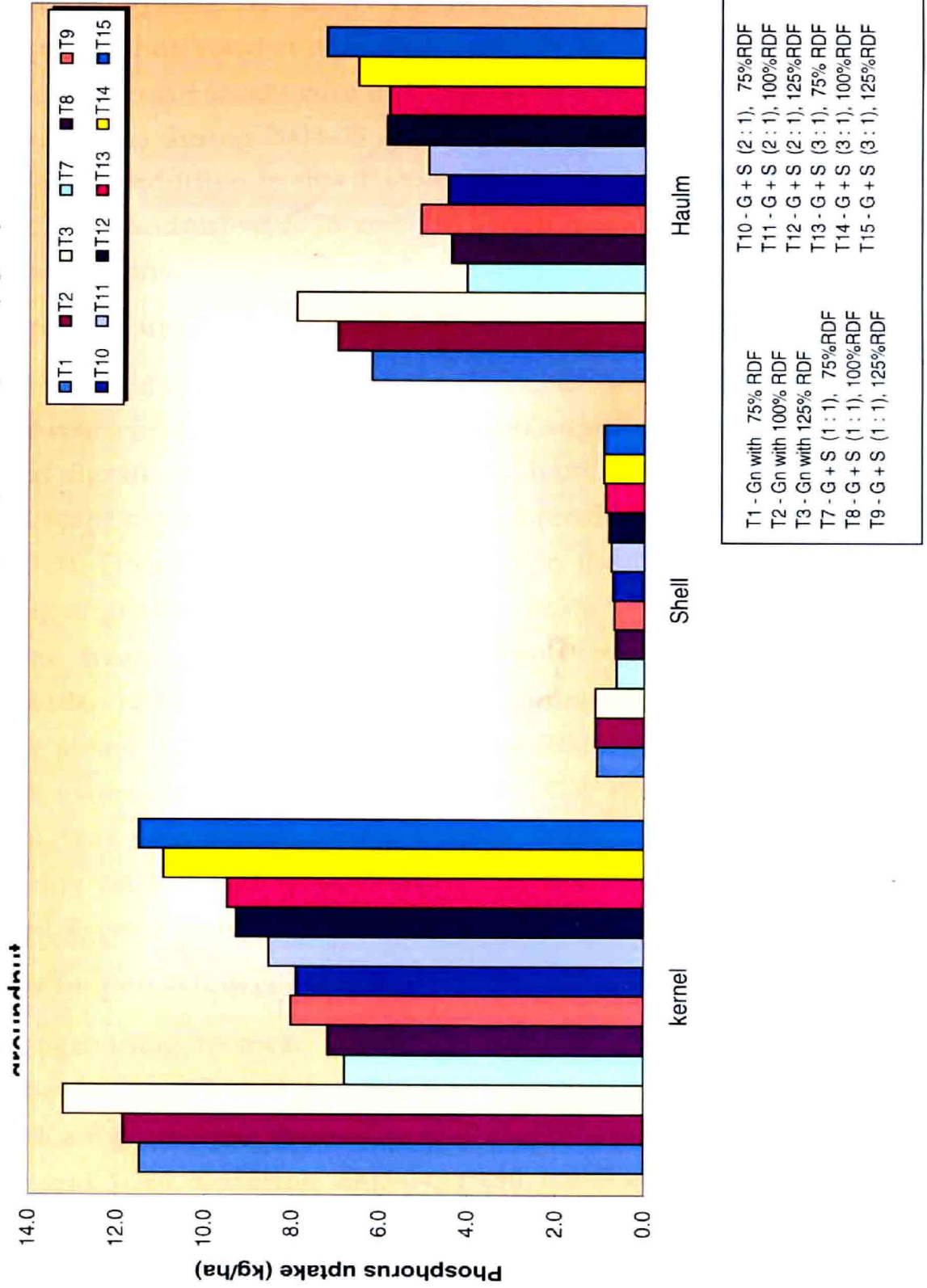
4.6.2.4 Phosphorus uptake by shell

Sole crop of groundnut fertilized with 125% RDF (T_3) recorded significantly higher P uptake by shell than the remaining treatments except treatment T_2 (sole groundnut fertilized with 100% RDF) and T_1 .

Table 20 : Effect of different treatments on phosphorous uptake (kg/ha) of groundnut

Sym.	Treatment	Kernel			Shell			Haulm		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	12.731	10.213	11.472	1.038	1.098	1.068	6.619	5.783
T ₂	13.257	10.441	11.849	1.077	1.130	1.104	7.555	6.415	6.985	
T ₃	14.293	12.119	13.206	1.062	1.156	1.109	8.394	7.450	7.922	
T ₇	G + S (1 : 1), 75% RDF	7.601	6.007	6.804	0.637	0.628	0.632	4.600	3.491	4.045
T ₈	G + S (1 : 1), 100% RDF	8.038	6.345	7.191	0.650	0.665	0.652	4.698	4.100	4.399
T ₉	G + S (1 : 1), 125% RDF	8.845	7.223	8.034	0.697	0.663	0.675	5.475	4.710	5.093
T ₁₀	G + S (2 : 1), 75% RDF	8.855	6.975	7.915	0.708	0.722	0.715	4.800	4.175	4.487
T ₁₁	G + S (2 : 1), 100% RDF	9.644	7.435	8.539	0.767	0.730	0.748	5.186	4.663	4.924
T ₁₂	G + S (2 : 1), 125% RDF	10.109	8.448	9.279	0.807	0.804	0.805	6.145	5.608	5.877
T ₁₃	G + S (3 : 1), 75% RDF	9.892	9.082	9.487	0.804	0.875	0.840	6.098	5.549	5.824
T ₁₄	G + S (3 : 1), 100% RDF	11.837	10.026	10.932	0.922	0.925	0.923	6.705	6.365	6.535
T ₁₅	G + S (3 : 1), 125% RDF	12.595	10.392	11.494	0.955	0.968	0.962	7.481	7.044	7.263
	S.E. +/-	0.409	0.309	0.282	0.054	0.046	0.043	0.288	0.241	0.239
	C.D. 5%	1.200	0.905	0.826	0.159	0.135	0.127	0.844	0.706	0.702

Fig. 13. Effect of different treatments on phosphorus uptake (kg/ha) of



(sole groundnut fertilized with 75% RDF) during both the years of experimentation and in the mean of two years. At the same time, the difference between the treatments T₁ and T₂ was also not conspicuous in relation with P uptake by shell. Further, in case of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100 and 75% RDF (T₁₁ and T₁₃ respectively) during 2004-05 and in the mean of two years and T₁₁ during 2003-04. In addition to this T₁₅ was also at par with the treatments T₁ and T₂ (sole groundnut with 75 and 100% RDF respectively) during all the three observations.

4.6.2.5 Phosphorus uptake by haulm

Data indicated that, during both the years of experimentation and in the mean of two years, sole crop of groundnut supplied with 125% RDF (T₃) recorded significantly higher P uptake by haulm than the remaining treatments except treatment T₂ (sole groundnut fertilized with 100% RDF) during 2003-04. However, during 2004-05 and in the mean of two years sole cropping of groundnut and supplied with 125% RDF (T₃) remained at par with the treatment T₁₅ (Groundnut+sweet corn in 3:1 ratio and fertilized with 125% RDF). Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁) during both the years and it was significantly superior over the remaining treatments. Further, during 2004-05 and in the mean of two years, T₁₅ was at par with the treatment T₂ (sole groundnut with 100% RDF).

4.6.3 Studies on potassium content (%)

Data pertaining to mean potassium content in groundnut kernel, shell and haulm as affected by different treatments are presented in Table 21. Mean potassium content in the kernel, shell and haulm was 1.129, 0.886 and 1.269 % during 2003-04; 1.156, 0.893 and 1.280 % during 2004-05 and 1.142, 0.890 and 1.275 % in the mean of two years respectively.

Table 21 : Effect of different treatments on potassium content (%) of groundnut

Sym.	Treatment	Kernel			Shell			Haulm		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Groundnut with 75% RDF	1.077	1.077	1.077	0.857	0.857	0.857	1.227
T ₂	Sole Groundnut with 100% RDF	1.120	1.160	1.140	0.887	0.887	0.887	1.260	1.260	1.260
T ₃	Sole Groundnut with 125% RDF	1.153	1.193	1.173	0.897	0.897	0.897	1.293	1.303	1.298
T ₇	G + S (1 : 1), 75% RDF	1.103	1.093	1.098	0.867	0.857	0.862	1.243	1.243	1.243
T ₈	G + S (1 : 1), 100% RDF	1.137	1.147	1.142	0.877	0.887	0.882	1.267	1.277	1.272
T ₉	G + S (1 : 1), 125% RDF	1.163	1.203	1.183	0.900	0.920	0.910	1.303	1.313	1.308
T ₁₀	G + S (2 : 1), 75% RDF	1.093	1.103	1.098	0.870	0.870	0.870	1.233	1.233	1.233
T ₁₁	G + S (2 : 1), 100% RDF	1.137	1.177	1.157	0.880	0.890	0.885	1.277	1.277	1.277
T ₁₂	G + S (2 : 1), 125% RDF	1.150	1.190	1.170	0.913	0.933	0.923	1.290	1.320	1.305
T ₁₃	G + S (3 : 1), 75% RDF	1.080	1.120	1.100	0.870	0.880	0.875	1.240	1.260	1.250
T ₁₄	G + S (3 : 1), 100% RDF	1.157	1.197	1.177	0.890	0.900	0.895	1.287	1.287	1.287
T ₁₅	G + S (3 : 1), 125% RDF	1.173	1.213	1.193	0.923	0.943	0.933	1.313	1.343	1.328
	S.E. +/-	0.022	0.024	0.011	0.014	0.017	0.010	0.023	0.025	0.018
	C.D.5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Mean	1.129	1.156	1.142	0.886	0.893	0.890	1.269	1.280	1.275

4.6.3.1 Potassium content in kernel, shell and haulm

The different treatments did not influence the potassium content in groundnut kernel, shell and haulm during both the years of experimentation and in the mean of two years.

4.6.3.2 Potassium uptake

Data pertaining to mean potassium uptake by groundnut kernel, shell and haulm as affected by different treatments are presented in Table 22 and Fig. 14. Potassium removal by the component parts of groundnut differed significantly in both the years as well as in the mean of two years due to different treatments. In case of sole cropping of groundnut, K uptake by kernel, shell and haulm increased with increase in the level of fertilizer while in case of intercropping, K uptake by kernel, shell and haulm increased with increase in the level of fertilizer and increased proportion of groundnut in intercropping.

4.6.3.3 Potassium uptake by kernel

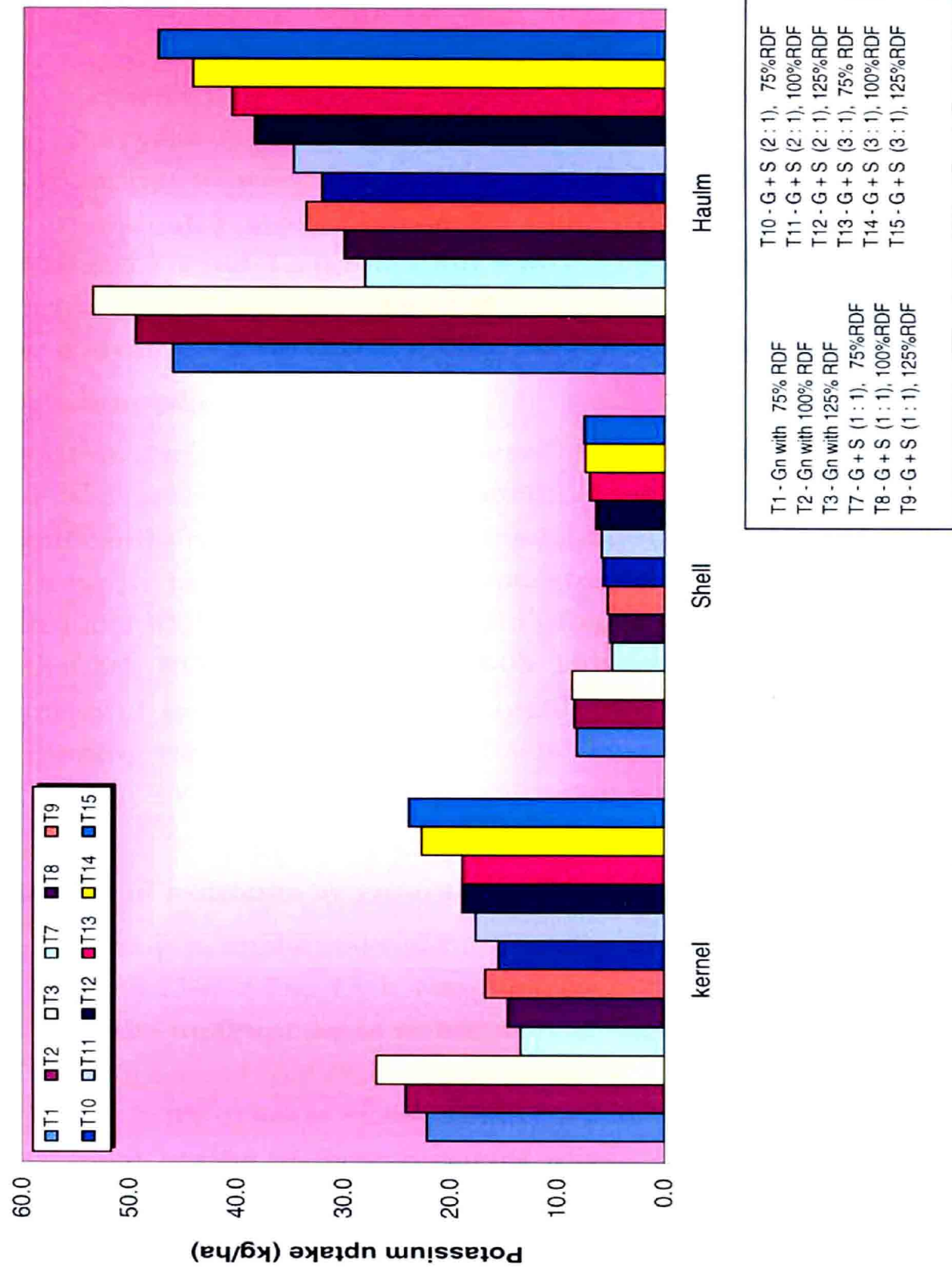
During both the years of experimentation and in the mean of two years, sole crop of groundnut with 125% RDF (T_3) recorded significantly higher K uptake in the kernels than the remaining treatments except T_2 (sole groundnut with 100% RDF) which was at par with T_3 .

Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T_{15}) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T_{14}) and both these treatments were significantly superior over the remaining intercropping treatments. Further, treatment T_{15} was at par with sole groundnut with 75% (T_1) and 100% RDF (T_2) during 2003-04 and in the mean of two years. While, during 2004-05, treatment T_{15} was at par with sole groundnut with 100% RDF (T_2) and it was significantly superior over T_1 .

Table 22 : Effect of different treatments on potassium uptake (kg/ha) of groundnut

Sym.	Treatment	Kernel			Shell			Haulm		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	24.29	20.14	22.21	8.31	8.13	8.22	47.06	45.01
T ₂	26.20	22.18	24.19	8.32	8.55	8.44	51.88	47.14	49.51	
T ₃	28.43	25.48	26.95	8.58	8.68	8.63	56.29	50.69	53.49	
T ₇	14.73	12.14	13.44	5.21	4.57	4.89	30.89	25.31	28.10	
T ₈	15.86	13.37	14.62	5.30	5.01	5.15	31.75	28.35	30.05	
T ₉	17.78	15.74	16.76	5.58	5.07	5.33	35.86	31.42	33.64	
T ₁₀	16.95	14.05	15.50	5.97	5.54	5.75	33.38	30.94	32.16	
T ₁₁	19.04	16.23	17.64	6.26	5.55	5.91	36.43	33.22	34.83	
T ₁₂	19.69	18.14	18.91	6.65	6.22	6.44	39.85	37.27	38.46	
T ₁₃	18.84	18.97	18.91	6.60	7.44	7.02	40.72	40.46	40.59	
T ₁₄	23.53	21.91	22.72	7.66	7.21	7.43	45.14	43.28	44.21	
T ₁₅	24.90	22.92	23.91	8.05	7.02	7.54	48.02	46.95	47.49	
	S.E. +/-	0.98	0.64	0.60	0.29	0.21	1.25	1.08	0.87	
	C.D. 5%	2.88	1.87	1.76	0.85	0.79	3.67	3.18	2.54	

Fig. 14. Effect of different treatments on potassium uptake (kg/ha) of groundnut



4.6.3.4 Potassium uptake by shell

Sole crop of groundnut with 125% RDF (T₃) recorded significantly higher K uptake by the shell than the remaining treatments except treatment T₂ (sole groundnut fertilized with 100% RDF), and T₁ (sole groundnut fertilized with 75% RDF) during 2004-05 and in the mean of two years and also with T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) during the year 2003-04. However, in case of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) during 2003-04 and T₁₄ and T₁₃ (groundnut + sweet corn in 3:1 ratio with 75% RDF) during 2004-05 and in the mean of two years. Further, treatment T₁₅ was at par with all the three sole cropping treatments during 2003-04.

4.6.3.5 Potassium uptake by haulm

Data indicated that, during both the years of experimentation and in the mean of two years, sole crop of groundnut with 125% RDF (T₃) recorded significantly higher K uptake in the haulm than the remaining treatments. In case of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) during 2003-04. However, during 2004-05 and in the mean of two years, T₁₅ was significantly superior over the other intercropping treatments. During 2003-04, T₁₅ and T₁₄ were at par with T₁ and during 2004-05 and in the mean of two years, T₁₅ was at par with T₁ and T₂.

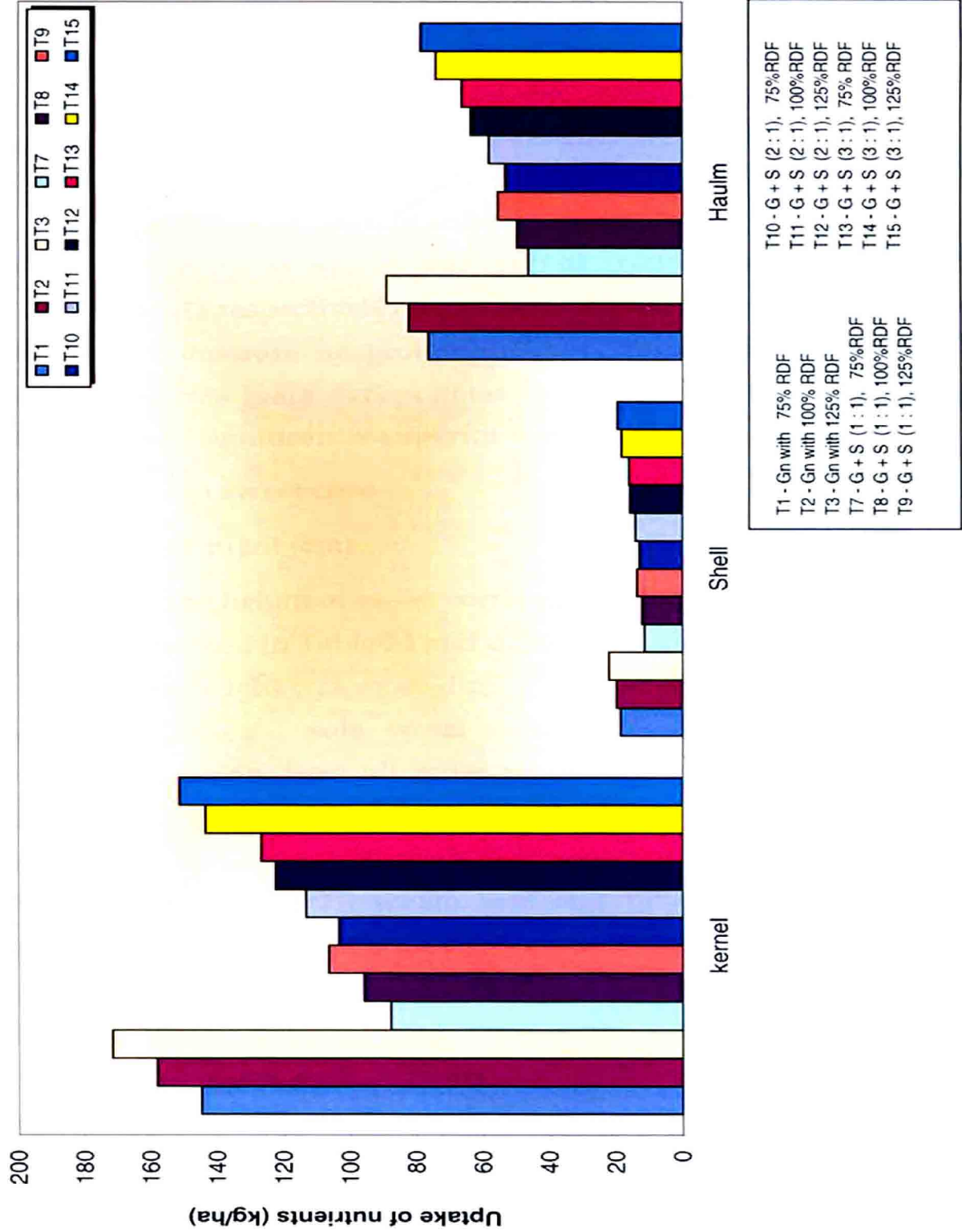
4.6.4 Total uptake of nutrients by groundnut crop

Data pertaining to total uptake of nutrients by groundnut crop have been given in Table 23 and Fig. 15. It was realized from data that, during the year 2003-04, the total uptake of nutrients was higher as compared to the year 2004-05. In case of sole cropping of groundnut, total uptake of N, P and K increased with increase in the level of fertilizers while in case of intercropping, total uptake of these nutrients increased with increase in the level of fertilizers and increased proportion of groundnut.

Table 23: Effect of different treatments on total uptake of nutrients (kg/ha) by groundnut crop

Sym.	Treatment	Nitrogen			Phosphorous			Potassium		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Groundnut with 75% RDF	154.40	135.45	144.92	20.39	17.09	18.74	79.65
T ₂	Sole Groundnut with 100% RDF	170.15	146.42	158.28	21.89	17.99	19.94	86.90	77.88	82.39
T ₃	Sole Groundnut with 125% RDF	182.35	161.12	171.73	23.75	20.73	22.24	93.30	84.86	89.08
T ₇	G + S (1 : 1), 75%RDF	96.34	79.28	87.81	12.84	10.13	11.48	50.83	42.02	46.43
T ₈	G + S (1 : 1), 100%RDF	103.18	88.81	95.99	13.38	11.10	12.24	52.91	46.73	49.82
T ₉	G + S (1 : 1), 125%RDF	113.93	99.21	106.57	15.02	12.59	13.80	59.23	52.23	55.73
T ₁₀	G + S (2 : 1), 75%RDF	110.89	96.19	103.54	14.36	11.87	13.12	56.30	50.53	53.42
T ₁₁	G + S (2 : 1), 100%RDF	122.10	104.72	113.41	15.60	12.83	14.21	61.73	55.01	58.37
T ₁₂	G + S (2 : 1), 125%RDF	128.84	116.23	122.54	17.06	14.86	15.96	65.99	61.64	63.82
T ₁₃	G + S (3 : 1), 75% RDF	128.15	125.69	126.92	16.79	15.60	16.20	66.16	66.88	66.52
T ₁₄	G + S (3 : 1), 100%RDF	149.49	138.00	143.75	19.46	17.32	18.39	76.32	72.40	74.36
T ₁₅	G + S (3 : 1), 125%RDF	158.51	144.57	151.54	21.05	18.31	19.68	80.98	76.89	78.94
	S.E. +/-	4.80	4.44	3.30	0.67	0.53	0.50	2.25	1.83	1.47
	C.D. 5%	14.09	13.01	9.69	1.97	1.56	1.46	6.59	5.37	4.32

Fig. 15. Effect of different treatments on total uptake of nutrients (kg/ha) by groundnut crop



4.6.4.1 Total uptake of nitrogen, phosphorus and potassium

During 2003-04, T₃ (sole groundnut with 125% RDF) and T₂ (Sole groundnut with 100% RDF) were at par in terms of total uptake of nitrogen, phosphorus and potassium by groundnut crop during 2003-04. However, during 2004-05 and in the mean of two years, T₃ was significantly superior over the remaining treatments. In case of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) and groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) were at par and T₁₅ was significantly superior than the remaining intercropping treatments as well as sole crop of groundnut with 75% and 100% RDF (T₁ and T₂ respectively) in respect of total uptake of nitrogen, phosphorus and potassium by groundnut crop during 2003-04, 2004-05 and in the mean of two years, except potassium uptake in the mean of two years, where T₁₅ was significantly superior over T₁₄ also.

4.7 Growth studies in sweet corn

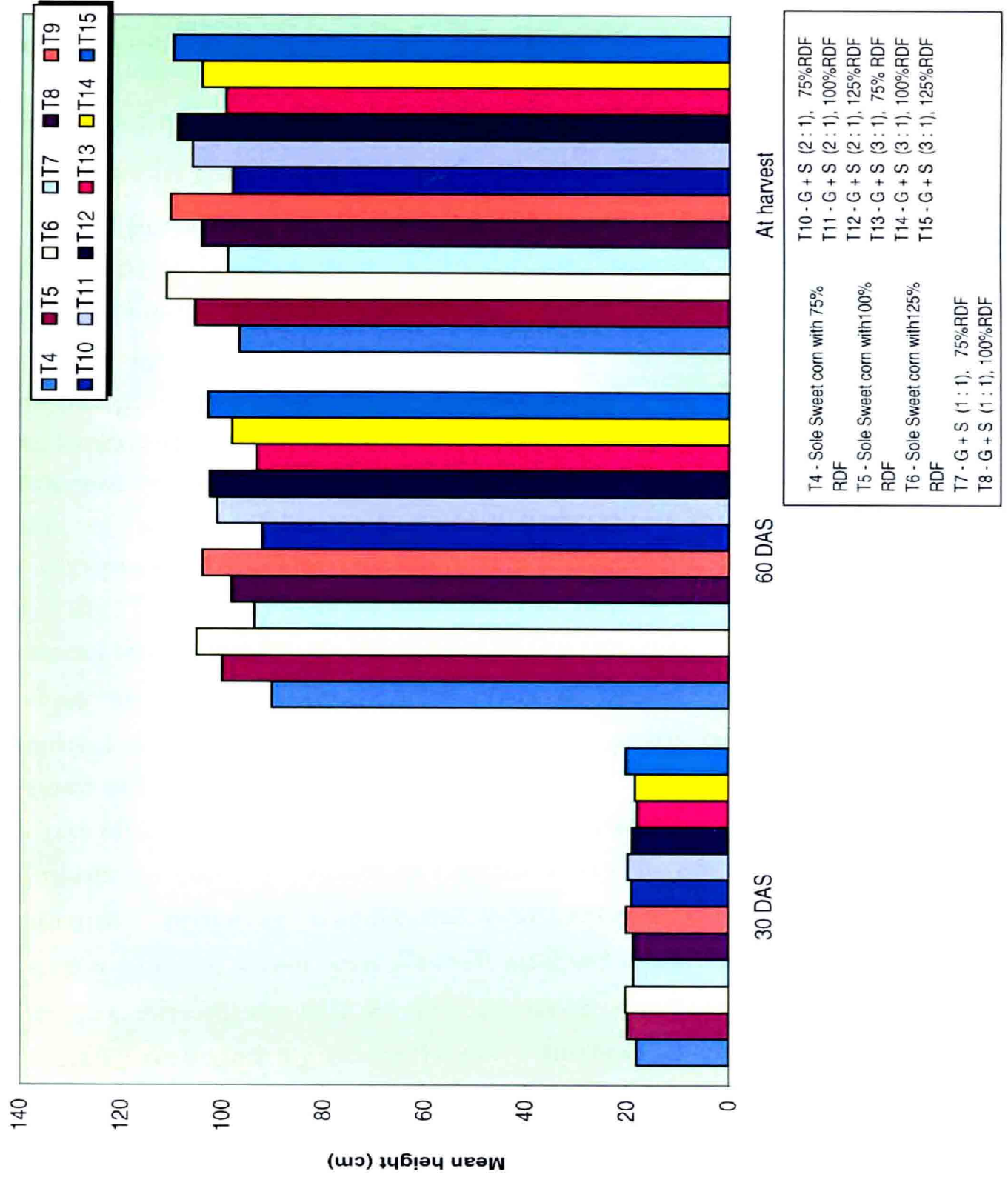
4.7.1 Mean height of plant (cm)

Data pertaining to the height of sweet corn plant as influenced by different treatments are presented in Table 24 and depicted in Fig. 16. It was noticed that the mean plant height was more during 2004-05 as compared to 2003-04. Treatment T₆ i.e. sole sweet corn with 125% RDF recorded significantly taller plants than all other treatments except groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅), T₉, T₁₁ and T₁₂ which were at par with the former treatment (T₆) at 60 DAS and at harvest during all the three observations except, T₁₁ which was significantly superior to T₆ during 2004-05 and in the mean of two years at harvest. Further, at 60 DAS and at harvest, plant height recorded under T₁₅ treatment was significantly more than all other intercropping treatments during all the three observations except, groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄), during 2003-04 at 60 DAS and at harvest; where both the treatments i.e. T₁₅ and T₁₄ were at par.

Table 24: Mean height (cm) of sweet corn plant as affected periodically by different treatments

Sym.	Treatment	30 DAS			60 DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	17.20	18.80	18.00	89.27	91.27	90.27	95.40
T ₂	Sole Sweet corn with 100% RDF	19.53	20.33	19.93	99.07	101.20	100.13	105.20	106.00	105.60
T ₃	Sole Sweet corn with 125% RDF	19.40	21.00	20.20	104.13	106.13	105.13	110.27	112.07	111.17
T ₄	G + S (1 : 1), 75%RDF	17.73	19.53	18.63	92.13	95.40	93.77	98.27	100.07	99.17
T ₅	G + S (1 : 1), 100%RDF	17.80	19.60	18.70	97.27	99.27	98.27	103.40	105.20	104.30
T ₆	G + S (1 : 1), 125%RDF	19.27	21.07	20.17	103.40	104.53	103.97	109.53	111.33	110.43
T ₇	G + S (2 : 1), 75%RDF	18.67	19.47	19.07	91.20	93.20	92.20	97.33	99.07	98.20
T ₈	G + S (2 : 1), 100%RDF	18.93	20.73	19.83	100.00	102.20	101.10	106.13	106.20	106.17
T ₉	G + S (2 : 1), 125%RDF	18.07	19.87	18.97	101.60	103.60	102.60	107.73	110.53	109.13
T ₁₀	G + S (3 : 1), 75% RDF	17.53	18.40	17.97	92.40	94.40	93.40	98.53	100.53	99.53
T ₁₁	G + S (3 : 1), 100%RDF	17.53	19.33	18.43	97.20	99.20	98.20	103.47	105.07	104.27
T ₁₂	G + S (3 : 1), 125%RDF	19.40	21.20	20.30	102.00	104.00	103.00	108.13	111.93	110.03
S.E. +/-		0.70	0.65	0.66	1.66	1.30	1.39	1.79	1.47	1.28
C.D. 5%		NS	NS	NS	4.86	3.82	4.08	5.26	4.30	3.76
Mean		18.42	19.94	19.18	97.47	99.53	98.50	103.62	105.52	104.57

Fig. 16. Mean height (cm) of sweet corn plant as affected periodically by different treatments



T4 - Sole Sweet corn with 75% RDF
 T5 - Sole Sweet corn with 100% RDF
 T6 - Sole Sweet corn with 125% RDF
 T7 - G + S (1 : 1), 75% RDF
 T8 - G + S (1 : 1), 100% RDF
 T9 - G + S (2 : 1), 75% RDF
 T10 - G + S (2 : 1), 100% RDF
 T11 - G + S (2 : 1), 125% RDF
 T12 - G + S (3 : 1), 75% RDF
 T13 - G + S (3 : 1), 100% RDF
 T14 - G + S (3 : 1), 125% RDF
 T15 - G + S (3 : 1), 125% RDF

In addition to this, T₁₅ recorded statistically similar plant height to sole sweet corn with 100% RDF (T₃), T₉, T₁₁ and T₁₂ at 60DAS during all the three observations as well as at harvest during 2003-04. In addition to this, T₉ and T₁₂ were also at par with T₁₅ during 2004-05 and in the mean of two years at harvest, in respect of plant height of sweet corn. Further, at 30 DAS height of sweet corn was not influenced significantly due to the different treatments during all the three observations.

4.7.2 Number of functional leaves per plant

Data pertaining to the number of functional leaves per plant of sweet corn periodically influenced by different treatments are presented in Table 25 and graphically shown in Fig. 17.

Data on general mean indicated that the number of functional leaves per plant increased up to 60 DAS. At harvest, there was reduction in the functional leaves because of shedding of some leaves. Application of different treatments to sweet corn significantly influenced the mean number of functional leaves per plant throughout the growth period of crop except 30 DAS. The treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was prominent resulting in the highest number of functional leaves per hill as compared to the remaining treatments.

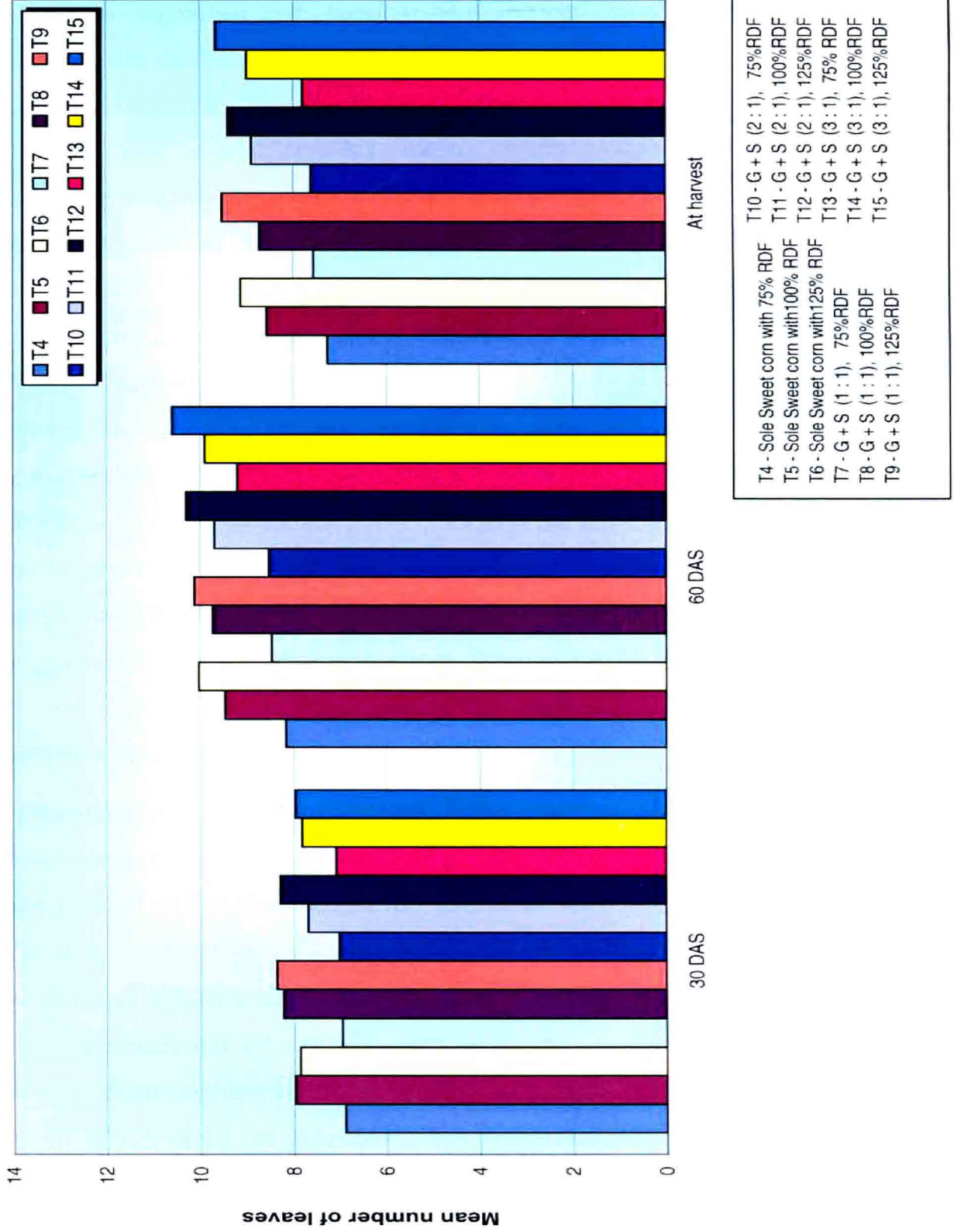
At 30 DAS, number of functional leaves per plant was not influenced significantly due to any treatment during both the years and in the mean of two years.

At 60 DAS, during 2004-05 and in the mean of two years, different treatments influenced number of functional leaves per plant of sweet corn significantly, however, during the year 2003-04, number of functional leaves per plant of sweet corn was not affected significantly due to various treatments. Among the sole sweet corn, treatment T₆ (sole sweet corn with 125% RDF) recorded significantly more number of functional leaves per plant than the treatment T₄ (sole sweet corn with 75% RDF) during 2004-

Table 25 : Mean number of leaves of sweet corn per plant as influenced periodically by different treatments

Sym.	Treatment	30 DAS			60 DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	6.80	7.00	6.90	8.13	8.20	8.17	7.33
T ₃	Sole Sweet corn with 100% RDF	7.87	8.07	7.97	9.67	9.27	9.47	8.87	8.20	8.57
T ₆	Sole Sweet corn with 125% RDF	7.93	7.80	7.87	10.07	10.00	10.03	9.27	9.07	9.13
T ₇	G + S (1 : 1), 75%RDF	6.87	7.07	6.97	8.67	8.27	8.47	7.87	7.33	7.57
T ₈	G + S (1 : 1), 100%RDF	8.13	8.33	8.23	9.93	9.53	9.73	8.93	8.53	8.73
T ₉	G + S (1 : 1), 125%RDF	8.27	8.47	8.37	9.80	10.47	10.13	9.00	10.07	9.53
T ₁₀	G + S (2 : 1), 75%RDF	6.93	7.13	7.03	8.73	8.33	8.53	7.93	7.27	7.63
T ₁₁	G + S (2 : 1), 100%RDF	7.80	7.60	7.70	9.60	9.80	9.70	8.80	9.00	8.90
T ₁₂	G + S (2 : 1), 125%RDF	8.20	8.40	8.30	10.00	10.60	10.30	9.20	9.67	9.40
T ₁₃	G + S (3 : 1), 75% RDF	7.00	7.20	7.10	8.80	9.60	9.20	8.00	7.60	7.80
T ₁₄	G + S (3 : 1), 100%RDF	7.73	7.93	7.83	9.53	10.27	9.90	8.73	9.33	9.00
T ₁₅	G + S (3 : 1), 125%RDF	8.07	7.87	7.97	10.13	11.07	10.60	9.27	10.27	9.77
	S.E. +/-	0.27	0.25	0.15	0.26	0.37	0.18	0.21	0.35	0.16
	C.D. 5%	NS	NS	NS	NS	1.09	0.53	0.61	1.03	0.47
	Mean	7.63	7.74	7.69	9.42	9.70	9.56	8.60	8.67	8.63

Fig. 17. Mean number of Functional leaves of sweet corn per plant as influenced periodically by different treatments



05 and treatments T₄ and T₅ (sole sweet corn with 100% RDF) in the mean of two years. During 2004-05 and in the mean of two years, application of 125% RDF to groundnut + sweet corn at 1:1, 2:1 or 3:1 proportion recorded significantly more number of functional leaves per plant than their respective treatments receiving 75% RDF.

During the above referred two observations at 60 DAS, T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded significantly more number of functional leaves per plant of sweet corn than the other treatments, however, statistically it was at par with T₆ (sole sweet corn with 125% RDF), T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF), T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) and T₁₄ (groundnut + sweet corn in 3:1 ratio with 100% RDF) during 2004-05 and treatments T₉ and T₁₂ in the mean of two years and it (T₁₅) was significantly superior over the remaining treatments.

At harvest, T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded the higher number of functional leaves per plant, however, it was at par with the treatments T₅, T₆, T₈, T₉, T₁₁, T₁₂, and T₁₄ during 2003-04 and the treatments T₆, T₉ and T₁₂ during 2004-05 and in the mean of two years.

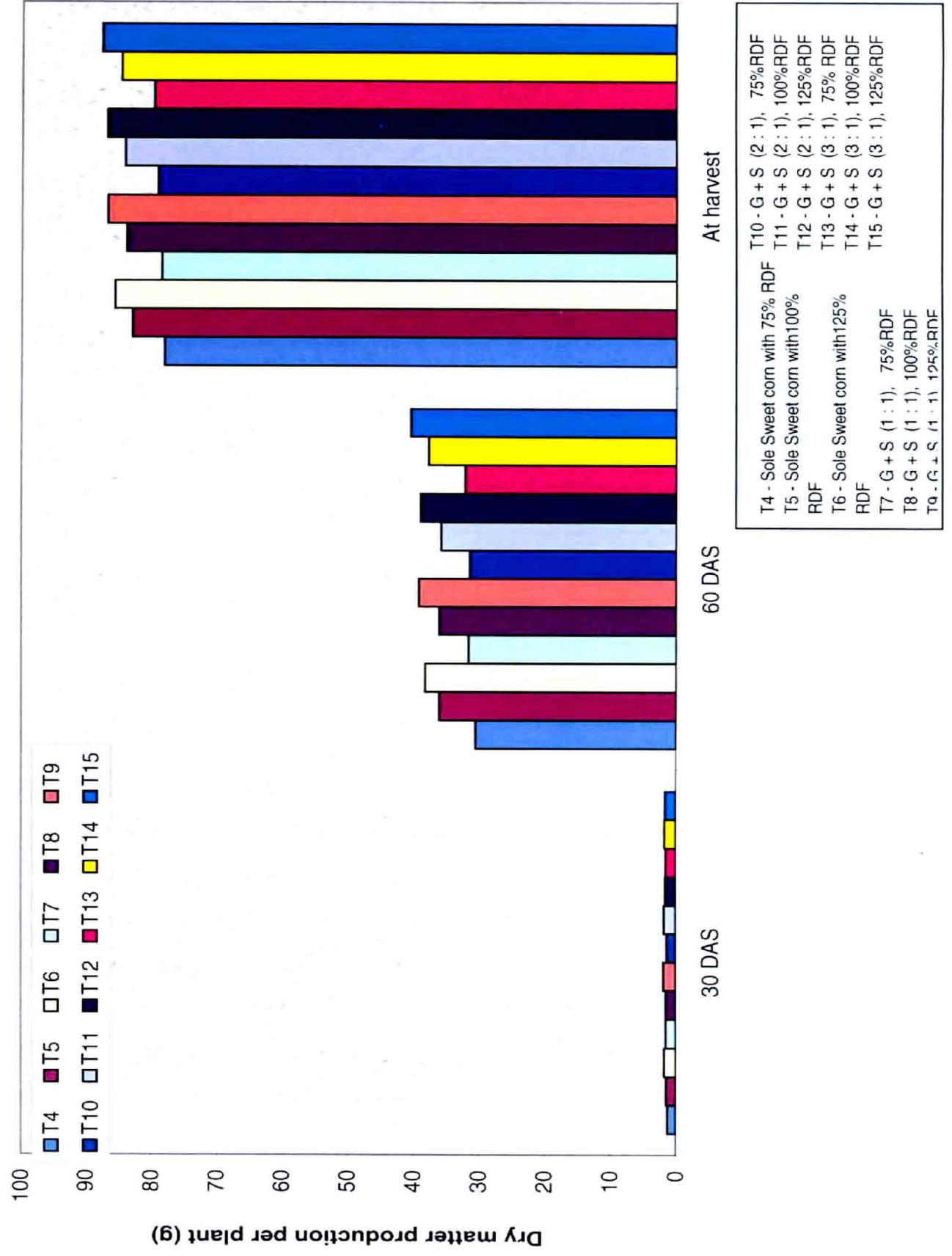
4.7.3 Dry matter accumulation per plant (g)

Data pertaining to the periodical dry matter accumulation in sweet corn are presented in Table 26 and Fig. 18. In general, the dry matter accumulation per plant increased with increase in the age of the crop and it was maximum at harvest. During all the growth stages as well as at harvest, dry matter production was higher during 2004-05 than 2003-04. Dry matter accumulation of sweet corn was not influenced significantly due to the different treatments at early growth stage i.e. at 30 DAS, however, at 60 DAS and at harvest, T₁₅ (groundnut + sweet corn in 3:1

Table 26: Mean dry matter (g) per plant of sweet corn as affected periodically by different treatments

Sym.	Treatment	30 DAS			60 DAS			At Harvest		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	1.18	1.40	1.29	30.02	31.20	30.61	74.78
T ₂	Sole Sweet corn with 100% RDF	1.32	1.62	1.47	34.71	37.51	36.11	79.88	86.21	83.04
T ₃	Sole Sweet corn with 125% RDF	1.61	1.91	1.76	37.15	39.32	38.23	82.23	89.23	85.73
T ₇	G + S (1 : 1), 75%RDF	1.33	1.76	1.54	30.61	32.75	31.68	75.52	81.52	78.52
T ₈	G + S (1 : 1), 100%RDF	1.36	1.66	1.51	35.10	37.18	36.14	79.95	87.95	83.95
T ₉	G + S (1 : 1), 125%RDF	1.71	2.01	1.86	38.39	40.07	39.23	83.33	90.30	86.82
T ₁₀	G + S (2 : 1), 75%RDF	1.39	1.37	1.38	31.31	31.64	31.48	76.13	82.13	79.13
T ₁₁	G + S (2 : 1), 100%RDF	1.65	1.95	1.80	35.21	36.42	35.82	80.17	88.17	84.17
T ₁₂	G + S (2 : 1), 125%RDF	1.48	1.78	1.63	38.41	39.55	38.98	83.41	90.43	86.92
T ₁₃	G + S (3 : 1), 75% RDF	1.34	1.67	1.51	31.25	33.20	32.22	76.17	83.37	79.77
T ₁₄	G + S (3 : 1), 100%RDF	1.53	1.83	1.68	36.21	39.35	37.78	80.91	88.60	84.76
T ₁₅	G + S (3 : 1), 125%RDF	1.62	1.71	1.66	39.61	41.41	40.51	84.68	90.75	87.71
	S.E. +/-	0.18	0.17	0.12	0.98	0.66	0.72	0.88	0.71	0.70
	C.D. 5%	N5	N5	N5	2.89	1.93	2.11	2.58	2.08	2.06
	Mean	1.46	1.72	1.59	34.83	36.63	35.73	79.76	86.70	83.23

Fig. 18. Dry matter production of sweet corn per plant (g) as affected periodically by different



ratio with 125% RDF) was at par with T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF), T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF) and T₆ (sole groundnut with 125% RDF) during all the three observations except at 60 DAS during 2004-05 and in the mean of two years, treatment T₆ was significantly inferior to T₁₁. Further, treatment T₁₁ was significantly superior over rest of the treatments during the above referred period.

4.8 Yield attributes and yield of sweet corn

Data pertaining to yield attributing characters of sweet corn namely length of cob (cm), girth of cob (cm), number of kernel rows per cob, number of kernels per cob, weight of kernels per cob (g) and weight per cob (g) are presented in Tables 27A and 27B. Except girth of cob, all the above referred yield attributes of sweet corn were influenced significantly due to the different treatments. In general, the values of all the yield attributes were higher during 2004-05 than 2003-04 except, number of kernel rows per cob.

4.8.1 Length of cob (cm)

Data related to length of cob as affected by different treatments during 2003-04, 2004-05 and mean of two years is presented in Table 27A and depicted in Fig 19.

Different treatments influenced the length of cob significantly during both the years of study and in the mean of two years. In case of sole crop of sweet corn, the length of cob was recorded maximum with T₆ (sole sweet corn with 125% RDF), which was significantly superior over T₁ and T₃ (sole sweet corn with 75 and 100% RDF respectively) during both the years of experimentation and in the mean of two years. In case of intercropping treatments, the length of cob of sweet corn increased with increase in the level of fertilizer and proportion of groundnut in intercropping. Length of cob recorded due to application of 125% RDF to groundnut + sweet corn system at 1:1, 2:1, 3:1 ratio (T₉, T₁₂ and T₁₅) or sole

sweet corn (T_6) was of similar magnitude. Further, application of 125% RDF to groundnut + sweet corn at 3:1 ratio (T_{15}) resulted into significantly higher length of cob than the remaining intercropping treatments.

4.8.2 Girth of cob (cm)

Data regarding girth of cob as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 27A and depicted in Fig 19. The girth of cob was not influenced significantly due to the different treatments during both the years of experimentation and in the mean of two years.

4.8.3 Average weight per cob (g)

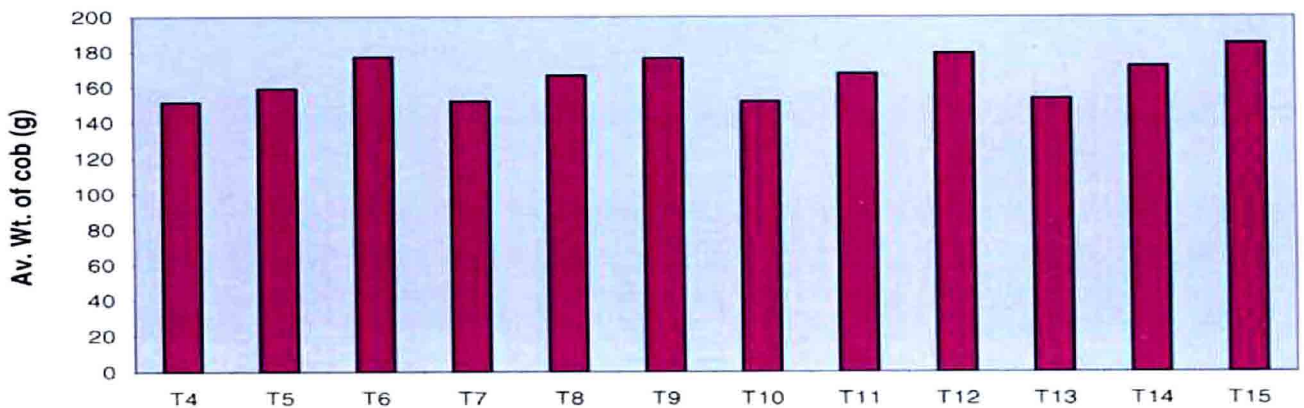
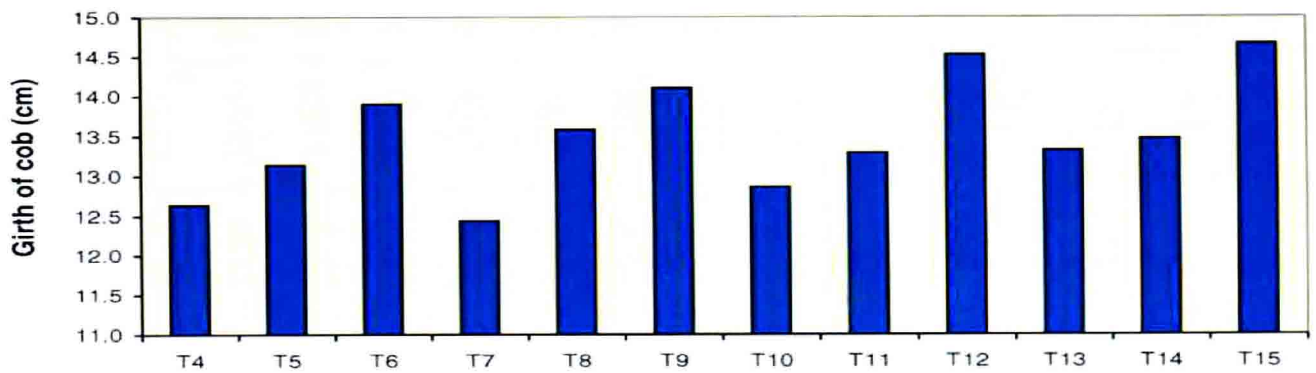
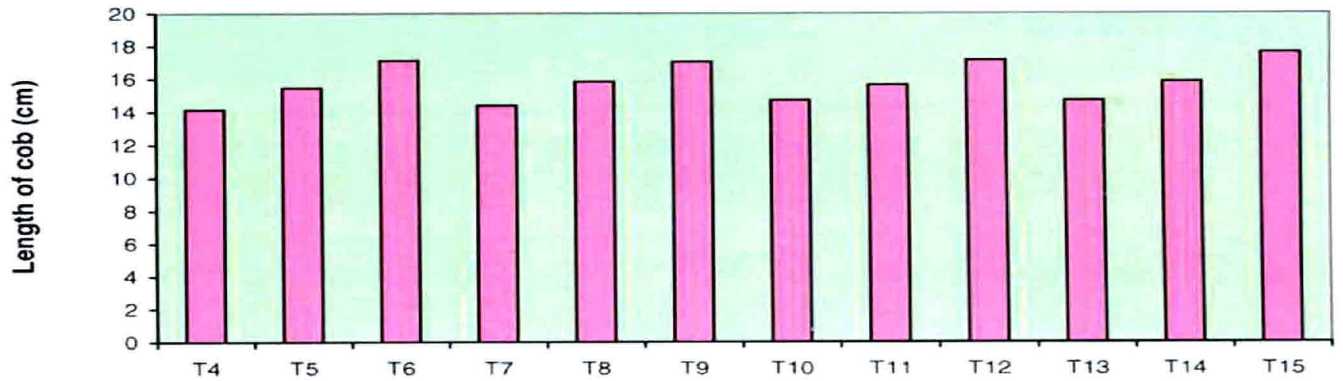
Data regarding weight per cob as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 27A and depicted in Fig. 19.

The average weight per cob was affected significantly due to different treatments during both the years and in the mean of two years. In case of sole planting of sweet corn, the maximum weight per cob was registered with T_6 (sole sweet corn with 125% RDF), which was significantly superior over T_4 and T_5 treatments (sole sweet corn with 75 and 100% RDF respectively) during both the years and in the mean of two years. In case of intercropping treatments, groundnut + sweet corn in 3:1 ratio receiving 125% RDF (T_{15}) was at par with the treatments receiving same fertilizer level at 1:1 and 2:1 ratio (T_9 and T_{12}) as well as sole crop of sweet corn receiving same fertilizer level i.e. T_6 during both the years. Further, treatment T_{15} (groundnut + sweet corn in 3:1 ratio receiving 125% RDF) was significantly superior over the remaining treatments during both the years, however, in the mean of two years T_{15} was at par with T_{12} (groundnut + sweet corn in 2:1 ratio receiving 125% RDF) and T_6 (sole sweet corn with 125% RDF) and it was significantly superior over the remaining treatments.

Table 27A: Mean yield attributing characters of sweet corn as affected by different treatments

Sym.	Treatment	Length of cob (cm)			Girth of cob (cm)			Av. Wt. of cob (g)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	13.91	14.35	14.13	12.41	12.87	12.64	143.01
T ₅	Sole Sweet corn with 100% RDF	15.09	15.80	15.45	12.81	13.47	13.14	152.36	165.89	159.13
T ₆	Sole Sweet corn with 125% RDF	16.34	17.88	17.11	13.86	14.93	13.90	170.58	183.19	176.88
T ₇	G + S (1 : 1), 75% RDF	14.09	14.66	14.38	12.59	12.29	12.44	146.66	157.53	152.09
T ₈	G + S (1 : 1), 100% RDF	15.17	16.51	15.84	13.34	13.81	13.58	162.39	170.47	166.43
T ₉	G + S (1 : 1), 125% RDF	16.52	17.53	17.03	14.35	13.86	14.10	170.89	181.69	176.29
T ₁₀	G + S (2 : 1), 75% RDF	14.67	14.71	14.69	12.73	12.99	12.86	146.93	156.94	151.93
T ₁₁	G + S (2 : 1), 100% RDF	15.51	15.71	15.61	13.33	13.26	13.29	157.44	177.63	167.53
T ₁₂	G + S (2 : 1), 125% RDF	16.42	17.83	17.13	14.41	14.63	14.52	171.09	187.18	179.13
T ₁₃	G + S (3 : 1), 75% RDF	14.70	14.67	14.68	13.36	13.29	13.32	149.06	157.61	153.33
T ₁₄	G + S (3 : 1), 100% RDF	15.05	16.59	15.82	13.26	13.67	13.47	167.87	175.49	171.68
T ₁₅	G + S (3 : 1), 125% RDF	16.73	18.47	17.60	14.47	14.85	14.66	176.59	192.85	184.72
	S.E. +/-	0.32	0.51	0.34	0.50	0.48	0.32	3.90	3.98	2.76
	C.D. 5%	0.94	1.51	1.01	NS	NS	NS	11.45	11.66	8.11
	Mean	15.35	16.23	15.79	13.41	13.66	13.49	159.57	172.18	165.87

Fig. 19. Mean yield attributing characters of sweet corn as affected by different treatments

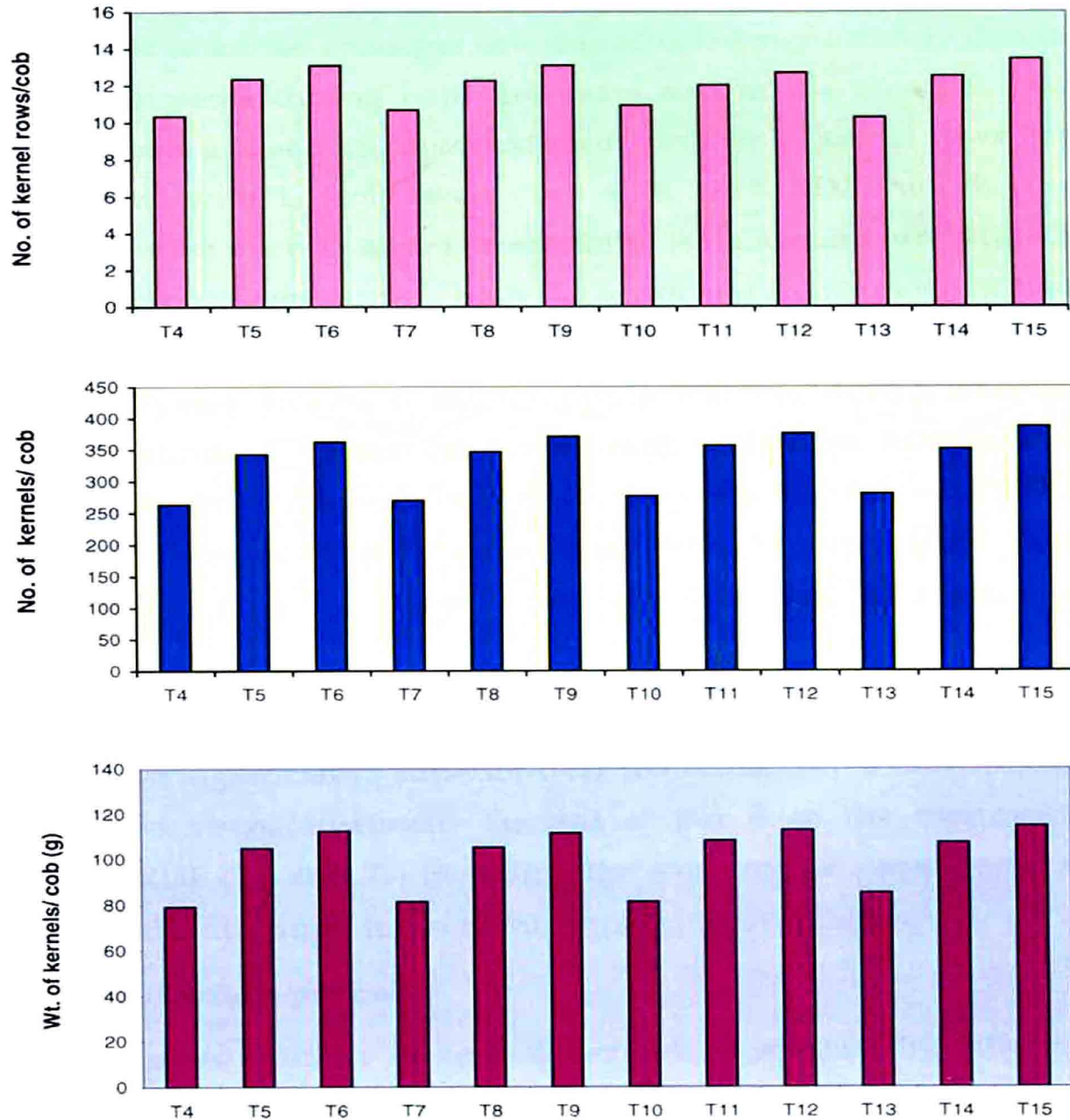


T4 - Sole Sweet corn with 75% RDF	T10 - G + S (2 : 1), 75%RDF
T5 - Sole Sweet corn with 100% RDF	T11 - G + S (2 : 1), 100%RDF
T6 - Sole Sweet corn with 125% RDF	T12 - G + S (2 : 1), 125%RDF
T7 - G + S (1 : 1), 75%RDF	T13 - G + S (3 : 1), 75% RDF
T8 - G + S (1 : 1), 100%RDF	T14 - G + S (3 : 1), 100%RDF
T9 - G + S (1 : 1), 125%RDF	T15 - G + S (3 : 1), 125%RDF

Table 27B: Mean yield attributing characters of sweet corn as affected by different treatments

Sym.	Treatment	No. of kernel rows/cob			No. of kernels/cob			Wt. of kernels/cob (g)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Sweet corn with 75% RDF	10.33	10.33	10.33	259.83	266.50	263.17	76.30	82.07	79.18
T ₂	Sole Sweet corn with 100% RDF	12.50	12.17	12.33	338.50	347.17	342.83	103.13	106.70	104.92
T ₃	Sole Sweet corn with 125% RDF	12.67	13.50	13.08	355.83	369.00	362.42	112.30	112.40	112.35
T ₄	G + S (1 : 1), 75% RDF	10.67	10.67	10.67	268.33	271.00	269.67	78.87	83.87	81.37
T ₅	G + S (1 : 1), 100% RDF	12.33	12.17	12.25	343.83	351.67	346.75	102.77	107.57	105.17
T ₆	G + S (1 : 1), 125% RDF	13.17	13.00	13.08	363.00	378.50	370.75	108.67	114.43	111.55
T ₁₀	G + S (2 : 1), 75% RDF	11.17	10.67	10.92	278.17	275.00	276.58	77.90	84.57	81.23
T ₁₁	G + S (2 : 1), 100% RDF	12.00	12.00	12.00	354.00	359.17	356.58	106.97	109.30	108.13
T ₁₂	G + S (2 : 1), 125% RDF	12.33	13.00	12.67	364.83	386.00	375.42	108.33	115.43	112.88
T ₃	G + S (3 : 1), 75% RDF	10.33	10.17	10.25	268.83	290.50	279.67	80.17	89.93	85.05
T ₁₄	G + S (3 : 1), 100% RDF	12.67	12.33	12.50	345.83	355.67	350.75	105.63	108.57	107.10
T ₅	G + S (3 : 1), 125% RDF	13.50	13.33	13.42	374.67	398.33	386.50	113.37	117.63	114.50
	S.E. +/-	0.37	0.40	0.28	14.06	9.36	10.44	5.02	1.45	2.77
	C.D. 5%	1.09	1.19	0.83	41.25	27.45	30.63	14.73	4.26	8.12
	Mean	11.97	11.94	11.96	326.14	337.38	331.76	97.87	102.71	100.29

Fig. 20. Mean yield attributing characters of sweet corn as affected by different treatments



T4 - Sole Sweet corn with 75% RDF	T10 - G + S (2 : 1), 75%RDF
T5 - Sole Sweet corn with 100% RDF	T11 - G + S (2 : 1), 100%RDF
T6 - Sole Sweet corn with 125% RDF	T12 - G + S (2 : 1), 125%RDF
T7 - G + S (1 : 1), 75%RDF	T13 - G + S (3 : 1), 75% RDF
T8 - G + S (1 : 1), 100%RDF	T14 - G + S (3 : 1), 100%RDF
T9 - G + S (1 : 1), 125%RDF	T15 - G + S (3 : 1), 125%RDF

4.8.4 Number of kernel rows per cob

Data related to number of kernel rows per cob as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 27B and depicted in Fig 20-.

The number of kernel rows per cob was affected significantly due to the different treatments during both the years and in the mean of two years. In case of sole sweet corn, the maximum number of kernel rows per cob was registered with T₆ (sole sweet corn with 125% RDF), which was significantly superior over T₄ and T₅ treatments (sole sweet corn with 75 and 100% RDF respectively) during both the years and in the mean of two years except treatment T₅ which was at par with the former treatment T₆ in the mean of two years. In case of intercropping systems, during 2003-04, treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with the treatments T₁₄ (groundnut + sweet corn in 3:1 ratio with 100% RDF), T₆ and T₅ treatments (sole sweet corn with 125 and 100% RDF respectively) and it (T₁₅) was significantly superior over the remaining treatments.

Further, during 2004-05, treatment T₁₅ was at par with T₁₄, T₁₂, T₉, T₈, T₆ and T₅ and was significantly superior over the remaining treatments. In the mean of two years, treatment T₁₅ was at par with the treatments receiving 125% RDF (T₁₂ and T₉) including the sole crop of sweet corn i.e. T₆ and was significantly superior over the remaining treatments.

4.8.5 Number of kernels per cob

Data related to number of kernels per cob as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 27B and depicted in Fig. 20. Different treatments influenced the number of kernels per cob significantly during both the years of study and in the mean of two years.

In case of sole crop of sweet corn, the number of kernels per cob was recorded maximum with T₆ (sole sweet corn with 125% RDF), which was significantly superior to T₄ (sole sweet corn with 75% RDF) but statistically similar with T₅ (sole sweet corn with 100% RDF) during both the years of experimentation and in the mean of two years.

Further, in case of intercropping treatments, the number of kernels per cob of sweet corn increased with increase in the level of fertilizer and decreased proportion of sweet corn. Application of 125% RDF to groundnut + sweet corn at 1:1, 2:1 or 3:1 ratio (T₉, T₁₂ and T₁₅) or sole sweet corn (T₆) were at par with the treatments which received 100% RDF to groundnut + sweet corn at 1:1, 2:1 or 3:1 ratio (T₈, T₁₁ and T₁₄) and sole sweet corn (T₅), however, application of 125% RDF to groundnut + sweet corn at 3:1 ratio (T₁₅) resulted into significantly higher number of kernels per cob than the treatments receiving 75% RDF at any of the row proportions adopted i.e. T₇, T₁₀, T₁₃ and sole sweet corn i.e. T₄. During 2004-05 and in the mean of two years, treatment T₁₅ was at par with the treatments receiving 125% RDF in the intercropping systems i.e. T₁₂ and T₆ and was significantly superior over the remaining intercropping treatments. Further, in the mean of two years, T₁₅ was also at par with T₆ (sole sweet corn with 125% RDF).

4.8.6 Weight of grains per cob (g)

Data pertaining to weight of grains per cob as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 27B and depicted in Fig 20. Different treatments significantly influenced the weight of grains per cob during both the years and in the mean of two years.

In case of sole cropping of sweet corn, the weight of grains per cob was recorded maximum with T₆ (Sole sweet corn with 125% RDF), which was significantly superior to T₄ (Sole sweet corn with 75% RDF) but

statistically at par with T₅ (Sole sweet corn with 100% RDF) during the year 2003-04 and in the mean of two years.

During 2003-04, weight of kernels of sweet corn remained at par in respect of the treatments receiving 100 and 125% RDF under all the intercropping ratios as well as sole cropping. In other words, treatments T₁₄, T₁₅, T₁₁, T₁₂, T₈, T₉, T₅ and T₆ were at par with each other and all these treatments were significantly superior over the remaining treatments receiving 78% RDF either in intercropping or sole cropping.

During 2004-05, treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with the other two intercropping ratios receiving 125% RDF i.e. T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) and T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF) and was significantly superior over the remaining treatments including sole cropping.

Further, in the mean of two years, treatment T₁₅ was at par with all the treatments receiving 125% RDF either in intercropping or sole cropping i.e. T₁₂, T₉ and T₆ as well as intercropping treatments receiving 100% RDF under 3:1 and 2:1 ratios i.e. T₁₄ and T₁₁ and it (T₁₅) was significantly superior over the remaining treatments.

4.8.7 Yield studies

Data pertaining to yield i.e. cob yield (q/ha), green stover yield (q/ha) and total biomass yield (q/ha) as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 28 and depicted in Fig. 21.

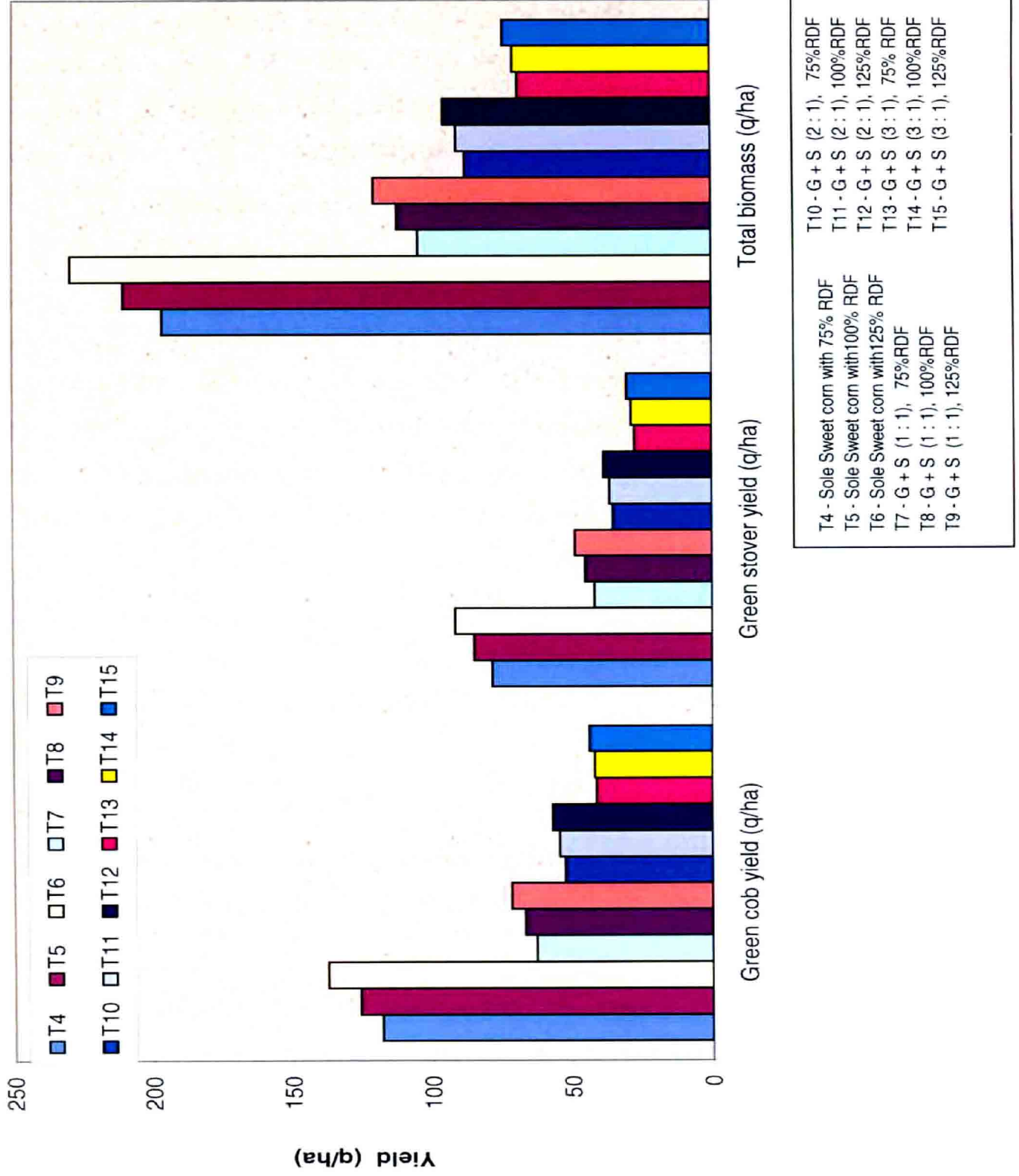
4.8.7.1 Cob yield and total biomass yield (q/ha)

Different treatments significantly influenced the cob yield and total biomass yield during both years and in the mean of two years.

Table 28 : Green cob yield, green stover yield and total green biomass of sweet corn (q/ha) as affected by different treatments

Sym.	Treatment	Green cob yield (q/ha)			Green stover yield (q/ha)			Total biomass (q/ha)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	108.89	127.25	118.07	72.93	83.83	78.38	181.82
T ₅	Sole Sweet corn with 100% RDF	116.56	135.32	125.94	78.71	89.88	84.89	195.27	225.20	210.23
T ₆	Sole Sweet corn with 125% RDF	124.52	150.44	137.48	82.02	101.29	91.66	206.54	251.73	229.14
T ₇	G + S (1 : 1), 75% RDF	58.85	66.75	62.80	39.23	44.51	41.87	98.08	111.26	104.67
T ₈	G + S (1 : 1), 100% RDF	64.05	69.75	66.90	42.70	47.84	45.27	106.76	117.59	112.17
T ₉	G + S (1 : 1), 125% RDF	65.92	77.60	71.76	44.95	52.59	48.77	110.87	130.19	120.53
T ₁₀	G + S (2 : 1), 75% RDF	51.83	53.24	52.53	34.55	35.99	35.27	86.38	89.23	87.80
T ₁₁	G + S (2 : 1), 100% RDF	54.42	54.67	54.55	36.28	36.60	36.44	90.70	91.27	90.98
T ₁₂	G + S (2 : 1), 125% RDF	56.56	57.58	57.07	38.69	38.39	38.54	95.25	95.97	95.61
T ₁₃	G + S (3 : 1), 75% RDF	40.03	42.68	41.36	26.69	28.45	27.57	66.72	71.13	68.92
T ₁₄	G + S (3 : 1), 100% RDF	40.30	43.61	41.95	27.87	29.51	28.69	68.17	73.11	70.64
T ₁₅	G + S (3 : 1), 125% RDF	42.95	44.83	43.89	29.63	31.06	30.32	72.58	75.84	74.21
	S.E. +/-	1.96	3.12	1.73	1.24	1.44	0.89	3.16	4.96	2.96
	C.D. 5%	5.74	9.14	5.07	3.63	4.23	2.62	9.25	14.54	8.69

Fig. 21. Green cob yield, green stover yield and total biomass of sweet corn (q/ha) as affected by different treatments



In case of sole cropping of sweet corn the response to the graded levels of fertilizers in terms of cob yield and total biomass yield was graded and significant during the year 2003-04 and in the mean of two years. The cob yield and total biomass yield was recorded maximum with T₆ (Sole sweet corn with 125% RDF), which was significantly superior to T₄ (Sole sweet corn with 75% RDF) and T₅ (Sole sweet corn with 100% RDF) as well as all the intercropping treatments during both the years of experimentation and in the mean of two years.

In case of intercropping treatments, the cob yield and total biomass yield of sweet corn increased with increase in the level of fertilizer and proportion of sweet corn in intercropping combinations. During both the years of experimentation and in the mean of two years, application of 125% RDF to groundnut + sweet corn at 1:1 row proportion (T₆) recorded significantly higher cob yield and total biomass yield than the application of 75% RDF to component crops at same ratio i.e. T₁ and all the remaining intercropping treatments in 2:1 and 3:1 ratios, however, T₈ (groundnut + sweet corn in 1:1 row proportion with 100% RDF) was at par with T₆ (groundnut + sweet corn in 1:1 row proportion with 125% RDF). Under 2:1 and 3:1 ratios of intercropping, generally the green cob yield and total biomass yield were not influenced significantly due to the levels of fertilizer.

4.8.7.2 Green stover yield (q/ha)

Different treatments significantly influenced the green stover yield of sweet corn during 2003-04, 2004-05 and in the mean of two years (Table 28).

In case of sole crop of sweet corn the response to the graded levels of fertilizers in terms of green stover yield was graded and significant during the year 2004-05 and in the mean of two years. The green stover yield was recorded maximum with T₆ (Sole sweet corn with 125% RDF),

which was significantly superior over T₄ (Sole sweet corn with 75% RDF) and T₅ (Sole sweet corn with 100% RDF) during 2004-05 and in the mean of two years, however, during 2003-04, T₆ was at par with T₅ and was significantly superior over T₄.

In case of intercropping treatments, the green stover yield of sweet corn increased with increase in the level of fertilizer and proportion of sweet corn in intercropping combinations. During both the years of experimentation, application of 125% RDF to groundnut + sweet corn at 1:1 row proportion (T₉) recorded significantly higher green stover yield than the remaining intercropping treatments except groundnut + sweet corn at same ratio with 100% RDF (T₈) which was at par with the former treatment i.e. T₉ during 2004-05. Application of 125% RDF to groundnut + sweet corn at 2 : 1 ratio (T₁₂) increased the green stover yield significantly than 75% RDF application to the component crops at the similar ratio i.e. T₁₀, during the year 2003-04 and in the mean of two years. Increase in the fertilizer level from 75% to 125% RDF to the intercropping of groundnut + sweet corn in 3:1 ratio (T₁₃, T₁₄ and T₁₅) did not increase green stover yield significantly, during both the years of experimentation, however, treatment T₁₅ was significantly superior to the treatment T₁₃, in the mean of two years.

4.9 Quality studies

The per cent protein content and per cent sucrose content were studied as the quality parameters during 2003-04, 2004-05 and in the mean of two years.

4.9.1 Protein content (%)

Data regarding protein content (%) of sweet corn kernels as influenced by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 29 and depicted graphically in Fig. 22. The protein content (%) was significantly affected due to different

treatments, during both the years and in the mean of two years. In general, mean protein content of kernels was slightly higher during the year 2004-05 as compared to 2003-04.

Among all the treatments including sole and intercropping, T₁₃ (groundnut + sweet corn in 3 : 1 ratio with 125% RDF) recorded significantly higher protein content than the remaining treatments except, groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁) and groundnut + sweet corn in 2 : 1 ratio with 125% RDF (T₁₂), which were at par with the former treatment (T₁₃) during 2003-04. During 2004-05, treatment T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with T₇ (groundnut + sweet corn in 2 : 1 ratio with 125% RDF) and T₆ (groundnut + sweet corn in 1 : 1 ratio with 125% RDF) and it (T₁₃) was statistically superior over the remaining treatments. Further, in the mean of two years, the trend was similar to that of 2004-05 with one exception i.e. T₁₁ (groundnut + sweet corn in 3 : 1 ratio with 100% RDF) which was also at par with T₁₃ in addition to T₉ and T₁₂.

4.9.2 Sucrose content (%)

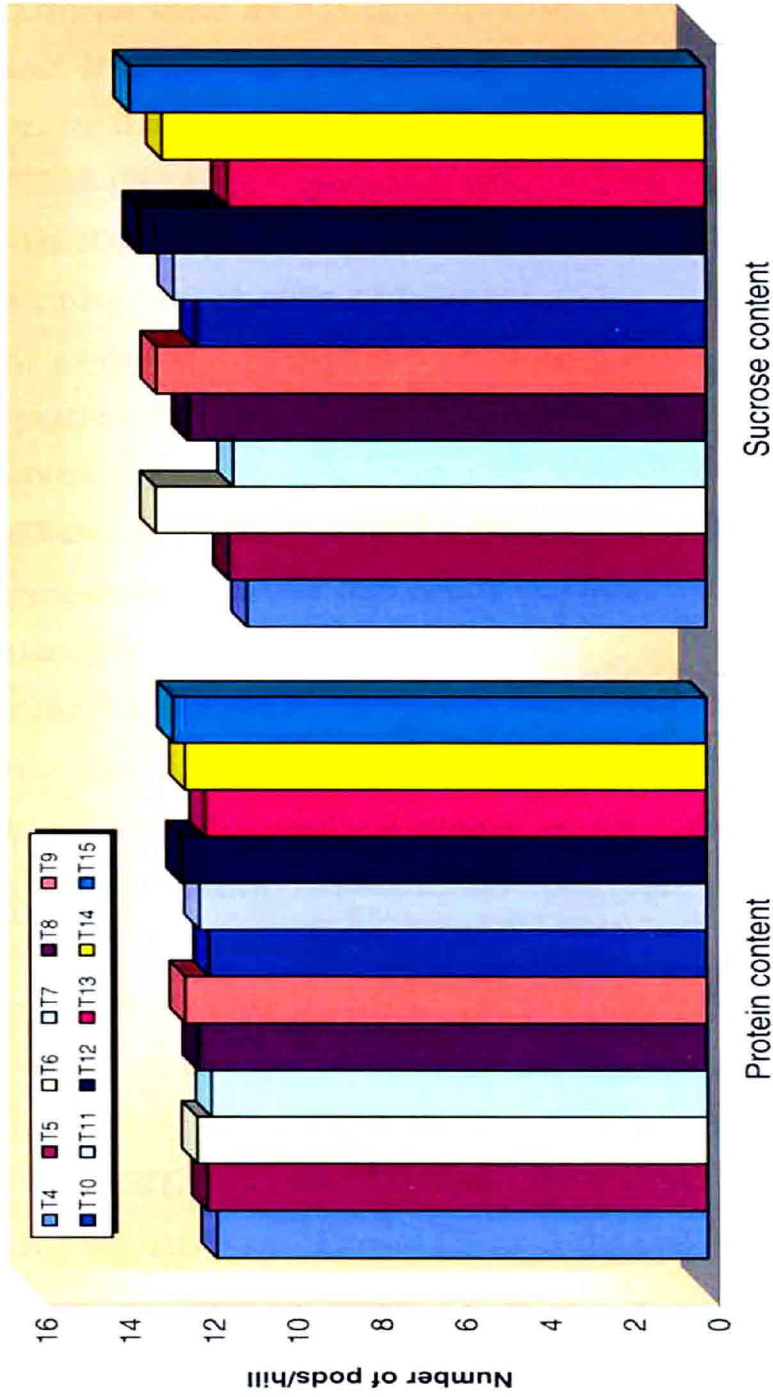
The data pertaining to sucrose content (%) in fresh kernels as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 29 and depicted in Fig 22. The sucrose content (%) was significantly affected due to different treatments, during both the years and in the mean of two years. In general, mean sucrose content of kernels was slightly higher during the year 2004-05 as compared to 2003-04.

Among all the treatments including sole and intercropping, T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded significantly higher sucrose content in kernels than the remaining treatments except, sole sweet corn with 125% RDF (T₁) which was at par

Table 29: Protein content (%) of dry grains and sucrose content (%) of fresh grains of sweet corn

Sym.	Treatment	Protein content			Sucrose content		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Sweet corn with 75% RDF	11.48	11.85	11.67	10.77	11.06	10.92
T ₅	Sole Sweet corn with 100% RDF	11.79	11.98	11.89	11.33	11.36	11.35
T ₆	Sole Sweet corn with 125% RDF	12.17	12.08	12.13	13.16	13.02	13.09
T ₇	G + S (1 : 1), 75%RDF	11.63	11.94	11.79	11.25	11.23	11.24
T ₈	G + S (1 : 1), 100%RDF	11.94	12.25	12.10	12.31	12.33	12.32
T ₉	G + S (1 : 1), 125%RDF	12.25	12.56	12.41	12.65	13.49	13.07
T ₁₀	G + S (2 : 1), 75%RDF	11.69	12.00	11.85	11.62	12.59	12.12
T ₁₁	G + S (2 : 1), 100%RDF	11.90	12.21	12.06	12.68	12.64	12.66
T ₁₂	G + S (2 : 1), 125%RDF	12.44	12.54	12.49	13.51	13.46	13.49
T ₁₃	G + S (3 : 1), 75% RDF	11.87	11.98	11.93	11.42	11.33	11.38
T ₁₄	G + S (3 : 1), 100%RDF	12.44	12.35	12.40	12.53	13.32	12.93
T ₁₅	G + S (3 : 1), 125%RDF	12.63	12.75	12.69	13.75	13.67	13.71
	S.E. +/-	0.11	0.13	0.12	0.28	0.30	0.23
	C.D.5%	0.33	0.38	0.35	0.81	0.87	0.67
	Mean	12.01	12.20	12.11	12.25	12.54	12.40

Fig. 22. Protein content (%) of dry grains and sucrose content (%) of fresh grains of sweet corn



T4 - Sole Sweet corn with 75% RDF
 T5 - Sole Sweet corn with 100% RDF
 T6 - Sole Sweet corn with 125% RDF
 T7 - G + S (1 : 1), 75% RDF
 T8 - G + S (1 : 1), 100% RDF
 T9 - G + S (1 : 1), 125% RDF
 T10 - G + S (2 : 1), 75% RDF
 T11 - G + S (2 : 1), 100% RDF
 T12 - G + S (2 : 1), 125% RDF
 T13 - G + S (3 : 1), 75% RDF
 T14 - G + S (3 : 1), 100% RDF
 T15 - G + S (3 : 1), 125% RDF

with the former treatment. Further, during 2004-05, T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with all the treatments receiving 125% RDF i.e. T₆ (sweet corn with 125% RDF), T₈ (groundnut + sweet corn in 1:1 ratio with 125% RDF), T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) as well as T₁₄ (groundnut + sweet corn in 3:1 ratio with 100% RDF) and it (T₁₅) was statistically superior over the remaining treatments. Further, in the mean of two years, the trend was more or less similar to that of 2004-05 with one exception i.e. T₁₁ (groundnut + sweet corn in 3:1 ratio with 100% RDF) which was statistically inferior to T₁₅.

4.10 Nutrient uptake by sweet corn at harvest

The per cent content and uptake of major nutrients viz. nitrogen, phosphorus and potassium was recorded separately in different plant parts i.e. stem, leaves, kernels, cob axis, cob sheath and total uptake at harvest during 2003-04, 2004-05 and in the mean of two years.

4.10.1 Per cent nitrogen content in different parts of sweet corn

4.10.1.1 Per cent nitrogen content in kernels

Data pertaining to per cent nitrogen content in kernels as affected by different treatments during 2003-04, 2004-05 and mean of two years are presented in Table 30A. Nitrogen content in kernels was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years.

Among all the treatments including sole crop and intercropping, T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded significantly higher nitrogen content in the kernels than the sole sweet corn with 75 and 100% RDF (T₄ and T₅) and groundnut + sweet corn in 1:1 and 2:1 ratios with 75% RDF i.e. T₇ and T₁₀ and it (T₁₃) was at par with the remaining treatments. Further, during 2004-05, T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with all the treatments

Table 30A: Nitrogen content (%) in different parts of sweet corn as affected by different treatments

Sym.	Treatment	Kernels			Cob axis			Cob sheath		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₄	Sole Sweet corn with 75% RDF	1.92	1.90	1.91	0.34	0.31	0.32	0.66	0.59	0.63
T ₅	Sole Sweet corn with 100% RDF	1.94	1.92	1.93	0.33	0.32	0.33	0.68	0.66	0.67
T ₆	Sole Sweet corn with 125% RDF	1.98	2.00	1.99	0.36	0.36	0.36	0.74	0.68	0.71
T ₇	G + S (1 : 1), 75%RDF	1.89	1.91	1.90	0.35	0.31	0.33	0.68	0.60	0.64
T ₈	G + S (1 : 1), 100%RDF	1.98	1.96	1.97	0.37	0.34	0.35	0.69	0.67	0.68
T ₉	G + S (1 : 1), 125%RDF	2.02	2.01	2.01	0.36	0.38	0.37	0.73	0.69	0.71
T ₁₀	G + S (2 : 1), 75%RDF	1.97	1.92	1.95	0.33	0.32	0.32	0.72	0.61	0.67
T ₁₁	G + S (2 : 1), 100%RDF	2.01	1.95	1.98	0.38	0.36	0.37	0.74	0.66	0.70
T ₁₂	G + S (2 : 1), 125%RDF	2.06	2.04	2.05	0.39	0.40	0.39	0.78	0.70	0.74
T ₁₃	G + S (3 : 1), 75% RDF	1.98	1.92	1.95	0.36	0.34	0.35	0.70	0.62	0.66
T ₁₄	G + S (3 : 1), 100%RDF	2.02	1.98	2.00	0.38	0.37	0.37	0.76	0.68	0.72
T ₁₅	G + S (3 : 1), 125%RDF	2.05	2.07	2.06	0.40	0.41	0.40	0.79	0.71	0.75
S.E. +/-		0.025	0.026	0.018	0.020	0.016	0.014	0.024	0.020	0.017
C.D.5%		0.07	0.07	0.05	NS	NS	NS	0.07	0.06	0.05

Table 30B: Nitrogen content (%) in different parts of sweet corn as affected by different treatments

Sym.	Treatment	Stem			Leaves		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	0.59	0.60	0.60	0.94
T ₂	Sole Sweet corn with 100% RDF	0.68	0.68	0.68	0.98	0.98	0.98
T ₃	Sole Sweet corn with 125% RDF	0.69	0.70	0.69	1.06	1.05	1.05
T ₄	G + S (1 : 1), 75%RDF	0.62	0.61	0.62	0.98	0.94	0.96
T ₅	G + S (1 : 1), 100%RDF	0.70	0.67	0.69	0.99	0.97	0.98
T ₆	G + S (1 : 1), 125%RDF	0.70	0.70	0.70	1.03	1.04	1.03
T ₇	G + S (2 : 1), 75%RDF	0.65	0.62	0.64	0.99	0.94	0.97
T ₈	G + S (2 : 1), 100%RDF	0.69	0.69	0.69	0.99	0.97	0.98
T ₉	G + S (2 : 1), 125%RDF	0.71	0.71	0.71	1.06	1.07	1.06
T ₁₀	G + S (3 : 1), 75% RDF	0.65	0.61	0.63	0.98	0.95	0.97
T ₁₁	G + S (3 : 1), 100%RDF	0.68	0.68	0.68	1.03	0.99	1.01
T ₁₂	G + S (3 : 1), 125%RDF	0.72	0.72	0.72	1.07	1.11	1.09
S.E. +/-		0.034	0.032	0.03	0.023	0.022	0.020
C.D.5%		NS	NS	NS	0.07	0.06	0.06

receiving 125% RDF i.e. T₆ (sweet corn with 125% RDF), T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF), T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) and it (T₁₅) was significantly superior over the remaining treatments. However, in the mean of two years, treatment T₁₅ was at par with the two intercropping ratios i.e. 1:1 and 2:1, receiving 125% RDF (T₉ and T₁₂) and was significantly superior over the remaining treatments.

4.10.1.2 Per cent nitrogen content in cob axis and stem

Data regarding per cent nitrogen content in cob axis as influenced by different treatments during 2003-04, 2004-05 and in the mean of two years are given in Table 30A and 30B, respectively. Nitrogen content in cob axis and stem was not influenced significantly due to the different treatments, during both the years of experimentation and in the mean of two years.

4.10.1.3 Per cent nitrogen content in cob sheath

Data pertaining to per cent nitrogen content in cob sheath as affected by different treatments during 2003-04, 2004-05 and mean of two years are presented in Table 30A. Nitrogen content in cob sheath was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. When the comparison was done between the sole cropping and intercropping, it was observed that, T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) recorded significantly higher nitrogen content in cob sheath than the treatments receiving 75 and 100% RDF under sole cropping and groundnut + sweet corn in 1:1 ratio i.e. T₄, T₅, T₇ and T₈ respectively as well as groundnut + sweet corn in 3:1 ratio with 75% RDF i.e. T₁₃ and former treatment (T₁₅) was at par with the remaining treatments. However, during 2004-05, T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with all the treatments receiving 100 and 125% RDF in sole as well as

intercropping i.e. T₅, T₆, T₈, T₉, T₁₁, T₁₂ as well as T₁₁. Further, in the mean of two years, again treatment T₁₅ was at par with all the treatments receiving 125% RDF in sole cropping as well as intercropping i.e. T₆, T₉ and T₁₂ and the treatments receiving 100% RDF at 2:1 and 3:1 ratios of intercropping i.e. T₁₁ and T₁₄ and it (T₁₅) was significantly superior over the remaining treatments.

4.10.1.4 Per cent nitrogen content in leaves

Data pertaining to per cent nitrogen content in leaves as affected by different treatments during 2003-04, 2004-05 and mean of two years are presented in Table 30B. Nitrogen content in leaves was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping and intercropping, during 2003-04, T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with all the treatments of sole and intercropping receiving 125% RDF i.e. T₆, T₉ and T₁₂ as well as groundnut + sweet corn in 3:1 ratio with 100% RDF i.e. T₁₁ and it (T₁₅) was significantly superior over the remaining treatments in respect of nitrogen content in leaves. However, during 2004-05 and in the mean of two years, T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) was at par with groundnut + sweet corn in 2:1 ratio with 125% RDF i.e. T₁₂ and it (T₁₅) was significantly superior over the remaining treatments.

4.10.1.5 Nitrogen uptake in different parts of sweet corn

4.10.1.6 Nitrogen uptake in kernels (kg/ha)

Data related to nitrogen uptake in kernels as affected by different treatments during 2003-04, 2004-05 and mean of two years are presented in Table 31A. Nitrogen uptake in kernels was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole crop of sweet corn, the response to

Table 31A : Nitrogen uptake (kg/ha) by the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Kernels			Cob axis			Cob sheath		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	32.49	33.88	33.19	3.45	3.35	3.40	6.10
T ₂	Sole Sweet corn with 100% RDF	35.25	36.53	35.89	3.59	3.69	3.64	6.75	6.83	6.79
T ₃	Sole Sweet corn with 125% RDF	38.06	42.50	40.28	4.15	4.57	4.36	7.77	7.84	7.81
T ₄	G + S (1 : 1), 75%RDF	17.26	17.99	17.63	1.91	1.79	1.85	3.39	3.11	3.25
T ₅	G + S (1 : 1), 100%RDF	19.66	19.48	19.57	2.08	2.08	2.14	3.75	3.59	3.67
T ₆	G + S (1 : 1), 125%RDF	20.85	22.13	21.49	2.20	2.35	2.29	3.85	4.13	3.99
T ₇	G + S (2 : 1), 75%RDF	15.84	14.50	15.17	1.59	1.43	1.51	3.16	2.49	2.83
T ₈	G + S (2 : 1), 100%RDF	16.96	15.08	16.02	1.92	1.68	1.80	3.41	2.80	3.11
T ₉	G + S (2 : 1), 125%RDF	18.25	16.48	17.37	2.07	1.95	2.01	3.78	3.09	3.44
T ₁₀	G + S (3 : 1), 75% RDF	12.30	11.50	11.90	1.34	1.24	1.29	2.24	1.99	2.12
T ₁₁	G + S (3 : 1), 100%RDF	12.81	12.22	12.52	1.44	1.39	1.42	2.63	2.29	2.46
T ₁₂	G + S (3 : 1), 125%RDF	13.84	13.27	13.56	1.62	1.57	1.60	2.92	2.50	2.71
	S.E. +/-	0.78	0.85	0.42	0.21	0.17	0.18	0.18	0.16	0.17
	C.D. 5%	2.30	2.49	1.23	0.60	0.49	0.51	0.52	0.47	0.49

Table 31B : Nitrogen uptake (kg/ha) by the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Stem			Leaves		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₄	Sole Sweet corn with 75% RDF	7.08	7.07	7.07	11.73	12.30	12.02
T ₅	Sole Sweet corn with 100% RDF	7.71	8.56	8.14	13.13	13.78	13.46
T ₆	Sole Sweet corn with 125% RDF	8.03	9.88	8.96	15.03	16.53	15.78
T ₇	G + S (1 : 1), 75%RDF	3.69	3.83	3.76	6.60	6.46	6.51
T ₈	G + S (1 : 1), 100%RDF	4.09	4.51	4.30	7.26	7.20	7.23
T ₉	G + S (1 : 1), 125%RDF	4.51	5.10	4.81	7.84	8.45	8.15
T ₁₀	G + S (2 : 1), 75%RDF	3.22	3.09	3.16	5.87	5.26	5.57
T ₁₁	G + S (2 : 1), 100%RDF	3.81	3.52	3.67	6.17	5.51	5.84
T ₁₂	G + S (2 : 1), 125%RDF	4.12	3.90	4.01	6.93	6.38	6.66
T ₁₃	G + S (3 : 1), 75% RDF	2.72	2.45	2.59	4.49	4.21	4.35
T ₁₄	G + S (3 : 1), 100%RDF	2.86	2.82	2.84	4.82	4.53	4.68
T ₁₅	G + S (3 : 1), 125%RDF	3.14	3.02	3.08	5.33	5.26	5.30
S.E. +/-		0.31	0.35	0.21	0.38	0.41	0.24
C.D. 5%		0.90	1.02	0.60	1.11	1.19	0.70

the increase in the level of fertilizers in relation to nitrogen uptake in kernels was graded and significant, during both the years of experimentation and in the mean of two years and therefore, sole sweet corn 125% RDF i.e. T₆ was significantly superior than all the remaining treatments including sole and intercropping treatments.

The nitrogen uptake in kernels increased with increase in the level of fertilizers and increased proportion of sweet corn in the intercropping combinations. Groundnut + sweet corn at 1:1 ratio, supplied with 125% RDF (T₉) recorded significantly higher nitrogen uptake in kernels than the other intercropping combinations at all the levels of fertilizer application, during both the years of experimentation and in the mean of two years except treatment T₈ (groundnut +sweet corn at 1:1 ratio with 100% RDF) which was at par with the former treatment (T₉) during the year 2003-04.

4.10.1.7 Nitrogen uptake in cob axis (kg/ha)

Data pertaining to nitrogen uptake in cob axis as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 31A. Nitrogen uptake in cob axis was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, treatment T₆ (sole sweet corn with 125% RDF) recorded significantly higher nitrogen uptake in cob axis than the application of 75% and 100% RDF i.e. T₄ and T₅ respectively, during both the years of experimentation and in the mean of two years, except treatment T₅, which was at par with the former treatment (T₆) in the year 2003-04

The nitrogen uptake in cob axis increased with increase in the level of fertilizers and increase in the proportion of sweet corn in intercropping combinations. Groundnut + sweet corn at 1 : 1 row proportion when supplied with 125% RDF (T₉) recorded significantly higher nitrogen uptake in cob axis than the other intercropping treatments except

treatment T₈ (groundnut + sweet corn at 1:1 ratio with 100% RDF) during all the three observations, except groundnut + sweet corn in 2:1 ratio with 100 and 125% RDF i.e. T₁₁ and T₁₂ and groundnut + sweet corn in 3:1 ratio with 125% RDF i.e. T₁₃ during 2003-04; groundnut + sweet corn in 1:1 ratio with 75% RDF (T₇) and groundnut + sweet corn in 2:1 ratio with 100 % RDF (T₁₁) , which were at par with the former treatment T₆ in respect of nitrogen uptake in cob axis.

4.10.1.8 Nitrogen uptake in cob sheath (kg/ha)

Data related to nitrogen uptake in cob sheath as affected by different treatments during 2003-04, 2004-05 and mean of two years are presented in Table 31A. Nitrogen uptake in cob sheath was affected significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of nitrogen uptake in cob sheath, treatment T₆ (Sole sweet corn with 125% RDF) recorded significantly higher nitrogen uptake than all the remaining treatments under sole and intercropping.

The nitrogen uptake by cob sheath increased with increase in the level of fertilizers and increased proportion of sweet corn in the intercropping combinations. Groundnut +sweet corn at 1:1 ratio with 125% RDF (T₉) recorded significantly higher nitrogen uptake in cob sheath than the other intercropping treatments during 2004-05. However, during 2003-04, the above referred treatment T₉ was at par with the remaining two treatments at 1:1 ratio i.e. T₇, T₈ as well as groundnut +sweet corn in 2:1 ratio with 100 and 125% RDF i.e. T₁₁ , T₁₂ and it was significantly superior than all the remaining treatments. Further, in the mean of two years, treatment T₆ (groundnut +sweet corn in 1:1 ratio with 125% RDF) recorded significantly higher nitrogen uptake in cob sheath than the other intercropping treatments, except groundnut +sweet corn in 1:1 ratio with 100% RDF i.e. T₈ which was at par with the former treatment T₆.

4.10.1.9 Nitrogen uptake in stem (kg/ha)

Data regarding nitrogen uptake in stem as influenced by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 31B. Nitrogen uptake in stem was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, treatment T₆ (Sole sweet corn with 125% RDF) recorded significantly higher nitrogen uptake in stem than the application of 75% and 100% RDF to sole sweet corn i.e. T₄ and T₅, during the year 2004-05 and in the mean of two years, while former treatment was at par with the treatment T₅ during the year 2003-04. Further, all the treatments of sole cropping were significantly superior over the intercropping treatments.

Among the intercropping treatments, during 2003-04, groundnut +sweet corn in 1:1 ratio with 125% RDF (T₉) was at par with the treatments receiving 100 and 75% RDF under the same ratio i.e. T₈ and T₇ and 2:1 ratio with 125% RDF i.e. T₁₂ and T₁₁ respectively and it (T₉) was significantly superior over the remaining intercropping treatments. However, during 2004-05 and in the mean of two years among the intercropping treatments, groundnut +sweet corn in 1:1 ratio with 125% RDF (T₉) was at par with groundnut +sweet corn in 1:1 ratio with 100% RDF (T₈) and it (T₉) was significantly superior over the remaining intercropping treatments in respect of nitrogen uptake in stem of sweet corn.

4.10.1.10 Nitrogen uptake in leaves (kg/ha)

The data concerned with nitrogen uptake in leaves of sweet corn as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 31B. Nitrogen uptake by leaves was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, treatment T₆ (Sole sweet corn with 125% RDF) recorded

significantly higher nitrogen uptake in leaves than the application of 75% and 100% RDF to sole sweet corn i.e. T₁ and T₂, during both the years of experimentation and in the mean of two years. Further, all the treatments of sole cropping were significantly superior over the intercropping treatments.

The nitrogen uptake in leaves increased with increase in the level of fertilizers and increased proportion of groundnut in intercrop combinations. Groundnut + sweet corn in 1:1 ratio with 125% RDF (T₆) recorded significantly higher nitrogen uptake in leaves than the other intercropping treatments with differential fertilizer levels, except treatment T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and T₁₁ (groundnut + sweet corn in 2:1 ratio with 125% RDF) during the year 2003-04. Further, during 2004-05 and in the mean of two years, among the intercropping treatments, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₆) was significantly superior over the remaining intercropping treatments in respect of nitrogen uptake in sweet corn leaves.

4.10.2 Per cent phosphorus content in different parts of sweet corn

4.10.2.1 Per cent phosphorus content in sweet corn kernels, cob axis, cob sheath, stem and leaves

It was observed from the data presented in Table 32A and 32B that per cent phosphorus content in all the parts of sweet corn namely kernels, cob axis, cob sheath, stem and leaves was not influenced significantly due to sole cropping as well as intercropping treatments during both the years of experimentation and in the mean of two years. However, in case of sole cropping as well as under different ratios of intercropping, phosphorus content in the different parts of sweet corn numerically increased with increase in the of fertilizer dose.

Table 32A : Phosphorous content (%) of sweet corn as affected by different treatments

Sym.	Treatment	Kernels			Cob axis			Cob sheath		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₄	Sole Sweet corn with 75% RDF	0.511	0.514	0.513	0.213	0.211	0.212	0.120
T ₅	Sole Sweet corn with 100% RDF	0.513	0.519	0.516	0.211	0.213	0.212	0.132	0.131	0.131
T ₆	Sole Sweet corn with 125% RDF	0.523	0.533	0.528	0.215	0.214	0.214	0.134	0.133	0.133
T ₇	G + S (1 : 1), 75%RDF	0.519	0.512	0.516	0.201	0.211	0.206	0.124	0.129	0.127
T ₈	G + S (1 : 1), 100%RDF	0.527	0.520	0.524	0.213	0.212	0.213	0.133	0.130	0.132
T ₉	G + S (1 : 1), 125%RDF	0.510	0.530	0.520	0.216	0.215	0.215	0.130	0.134	0.132
T ₁₀	G + S (2 : 1), 75%RDF	0.514	0.513	0.513	0.213	0.208	0.211	0.129	0.127	0.128
T ₁₁	G + S (2 : 1), 100%RDF	0.527	0.517	0.522	0.208	0.212	0.210	0.130	0.131	0.131
T ₁₂	G + S (2 : 1), 125%RDF	0.529	0.528	0.528	0.213	0.214	0.213	0.130	0.133	0.132
T ₁₃	G + S (3 : 1), 75% RDF	0.509	0.509	0.509	0.211	0.209	0.210	0.123	0.128	0.126
T ₁₄	G + S (3 : 1), 100%RDF	0.525	0.515	0.520	0.211	0.212	0.211	0.130	0.130	0.130
T ₁₅	G + S (3 : 1), 125%RDF	0.534	0.524	0.529	0.214	0.216	0.215	0.133	0.135	0.134
S.E. +/-		0.005	0.007	0.006	0.004	0.003	0.003	0.003	0.004	0.003
C.D. 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 32B : Phosphorous content (%) in different parts of sweet corn as affected by different treatments

Sym.	Treatment	Stem			Leaves		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	0.354	0.364	0.359	0.448
T ₂	Sole Sweet corn with 100% RDF	0.371	0.375	0.373	0.444	0.454	0.449
T ₃	Sole Sweet corn with 125% RDF	0.374	0.377	0.376	0.446	0.456	0.451
T ₇	G + S (1 : 1), 75%RDF	0.368	0.368	0.368	0.449	0.447	0.448
T ₈	G + S (1 : 1), 100%RDF	0.370	0.376	0.373	0.443	0.453	0.448
T ₉	G + S (1 : 1), 125%RDF	0.376	0.386	0.381	0.456	0.466	0.461
T ₁₀	G + S (2 : 1), 75%RDF	0.376	0.369	0.373	0.447	0.444	0.446
T ₁₁	G + S (2 : 1), 100%RDF	0.370	0.373	0.372	0.450	0.452	0.451
T ₁₂	G + S (2 : 1), 125%RDF	0.374	0.384	0.379	0.461	0.463	0.462
T ₁₃	G + S (3 : 1), 75% RDF	0.360	0.365	0.363	0.447	0.445	0.446
T ₁₄	G + S (3 : 1), 100%RDF	0.372	0.371	0.372	0.449	0.447	0.448
T ₁₅	G + S (3 : 1), 125%RDF	0.377	0.380	0.379	0.469	0.459	0.464
S.E. +/-		0.004	0.006	0.005	0.005	0.005	0.004
C.D. 5%		NS	NS	NS	NS	NS	NS

4.10.2.2 Phosphorus uptake (kg/ha) by different plant parts of sweet corn

4.10.2.3 Phosphorus uptake in kernels (kg/ha)

Data related to phosphorus uptake in kernels as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 33A. Phosphorus uptake in the kernels was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, the response to the increase in the level of fertilizers in relation to phosphorus uptake in kernels was graded and significant, during both the years of experimentation and in the mean of two years. All the sole cropping treatments recorded significantly higher phosphorus uptake in the kernels of sweet corn than the intercropping treatments.

The phosphorus uptake in kernels increased with increase in the level of fertilizers and increased proportion of sweet corn in the intercropping combinations. Groundnut + sweet corn in 1:1 ratio with 125% RDF (T₆) recorded significantly higher phosphorus uptake in kernels than the other intercropping combinations at all the levels of fertilizer application except treatment T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF), during both the years of experimentation and in the mean of two years and the treatments T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) and T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) during 2003-04; which were at par with the former treatment (T₆).

4.10.2.4 Phosphorus uptake in cob axis and cob sheath (kg/ha)

The data pertaining to phosphorus uptake in cob axis and sheath as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 33A. Phosphorus uptake in cob axis and sheath was influenced significantly due to different treatments,

during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, treatment T₆ (Sole sweet corn with 125% RDF) recorded significantly higher phosphorus uptake in cob axis and sheath than the application of 75% and 100% RDF to sole sweet corn i.e. T₄ and T₅, during both the years of experimentation and in the mean of two years, except treatment T₅ in the year 2003-04 in respect of cob sheath, which was at par with the former treatment T₆. Further, all the sole cropping treatments recorded significantly higher phosphorus uptake in cob axis and sheath of sweet corn than the intercropping treatments.

The phosphorus uptake in cob axis and sheath increased with increase in the level of fertilizers and increased proportion of sweet corn in intercropping combinations. In case of intercropping treatments, groundnut + sweet corn in 1 : 1 ratio with 125% RDF (T₆) was at par with the treatments with same planting ratio with 100 and 125% RDF i.e. T₇ and T₈ during 2003-04 in respect of both the observations and groundnut + sweet corn in 2:1 ratio with 100 and 125% RDF i.e. T₁₁ and T₁₂ in respect of cob sheath during the same year. Further, in respect of both observations during 2004-05, again groundnut + sweet corn in 1 : 1 ratio with 125% RDF (T₉) was significantly superior over the remaining intercropping treatments. However, in the mean of two years, again treatment T₉ was significantly superior over the remaining intercropping treatments except groundnut + sweet corn in 1:1 ratio with 100 % RDF i.e. T₈ which was at par with the former treatment (T₉) in respect of both the observations.

4.10.2.5 Phosphorus uptake in stem and leaves (kg/ha)

Data regarding phosphorus uptake in stem and leaves as influenced by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 33B.

Table 33A: Phosphorous uptake (kg/ha) by the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Grains			Cob axis			Cob sheath		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Sweet corn with 75% RDF	8.65	9.18	8.92	2.16	2.25	2.21	1.11	1.26	1.19
T ₂	Sole Sweet corn with 100% RDF	9.32	9.88	9.60	2.30	2.43	2.37	1.31	1.37	1.34
T ₃	Sole Sweet corn with 125% RDF	10.05	11.33	10.69	2.48	2.73	2.61	1.41	1.54	1.48
T ₄	G + S (1 : 1), 75%RDF	4.74	4.82	4.78	1.10	1.19	1.15	0.62	0.67	0.65
T ₅	G + S (1 : 1), 100%RDF	5.23	5.18	5.21	1.25	1.26	1.26	0.70	0.71	0.71
T ₆	G + S (1 : 1), 125%RDF	5.26	5.84	5.55	1.25	1.42	1.34	0.70	0.80	0.75
T ₇	G + S (2 : 1), 75%RDF	4.13	3.87	4.00	1.03	0.94	0.99	0.57	0.51	0.54
T ₈	G + S (2 : 1), 100%RDF	4.45	4.00	4.23	1.05	0.98	1.02	0.60	0.55	0.58
T ₉	G + S (2 : 1), 125%RDF	4.69	4.28	4.49	1.13	1.03	1.08	0.63	0.60	0.62
T ₁₀	G + S (3 : 1), 75% RDF	3.16	3.06	3.11	0.78	0.75	0.77	0.39	0.42	0.41
T ₁₁	G + S (3 : 1), 100%RDF	3.33	3.20	3.27	0.80	0.79	0.80	0.45	0.44	0.45
T ₁₂	G + S (3 : 1), 125%RDF	3.60	3.37	3.49	0.87	0.83	0.85	0.49	0.48	0.49
	S.E. +/-	0.21	0.23	0.19	0.06	0.05	0.04	0.04	0.03	0.03
	C.D. 5%	0.60	0.66	0.54	0.16	0.14	0.11	0.11	0.08	0.08

Table 33B: Phosphorous uptake (kg/ha) by the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Stem			Leaves		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Sweet corn with 75% RDF	3.97	4.30	4.14	5.59	5.84	5.72
T ₂	Sole Sweet corn with 100% RDF	4.47	4.73	4.60	5.95	6.39	6.17
T ₃	Sole Sweet corn with 125% RDF	4.77	5.33	5.05	6.32	7.16	6.74
T ₄	G + S (1 : 1), 75%RDF	2.23	2.30	2.27	3.02	3.10	3.06
T ₅	G + S (1 : 1), 100%RDF	2.44	2.48	2.46	3.25	3.33	3.29
T ₆	G + S (1 : 1), 125%RDF	2.57	2.82	2.70	3.47	3.78	3.63
T ₁₀	G + S (2 : 1), 75%RDF	1.91	1.85	1.88	2.65	2.47	2.56
T ₁₁	G + S (2 : 1), 100%RDF	2.07	1.91	1.99	2.80	2.58	2.69
T ₁₂	G + S (2 : 1), 125%RDF	2.20	2.06	2.13	3.01	2.78	2.90
T ₁₃	G + S (3 : 1), 75% RDF	1.48	1.45	1.47	2.05	1.98	2.02
T ₁₄	G + S (3 : 1), 100%RDF	1.57	1.53	1.55	2.10	2.03	2.07
T ₁₅	G + S (3 : 1), 125%RDF	1.69	1.62	1.66	2.34	2.17	2.26
	S.E. +/-	0.10	0.11	0.09	0.13	0.15	0.13
	C.D. 5%	0.28	0.32	0.25	0.37	0.44	0.37

In case of sole cropping of sweet corn, treatment T₆ (sole sweet corn with 125% RDF) recorded significantly higher phosphorus uptake in stem and leaves than the application of 75% and 100% RDF to sole sweet corn i.e. T₁ and T₅, during all the three observations except sole sweet corn with 100% RDF i.e. T₅ during 2003-04 in respect of leaves which was at par with the former treatment i.e. T₆.

The phosphorus uptake by stem and leaves increased with increase in the level of fertilizers and increased proportion of sweet corn in the intercropping treatments. Groundnut +sweet corn in 1:1 ratio with 125% RDF (T₉) recorded significantly higher phosphorus uptake in stem and leaves during 2004-05, however, during 2003-04 and in the mean of two years, treatment T₉ was at par with T₈ (Groundnut +sweet corn in 1:1 ratio with 100% RDF) and it (T₉) was significantly superior over the remaining intercropping treatments.

4.10.3 Per cent potassium content in different plant parts of sweet corn

4.10.3.1 Per cent potassium content in kernels

Data related to per cent potassium content in kernels of sweet corn as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 34A. Potassium content in kernels was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years.

When the comparison was made among the sole cropping and intercropping treatments, it was observed that groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) was at par with groundnut + sweet corn in 2:1 and 3:1 ratio with 125% RDF (T₁₂ and T₁₅) and it (T₉) was significantly superior over the remaining treatments during 2003-04 and in the mean of two years.

Table 34A: Potassium content (%) in the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Grains			Cob axis			Cob sheath		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Sweet corn with 75% RDF	0.43	0.47	0.45	0.31	0.30	0.31	0.26	0.25	0.26
T ₃	Sole Sweet corn with 100% RDF	0.47	0.49	0.48	0.32	0.33	0.33	0.28	0.31	0.30
T ₆	Sole Sweet corn with 125% RDF	0.49	0.53	0.51	0.37	0.39	0.38	0.34	0.31	0.33
T ₇	G + S (1 : 1), 75%RDF	0.44	0.48	0.46	0.34	0.31	0.33	0.28	0.27	0.28
T ₈	G + S (1 : 1), 100%RDF	0.47	0.49	0.48	0.36	0.34	0.35	0.29	0.33	0.31
T ₉	G + S (1 : 1), 125%RDF	0.56	0.53	0.55	0.38	0.41	0.40	0.33	0.34	0.34
T ₁₀	G + S (2 : 1), 75%RDF	0.48	0.50	0.49	0.33	0.32	0.33	0.32	0.28	0.30
T ₁₁	G + S (2 : 1), 100%RDF	0.51	0.50	0.51	0.34	0.39	0.37	0.30	0.31	0.31
T ₁₂	G + S (2 : 1), 125%RDF	0.53	0.52	0.53	0.39	0.40	0.40	0.33	0.34	0.34
T ₁₃	G + S (3 : 1), 75% RDF	0.44	0.48	0.46	0.36	0.35	0.36	0.26	0.27	0.27
T ₁₄	G + S (3 : 1), 100%RDF	0.49	0.51	0.50	0.38	0.40	0.39	0.30	0.33	0.32
T ₁₅	G + S (3 : 1), 125%RDF	0.53	0.54	0.54	0.43	0.41	0.42	0.33	0.34	0.34
S.E. +/-		0.010	0.011	0.009	0.019	0.014	0.015	0.026	0.012	0.016
C.D. 5%		0.03	0.03	0.03	NS	0.04	0.04	NS	0.03	0.05

Table 34B: Potassium content (%) in the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Stem			Leaves		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	0.83	0.84	0.84	0.94
T ₅	Sole Sweet corn with 100% RDF	0.84	0.92	0.88	0.98	1.06	1.02
T ₆	Sole Sweet corn with 125% RDF	0.93	0.94	0.94	1.16	1.23	1.20
T ₇	G + S (1 : 1), 75%RDF	0.81	0.85	0.83	0.98	0.95	0.97
T ₈	G + S (1 : 1), 100%RDF	0.82	0.91	0.87	0.99	1.09	1.04
T ₉	G + S (1 : 1), 125%RDF	0.86	0.94	0.90	1.13	1.25	1.19
T ₁₀	G + S (2 : 1), 75%RDF	0.84	0.86	0.85	0.99	0.96	0.98
T ₁₁	G + S (2 : 1), 100%RDF	0.88	0.93	0.91	1.06	1.10	1.08
T ₁₂	G + S (2 : 1), 125%RDF	0.90	0.95	0.93	1.16	1.25	1.21
T ₁₃	G + S (3 : 1), 75% RDF	0.86	0.85	0.86	0.98	1.11	1.05
T ₁₄	G + S (3 : 1), 100%RDF	0.88	0.95	0.92	1.13	1.15	1.14
T ₁₅	G + S (3 : 1), 125%RDF	0.94	0.96	0.95	1.17	1.26	1.22
	S.E. +/-	0.035	0.020	0.024	0.023	0.041	0.033
	C.D.5%	NS	NS	NS	0.07	0.12	0.10

However, during 2004-05, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with all the treatments receiving 125% RDF i.e. T₆ (sole sweet corn with 125% RDF), T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF) and T₁₂ (groundnut + sweet corn in 2:1 ratio with 125% RDF) as well as T₁₄ (groundnut + sweet corn in 3:1 ratio with 100% RDF) and was significantly superior over the remaining treatments.

4.10.3.2 Per cent potassium content in cob axis

Data pertaining to per cent potassium content in cob axis are presented in Table 34A. Potassium content in cob axis was not influenced significantly due to different treatments, during 2003-04. During 2004-05, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) recorded significantly higher potassium content in cob axis than the remaining treatments, however, statistically it was at par with the treatments receiving 100 and 125% RDF 2:1 and 3:1 ratios i.e. T₁₁, T₁₂ and T₁₄ and T₁₅ respectively as well as sole sweet corn with 125% RDF i.e. T₆. Further, treatment T₉ was significantly superior over the remaining treatments during the same period.

On the other hand, in the mean of two years, groundnut +sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with all the treatments receiving 125% RDF i.e. T₆ (sole sweet corn with 125% RDF), T₉ (groundnut +sweet corn in 1:1 ratio with 125% RDF) and T₁₂ (groundnut +sweet corn in 2:1 ratio with 125% RDF) as well as T₁₄ (groundnut +sweet corn in 3:1 ratio with 100% RDF) and it (T₁₅) was significantly superior over the remaining treatments.

4.10.3.3 Per cent potassium content in cob sheath

Data related to per cent potassium content in cob sheath as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 34A. During 2003-04, potassium content in cob sheath was not influenced significantly due to different treatments.

However, during 2004-05 and in the mean of two years, groundnut +sweet corn at 3:1 ratio with 125% RDF (T₁₅) was significantly superior than all the treatments receiving 75% RDF i.e. T₁ (sole sweet corn with 75% RDF), T₇ (groundnut +sweet corn at 1:1 ratio with 75% RDF), T₁₀ (groundnut +sweet corn at 2:1 ratio with 75% RDF) and T₁₃ (groundnut +sweet corn at 3:1 ratio with 75% RDF) except treatment T₁₀ (groundnut +sweet corn at 2:1 ratio with 75% RDF) in the mean of two years; which was at par with the former treatment T₁₅.

4.10.3.4 Per cent potassium content in stem

Data pertaining to per cent potassium content in stem are presented in Table 34B. Potassium content in stem was not influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. However, there was graded increase in potassium content in sweet corn stem with the increase in the level of fertilizers in sole cropping as well as intercropping. Further, there was slight increase in potassium content in sweet corn stem with increase in the groundnut proportion in the intercropping combinations.

4.10.3.5 Per cent potassium content in leaves

Data pertaining to per cent potassium content in leaves are presented in Table 34B. Potassium content in leaves was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. From the overall comparison, it was observed that, groundnut +sweet corn at 3:1 ratio with 125% RDF (T₁₅) was at par with all the treatments receiving 125% RDF i.e. T₆ (sole sweet corn with 125% RDF), T₉ (groundnut +sweet corn at 1:1 ratio with 125% RDF) and T₁₂ (groundnut +sweet corn at 2:1 ratio with 125% RDF) as well as treatment T₁₄ (groundnut +sweet corn at 3:1 ratio with 100% RDF) and it (T₁₅) was significantly superior over the remaining treatments during 2004-05 and in the mean of two years.

4.10.3.6 Potassium uptake in different plant parts of sweet corn (kg/ha).

4.10.3.7 Potassium uptake in kernels and leaves (kg/ha).

Data related to potassium uptake in kernels and leaves as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 35A and 35B. Potassium uptake in kernels and leaves was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, the response to the increase in the level of fertilizers in relation to potassium uptake in kernels and leaves was graded and significant and therefore, sole sweet corn with 125% RDF (T₆) recorded significantly higher potassium uptake in kernels and leaves than all the remaining treatments of sole cropping as well as intercropping.

The potassium uptake by kernels and leaves increased with increase in the level of fertilizers and increased proportion of sweet corn in the intercropping combinations. Groundnut +sweet corn in 1:1 ratio with 125% RDF (T₉) recorded significantly higher potassium uptake in kernels and leaves than the other intercropping combinations at all the levels of fertilizer application, during both the years of experimentation and in the mean of two years.

4.10.3.8 Potassium uptake in cob axis and cob sheath (kg/ha)

Data pertaining to potassium uptake in cob axis and sheath as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 35A. Potassium uptake in cob axis and sheath was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, the response to the increase in the level of fertilizers in relation to potassium uptake in cob axis and sheath was graded and significant.

Table 35A: Potassium uptake (kg/ha) by the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Kernels			Cob axis			Cob sheath		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₄	Sole Sweet corn with 75% RDF	7.28	8.46	7.87	3.14	3.17	3.16	2.40
T ₅	Sole Sweet corn with 100% RDF	8.54	9.29	8.92	3.48	3.80	3.64	2.78	3.22	3.00
T ₆	Sole Sweet corn with 125% RDF	9.42	11.37	10.40	4.26	4.96	4.61	3.57	3.62	3.60
T ₇	G + S (1 : 1), 75% RDF	4.02	4.52	4.27	1.86	1.77	1.82	1.39	1.39	1.39
T ₈	G + S (1 : 1), 100% RDF	4.67	4.90	4.79	2.14	2.03	2.09	1.57	1.76	1.67
T ₉	G + S (1 : 1), 125% RDF	5.78	5.84	5.81	2.20	2.68	2.44	1.74	2.06	1.90
T ₁₀	G + S (2 : 1), 75% RDF	3.86	3.80	3.83	1.59	1.45	1.52	1.40	1.14	1.27
T ₁₁	G + S (2 : 1), 100% RDF	4.30	3.83	4.07	1.72	1.82	1.77	1.38	1.32	1.35
T ₁₂	G + S (2 : 1), 125% RDF	4.70	4.22	4.46	2.02	1.91	1.97	1.60	1.53	1.57
T ₁₃	G + S (3 : 1), 75% RDF	2.73	2.87	2.80	1.34	1.28	1.31	0.83	0.88	0.86
T ₁₄	G + S (3 : 1), 100% RDF	3.11	3.18	3.15	1.44	1.50	1.47	1.04	1.12	1.08
T ₁₅	G + S (3 : 1), 125% RDF	3.58	3.48	3.53	1.74	1.57	1.66	1.22	1.19	1.21
	S.E. +/-	0.22	0.25	0.19	0.12	0.13	0.11	0.07	0.08	0.06
	C.D. 5%	0.64	0.72	0.54	0.34	0.37	0.31	0.20	0.22	0.16

Table 35B: Potassium uptake (kg/ha) by the different parts of sweet corn as affected by different treatments

Sym.	Treatment	Stem			Leaves		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	9.31	9.91	9.61	11.73	11.94
T ₂	10.12	11.59	10.86	13.13	14.89	14.01	
T ₃	11.86	13.25	12.56	16.45	19.34	17.90	
T ₇	G + S (1 : 1), 75% RDF	4.90	5.33	5.12	6.60	6.58	6.59
T ₈	G + S (1 : 1), 100% RDF	5.40	6.09	5.75	7.26	7.99	7.63
T ₉	G + S (1 : 1), 125% RDF	5.88	6.85	6.37	8.60	10.14	9.37
T ₁₀	G + S (2 : 1), 75% RDF	4.23	4.29	4.26	5.87	5.31	5.59
T ₁₁	G + S (2 : 1), 100% RDF	4.93	4.75	4.84	6.60	6.21	6.41
T ₁₂	G + S (2 : 1), 125% RDF	5.29	5.11	5.20	7.59	7.50	7.55
T ₁₃	G + S (3 : 1), 75% RDF	3.54	3.41	3.48	4.49	4.94	4.72
T ₁₄	G + S (3 : 1), 100% RDF	3.70	3.91	3.81	5.29	5.30	5.30
T ₁₅	G + S (3 : 1), 125% RDF	4.21	4.06	4.14	5.83	6.01	5.92
	S.E. +/-	0.32	0.35	0.29	0.43	0.45	0.34
	C.D. 5%	0.93	1.02	0.84	1.26	1.31	1.00

The potassium uptake in cob axis and sheath increased with increase in the level of fertilizers and increased proportion of sweet corn in the intercropping combinations. Groundnut +sweet corn at 1:1 row proportion when applied with 125% RDF (T₆) recorded significantly higher potassium uptake in cob axis and sheath than the other intercropping treatments during 2004-05 and in the mean of two years. However, in respect of cob sheath, the former treatment T₆ was at par with T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and was significantly superior than the remaining treatments during 2003-04.

4.10.3.9 Potassium uptake in stem (kg/ha)

Data regarding potassium uptake in stem as influenced by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 35B. Among all the treatments, sole sweet corn with 125% RDF (T₆) recorded significantly higher potassium uptake in the stem during all the three observations. In case of intercropping, T₆ (groundnut + sweet corn in 1:1 ratio with 125% RDF) was at par with T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and was significantly superior over the remaining intercropping treatments during all the three observations.

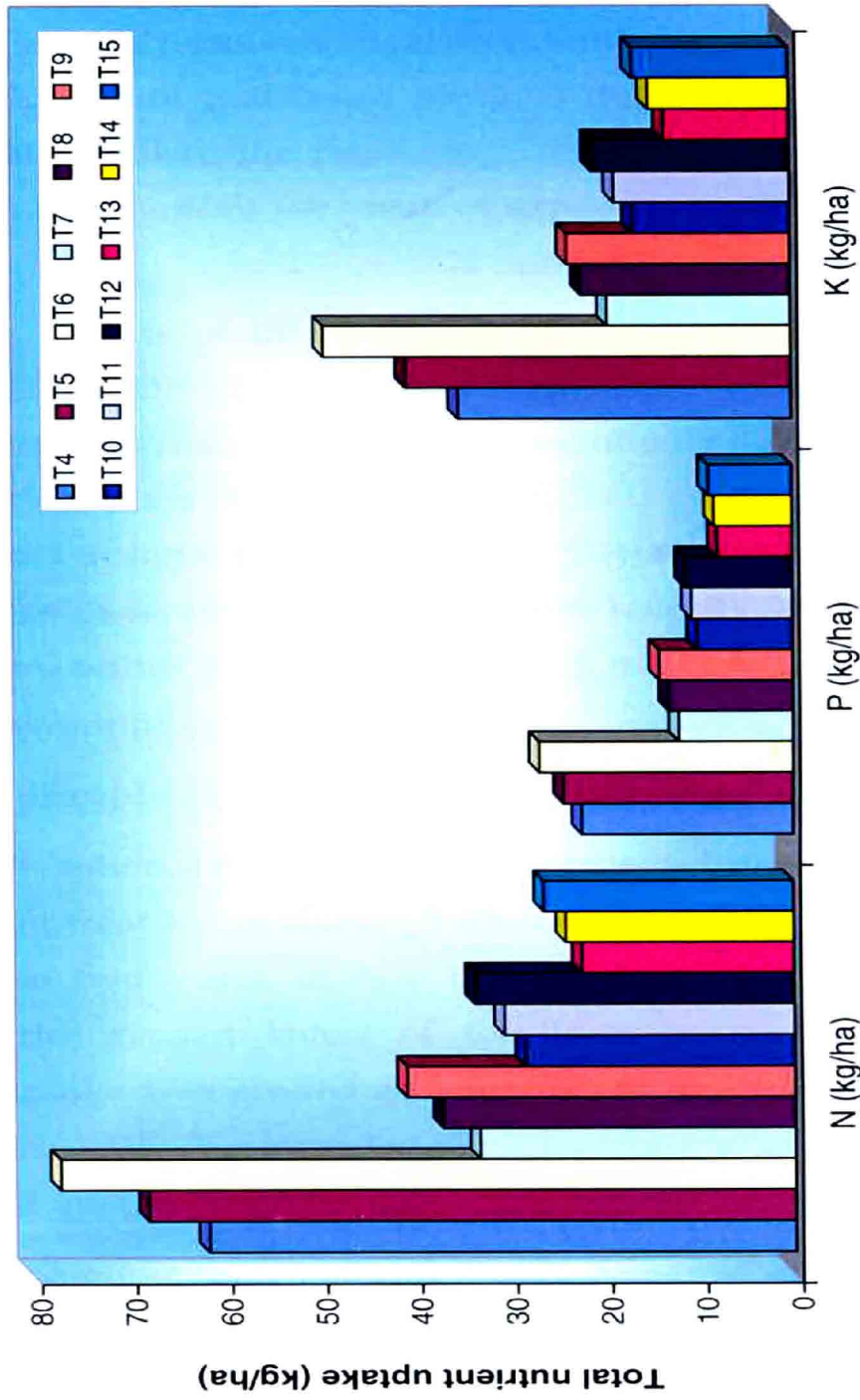
4.10.4 Total nutrient uptake by sweet corn (kg/ha)

Data concerned with total nitrogen, phosphorus and potassium uptake by sweet corn as affected by different treatments during 2003-04, 2004-05 and in the mean of two years are presented in Table 36 and depicted in Fig. 23. In general, it was observed that the total nutrient uptake i.e. N, P, K increased with the increase in the level of fertilizer in sole cropping as well as intercropping treatments. Further, in the intercropping treatments, the total nutrient uptake by the sweet corn was increased with increase in the proportion of groundnut in the intercropping.

Table 36 : Total nutrient uptake (kg/ha) by sweet corn as affected by different treatments

Sym.	Treatment	N (kg/ha)			P (kg/ha)			K (kg/ha)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		T ₁	Sole Sweet corn with 75% RDF	60.85	62.35	61.60	21.48	22.83	22.16	33.86
T ₂	Sole Sweet corn with 100% RDF	66.43	69.39	67.91	23.34	24.80	24.07	38.05	42.80	40.43
T ₃	Sole Sweet corn with 125% RDF	73.04	81.28	77.16	25.03	28.14	26.59	45.56	52.49	49.03
T ₄	G + S (1 : 1), 75%RDF	32.85	33.19	33.02	11.71	12.08	11.90	18.77	19.59	19.18
T ₅	G + S (1 : 1), 100%RDF	36.96	36.85	36.91	12.91	12.96	12.94	21.04	22.78	21.91
T ₆	G + S (1 : 1), 125%RDF	39.13	42.29	40.71	13.24	14.67	13.96	24.20	22.58	23.39
T ₇	G + S (2 : 1), 75%RDF	29.68	26.76	28.22	10.29	9.65	9.97	16.95	16.00	16.48
T ₈	G + S (2 : 1), 100%RDF	32.27	28.58	30.43	10.97	10.09	10.53	18.93	17.92	18.43
T ₉	G + S (2 : 1), 125%RDF	35.15	31.81	33.48	11.66	10.75	11.21	21.20	20.27	20.74
T ₁₀	G + S (3 : 1), 75% RDF	23.09	21.38	22.24	7.86	7.66	7.76	12.93	13.39	13.16
T ₁₁	G + S (3 : 1), 100%RDF	24.56	23.26	23.91	8.25	7.99	8.12	14.58	15.02	14.80
T ₁₂	G + S (3 : 1), 125%RDF	26.85	25.62	26.24	8.99	8.46	8.73	16.58	16.31	16.45
S.E. +/-		1.49	1.62	0.87	0.57	0.53	0.31	0.98	1.03	0.74
C.D. 5%		4.44	4.84	2.58	1.68	1.56	0.91	2.92	3.03	2.20

Fig. 23. Total nutrient uptake (kg/ha) by sweet corn as affected by different treatments



T4 - Sole Sweet corn with 75% RDF
 T5 - Sole Sweet corn with 100% RDF
 T6 - Sole Sweet corn with 125% RDF
 T7 - G + S (1 : 1), 75% RDF
 T8 - G + S (1 : 1), 100% RDF
 T9 - G + S (1 : 1), 125% RDF
 T10 - G + S (2 : 1), 75% RDF
 T11 - G + S (2 : 1), 100% RDF
 T12 - G + S (2 : 1), 125% RDF
 T13 - G + S (3 : 1), 75% RDF
 T14 - G + S (3 : 1), 100% RDF
 T15 - G + S (3 : 1), 125% RDF

4.10.4.1 Total nitrogen uptake by sweet corn (kg/ha)

Total nitrogen uptake by sweet corn was affected significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, the response to the graded level of fertilizers in relation to the total nitrogen uptake was graded and significant maximum being at the treatment T_6 , which was significantly higher than the remaining treatments of sole cropping and intercropping, during both the years of experimentation and in the mean of two years.

Further, in case of intercropping, groundnut + sweet corn in 1:1 ratio with 125% RDF (T_9) recorded significantly more total nitrogen uptake in sweet corn than the remaining treatments during 2004-05 and in the mean of two years. However, during 2003-04, though groundnut + sweet corn in 1:1 ratio with 125% RDF (T_9) recorded maximum total nitrogen uptake in sweet corn, it was at par with T_8 (groundnut + sweet corn in 1:1 ratio with 100% RDF) and was significantly superior over the remaining intercropping treatments.

4.10.4.2 Total phosphorus uptake by sweet corn (kg/ha)

Total phosphorus uptake by sweet corn was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, the response to the graded levels of fertilizers in relation to the total phosphorus uptake was graded and significant and therefore, sole sweet corn with 125% RDF (T_6) recorded significantly higher total phosphorus uptake than all the treatments of sole cropping and intercropping.

Further, among the intercropping treatments, groundnut + sweet corn in 1:1 ratio with 125% RDF (T_9) recorded significantly more total phosphorus uptake in sweet corn than the remaining treatments during 2004-05 and in the mean of two years. However, during 2003-04,

groundnut + sweet corn in 1:1 ratio with 125% RDF (T₆) was at par with the treatments having same intercropping ratio with 75 and 100% RDF i.e. T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) and T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and was significantly superior over the remaining intercropping treatments.

4.10.4.3 Total potassium uptake by sweet corn (kg/ha)

Total potassium uptake by sweet corn was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of sole cropping of sweet corn, the response to the graded levels of fertilizers in relation to the total potassium uptake was graded and significant. Further, sole sweet corn with 125% RDF (T₆) recorded significantly higher total potassium uptake than all the remaining treatments of sole cropping and intercropping.

In respect of intercropping treatments, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) recorded significantly higher total potassium uptake in sweet corn than the remaining treatments during 2003-04. However, during 2004-05, the above referred treatment T₉ was at par with the treatments having same intercropping ratio with 75 and 100% RDF i.e. T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) and T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and in the mean of two years, it was at par with groundnut + sweet corn in 1:1 ratio with 100% RDF (T₈) and was significantly superior over the remaining intercropping treatments.

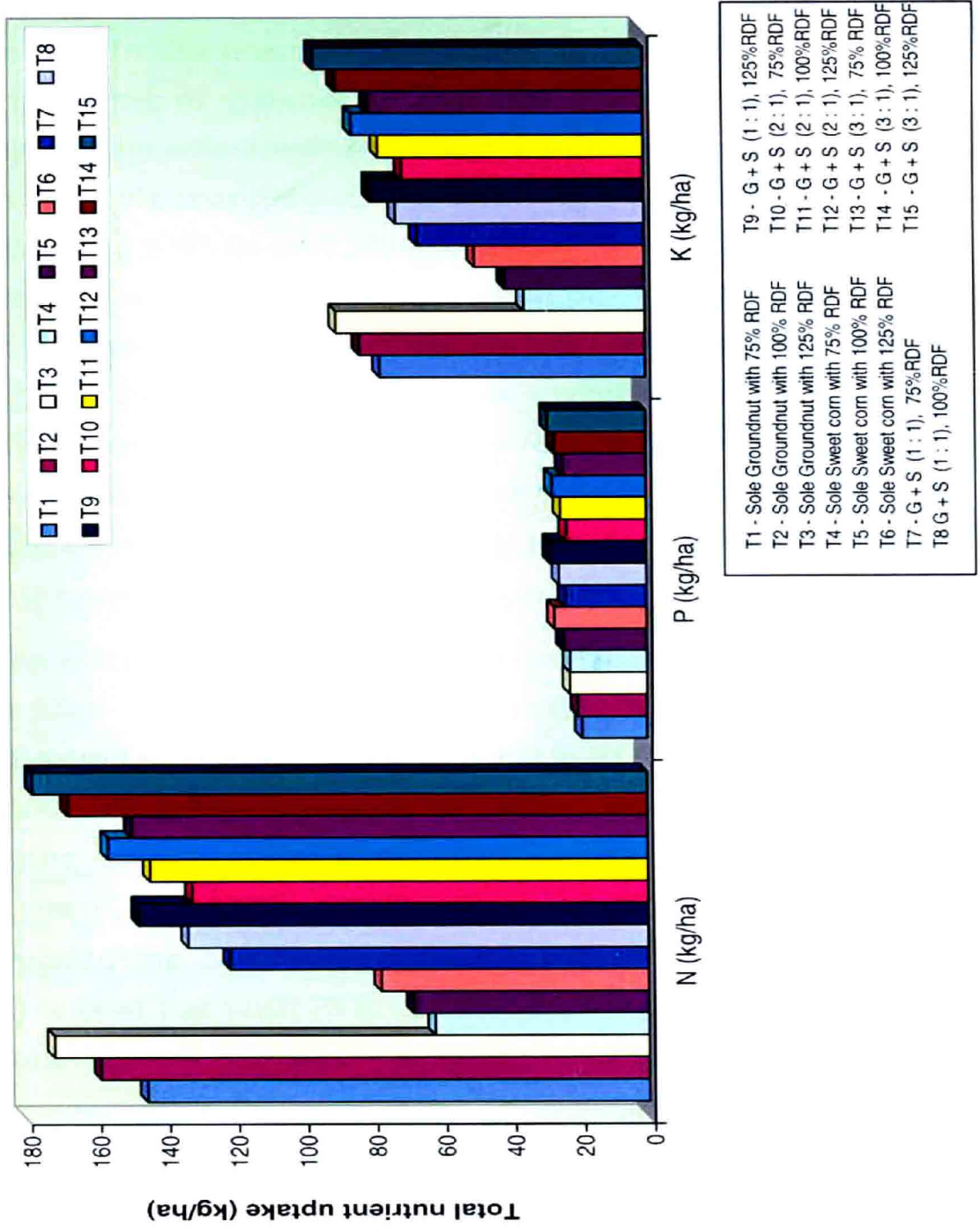
4.10.5 Total nutrient uptake by groundnut + sweet corn intercropping (kg/ha)

The data concerned with total nitrogen, phosphorus and potassium uptake by groundnut + sweet corn intercropping as affected by different treatments, during 2003-04, 2004-05 and in the mean of two years are presented in Table 37 and graphically shown in Fig. 24.

Table 37 : Total N, P, K uptake (kg/ha) by groundnut + sweet corn intercropping as affected by different treatments

Sym.	Treatment	N (kg/ha)			P (kg/ha)			K (kg/ha)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	154.40	135.45	144.93	20.39	17.09	18.74	79.65	73.28	76.47
T ₂	Sole Groundnut with 100% RDF	170.15	146.42	158.29	21.89	17.99	19.94	86.90	77.88	82.39
T ₃	Sole Groundnut with 125% RDF	182.35	161.12	171.74	23.75	20.73	22.24	93.30	84.86	89.08
T ₄	Sole Sweet corn with 75% RDF	60.85	62.35	61.60	21.48	22.83	22.16	33.86	35.89	34.88
T ₅	Sole Sweet corn with 100% RDF	66.43	69.39	67.91	23.35	24.80	24.08	38.05	42.80	40.43
T ₆	Sole Sweet corn with 125% RDF	73.04	81.28	77.16	25.03	28.14	26.59	45.56	52.49	49.03
T ₇	G + S (1 : 1), 75%RDF	129.19	112.47	120.83	24.55	22.21	23.38	69.60	61.61	65.61
T ₈	G + S (1 : 1), 100%RDF	140.14	125.66	132.90	26.30	24.06	25.18	73.95	69.51	71.73
T ₉	G + S (1 : 1), 125%RDF	153.06	141.50	147.28	28.26	27.26	27.76	83.43	74.81	79.12
T ₁₀	G + S (2 : 1), 75%RDF	140.57	122.95	131.76	24.65	21.52	23.09	73.25	66.53	69.89
T ₁₁	G + S (2 : 1), 100%RDF	154.37	133.30	143.84	26.57	22.92	24.75	80.66	72.93	76.80
T ₁₂	G + S (2 : 1), 125%RDF	163.99	148.04	156.02	28.72	25.61	27.17	87.19	81.91	84.55
T ₁₃	G + S (3 : 1), 75% RDF	151.24	147.07	149.16	24.65	23.26	23.96	79.09	80.27	79.68
T ₁₄	G + S (3 : 1), 100%RDF	174.05	161.26	167.66	27.71	25.31	26.51	90.90	87.42	89.16
T ₁₅	G + S (3 : 1), 125%RDF	185.36	170.19	177.78	30.04	26.77	28.41	97.56	93.20	95.38
S.E. +/-		11.46	9.48	7.49	1.44	1.29	0.57	3.16	2.97	1.86
C.D. 5%		34.27	28.31	22.29	4.29	3.84	1.69	9.41	8.85	5.54

Fig. 24. Total N, P, K uptake (kg/ha) by groundnut + sweet corn intercropping as affected by different treatments



4.10.5.1 Total nitrogen uptake by groundnut + sweet corn intercropping (kg/ha)

Total nitrogen uptake by groundnut + sweet corn intercropping was affected significantly due to different treatments, during both the years of experimentation and in the mean of two years. In general total nitrogen uptake by sole cropping of groundnut was significantly higher than the total nitrogen uptake by sole sweet corn under different fertilizers levels. In case of groundnut sole cropping, all the fertilizer treatments were at par with each other during 2003-04 and 2004-05. However, in the mean of two years, sole groundnut with 125% RDF (T₃) was at par with sole groundnut with 100% RDF (T₂) and was significantly superior over sole groundnut with 75% RDF (T₁). However, in case of sole sweet corn, total nitrogen uptake was influenced significantly due to variable levels of fertilizer application. It was further observed that total nitrogen uptake by sweet corn under all the treatments was significantly less than all the treatments of groundnut sole cropping as well as intercropping.

Among the intercropping treatments, T₁₅ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with the treatments having 75 and 100% RDF in 3:1 ratio i.e. T₁₃ and T₁₄; 100 and 125% RDF under 2:1 ratio i.e. T₁₁ and T₁₂ and 100% RDF in 1:1 ratio i.e. T₉ and was significantly superior over the remaining intercropping treatments. Further, T₁₅ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with all the treatments of sole groundnut. During 2004-05, T₁₅ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with 75 and 100% RDF in 3:1 ratio i.e. T₁₃ and T₁₄ and groundnut + sweet corn at 2:1 ratio with 125% RDF (T₁₂) and was significantly superior over the remaining intercropping treatments. In addition to this, the former treatment T₁₅ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with sole groundnut with 100 and 125% RDF i.e. T₂ and T₃ and was significantly superior over sole groundnut

with 75% RDF i.e. T₁. In the mean of two years, the pattern in respect of total nitrogen uptake was similar to that of 2004-05 except, T₁₃ (groundnut + sweet corn at 3:1 ratio with 75% RDF), which was significantly inferior to the former treatment T₁₅.

4.10.5.2 Total phosphorus uptake by groundnut + sweet corn intercropping (kg/ha)

Total phosphorus uptake by sweet corn was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. In case of groundnut sole cropping, all the fertilizer treatments were at par with each other during 2003-04 and 2004-05. However, in the mean of two years, sole groundnut with 125% RDF (T₃) was significantly superior over sole groundnut with 75 and 100% RDF i.e. T₁ and T₂ which were at par with each other.

In case of sole cropping of sweet corn, the response to the graded levels of fertilizers in relation to the total phosphorus uptake was graded and significant maximum being at the treatment T₆ (sole sweet corn with 125% RDF). However, during 2003-04, total phosphorus uptake by sweet corn was not influenced significantly due to variable levels of fertilizer application. Further, during 2004-05, sole sweet corn treatments with 100 and 125% RDF (T₅ and T₆) were at par and they were significantly superior over sole sweet corn with 75% RDF i.e. T₄.

Among the intercropping treatments, T₁₃ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) and the treatments having 2:1 and 1:1 ratios with 100 and 125% RDF i.e. T₁₁, T₁₂ and T₈ and T₉ respectively and was significantly superior over the remaining intercropping treatments as well as all the treatments of groundnut and sweet corn sole cropping. Further, during 2004-05, again treatment T₁₃ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was significantly superior over the treatments of

groundnut + sweet corn at 1:1 and 2:1 ratio with 75% RDF (T₇ and T₁₀) and was at par with remaining treatments. Further, treatment T₁₁ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with all the treatments of sole sweet corn i.e. T₄, T₅ and T₆ and it was significantly superior over all the treatments of sole groundnut.

4.10.5.3 Total potassium uptake by groundnut + sweet corn intercropping (kg/ha)

Total potassium uptake by sole cropping and intercropping treatments was influenced significantly due to different treatments, during both the years of experimentation and in the mean of two years. The total potassium uptake increased with increase in the level of fertilizers and increased proportion of groundnut in intercropping combinations. In case of groundnut sole cropping, sole groundnut with 125% RDF (T₃) was at par with sole groundnut with 100% RDF i.e. T₂ and it was significantly superior over sole groundnut with 75% RDF i.e. T₁ during 2003-04 and 2004-05. However, in the mean of two years, total potassium uptake by groundnut increased significantly with subsequent increase in the fertilizer level. In case of sole cropping of sweet corn, the response to the graded levels of fertilizers in relation to the total potassium uptake was graded and significantly higher total potassium uptake was recorded due to the treatment T₆ in the mean of two years. However, during 2003-04, sole sweet corn treatments with 125% RDF (T₆) was at par with sole sweet corn with 100% RDF (T₅) and it was significantly superior over the treatment T₄. Further, during 2004-05, sole sweet corn 125% RDF (T₆) was significantly superior over the lower levels of fertilizer application i.e. T₁ and T₅.

Among the intercropping treatments, T₁₅ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) during 2003-04 and 2004-05 and was significantly superior over the remaining intercropping treatments as well

as all the treatments of groundnut and sweet corn sole cropping. Further, in the mean of two years, again treatment T₁₁ (groundnut + sweet corn at 3:1 ratio with 125% RDF) was significantly superior over all the treatments of sole cropping and intercropping in respect of total potassium uptake.

4.11 Available Nitrogen, Phosphorus and Potassium in soil after harvest of crops

The data regarding available nitrogen, phosphorus and potassium, in soil after harvest of crops (kg/ha) are given in Table 38.

4.11.1 Available nitrogen in soil

The available nitrogen in soil revealed significant variation due to different treatments. It was observed from the data that available N in soil after harvest of crops was ameliorated over initial value, due sole cropping of sweet corn and increased with successive increase in the fertilizer level. Application of 125% RDF to sole sweet corn (T₆) resulted into highest available nitrogen content in the soil after harvest of crops which was significantly higher than the application of 100% RDF (T₅) and 75% RDF (T₁), and all the remaining treatments, during both the years of experimentation and in the mean of two years. The intercropping treatments at different row proportions and fertilizer levels caused depletion in available nitrogen in soil over the initial value and maximum being due to sole cropping of groundnut at 75% RDF (T₁).

4.11.2 Available phosphorus in soil

Data indicated that available P₂O₅ in soil after harvest of crops was not influenced significantly due to different treatments, during both the years and in the mean of two years. Application of 125% RDF to component crops in intercropping system (T₁₃) resulted into maximum available P₂O₅ content of soil over initial values, during both the years of experimentation and in the mean of two years.

Table 38 : Mean available N, P, K content (kg/ha) in the soil as affected by different treatments after harvest of crops

Sym.	Treatment	N (kg/ha)			P (kg/ha)			K (kg/ha)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
		I ₁	Sole Groundnut with 75% RDF	241.70	249.01	245.36	13.92	14.01	13.97	271.94
I ₂	Sole Groundnut with 100% RDF	244.18	251.49	247.84	14.17	15.49	14.83	280.62	288.16	284.39
I ₃	Sole Groundnut with 125% RDF	250.25	257.56	253.91	15.58	15.22	15.40	283.76	290.89	287.33
I ₄	Sole Sweet corn with 75% RDF	350.60	357.91	354.26	14.75	14.91	14.83	287.15	291.24	289.20
I ₅	Sole Sweet corn with 100% RDF	364.63	371.94	368.29	14.62	14.61	14.62	294.43	291.94	293.19
I ₆	Sole Sweet corn with 125% RDF	383.79	391.10	387.45	16.71	15.10	15.91	293.80	294.44	294.12
I ₇	G + S (1:1), 75%RDF	265.96	273.27	269.62	14.22	14.34	14.28	285.70	286.34	286.02
I ₈	G + S (1:1), 100%RDF	270.02	277.33	273.68	15.79	15.67	15.73	296.79	290.67	293.73
I ₉	G + S (1:1), 125%RDF	285.69	293.00	289.35	15.94	15.27	15.61	296.08	296.60	296.34
I ₁₀	G + S (2:1), 75%RDF	264.39	271.70	268.05	14.36	14.03	14.20	284.20	288.36	286.28
I ₁₁	G + S (2:1), 100%RDF	258.30	265.61	261.96	15.00	15.27	15.14	295.16	288.94	292.05
I ₁₂	G + S (2:1), 125%RDF	254.06	261.37	257.72	14.96	16.70	15.83	294.05	291.37	292.71
I ₁₃	G + S (3:1), 75% RDF	260.62	267.93	264.28	13.95	14.26	14.11	287.29	291.26	289.28
I ₁₄	G + S (3:1), 100%RDF	253.47	280.78	267.13	14.64	15.12	14.88	290.02	294.12	292.07
I ₁₅	G + S (3:1), 125%RDF	267.84	285.15	276.50	16.82	17.15	16.99	297.85	298.48	298.17
S.E.D.		4.15	3.91	2.39	0.72	0.67	0.53	3.44	2.34	2.48
C.D. 5%		12.02	11.31	7.10	NS	NS	NS	NS	NS	NS
Initial Values		327.63	342.61	335.12	14.47	16.17	15.32	289.16	297.44	293.30

4.11.3 Available potassium in soil (kg/ha)

Data indicated that available K_2O in soil after harvest of crops was not influenced significantly due to different treatments, during both the years and in the mean of two years. Application of 100% RDF and 125% RDF to either sole sweet corn (T_5 and T_6) or component crops of intercropping system caused positive balance of potassium in soil while rest of the treatments showed depletion of soil potassium over initial values of potassium, during the year 2003-04. Application of 125% RDF to component crops at 3:1 ratio (T_{15}) during the year 2004-05 and to sole sweet corn and component crops (T_6 , T_9 , T_{12} and T_{15}) in the mean of two years showed addition in available K_2O in soil over the initial values.

4.11.4 Nitrogen balance sheet:

The data related to the status of nitrogen and its gain or loss due to different treatments are given in Table 39 and 40. It is clear from the data that, under sole cropping systems, groundnut only reported addition of nitrogen to the soil while sole sweet corn resulted into depletion of nitrogen. The net gain in available nitrogen of soil was maximum due to application of 125% RDF to groundnut (T_6) followed by 100% and 75% RDF (T_5 and T_4), during both the years of experimentation.

With increase in groundnut proportion in the intercropping system, the net gain in the available nitrogen of soil was increased with increase in fertilizer level. Application of 100% or 125% RDF to component crops of intercropping system at 1:1 or 2:1 ratio could not improve the available nitrogen content of soil during both the years of experimentation, however, increasing fertilizer levels to the component crops at 3:1 row proportion increased available nitrogen of soil as compared to other intercropping treatments.

Table 39: Nitrogen balance sheet (2003-04) in the soil after harvest

Sym	Treatment	Initial Av. N (Kg/ha)	Added N (Kg/ha)	Total (Kg/ha)	Uptake (Kg/ha)	Expected (Kg/ha)	Actual Balance (Kg/ha)	Net Loss/gain (Kg/ha)
T ₁	Sole Groundnut with 75% RDF	347.63	18.75	366.38	154.4	211.98	241.70	29.72
T ₂	Sole Groundnut with 100% RDF	347.63	25.00	372.63	170.15	202.48	244.18	41.70
T ₃	Sole Groundnut with 125% RDF	347.63	31.25	378.88	182.35	196.53	250.25	53.72
T ₄	Sole Sweet corn with 75% RDF	347.63	112.50	460.13	60.85	399.28	350.60	-48.68
T ₅	Sole Sweet corn with 100% RDF	347.63	150.00	497.63	66.43	431.20	364.63	-66.57
T ₆	Sole Sweet corn with 125% RDF	347.63	187.50	535.13	73.04	462.09	383.79	-78.30
T ₇	G + S (1 : 1), 75%RDF	347.63	65.63	413.26	129.19	284.07	265.96	-18.11
T ₈	G + S (1 : 1), 100%RDF	347.63	87.50	435.13	140.14	294.99	270.02	-24.97
T ₉	G + S (1 : 1), 125%RDF	347.63	109.38	457.01	153.06	303.95	285.69	-18.26
T ₁₀	G + S (2 : 1), 75%RDF	347.63	50.00	397.63	140.57	257.06	254.06	-3.00
T ₁₁	G + S (2 : 1), 100%RDF	347.63	66.67	414.30	154.37	259.93	258.30	-1.63
T ₁₂	G + S (2 : 1), 125%RDF	347.63	83.33	430.96	163.99	266.97	264.39	-2.58
T ₁₃	G + S (3 : 1), 75% RDF	347.63	42.19	389.82	151.24	238.58	260.62	22.04
T ₁₄	G + S (3 : 1), 100%RDF	347.63	56.25	403.88	174.05	229.83	253.47	23.64
T ₁₅	G + S (3 : 1), 125%RDF	347.63	70.31	417.94	185.36	232.58	267.84	35.26

Table 40: Nitrogen balance sheet (2004-05) in the soil after harvest

Sym	Treatment	Initial Av. N (Kg/ha)	Added N (Kg/ha)	Total (Kg/ha)	Uptake (Kg/ha)	Expected (Kg/ha)	Actual Balance (Kg/ha)	Net Loss/gain (Kg/ha)
T ₁	Sole Groundnut with 75% RDF	342.61	18.75	361.36	135.45	225.91	239.01	13.10
T ₂	Sole Groundnut with 100% RDF	342.61	25.00	367.61	146.42	221.19	241.49	20.30
T ₃	Sole Groundnut with 125% RDF	342.61	31.25	373.86	161.12	212.74	237.56	24.82
T ₄	Sole Sweet corn with 75% RDF	342.61	112.50	455.11	62.35	392.76	357.91	-34.85
T ₅	Sole Sweet corn with 100% RDF	342.61	150.00	492.61	69.39	423.22	371.94	-51.28
T ₆	Sole Sweet corn with 125% RDF	342.61	187.50	530.11	81.28	448.83	391.10	-57.73
T ₇	G + S (1 : 1), 75% RDF	342.61	65.63	408.24	112.47	295.77	273.27	-22.50
T ₈	G + S (1 : 1), 100% RDF	342.61	87.50	430.11	125.66	304.45	277.33	-27.12
T ₉	G + S (1 : 1), 125% RDF	342.61	109.38	451.99	141.5	310.49	293.00	-17.49
T ₁₀	G + S (2 : 1), 75% RDF	342.61	50.00	392.61	122.95	269.66	261.37	-8.29
T ₁₁	G + S (2 : 1), 100% RDF	342.61	66.67	409.28	133.3	275.98	265.61	-10.37
T ₁₂	G + S (2 : 1), 125% RDF	342.61	83.33	425.94	148.04	277.90	271.70	-6.20
T ₁₃	G + S (3 : 1), 75% RDF	342.61	42.19	384.80	147.07	237.73	257.93	20.20
T ₁₄	G + S (3 : 1), 100% RDF	342.61	56.25	398.86	161.26	237.60	260.78	23.18
T ₁₅	G + S (3 : 1), 125% RDF	345.12	70.31	412.92	170.19	242.73	265.15	22.42

4.12 Weed Studies

The data related to number of broad leaved weeds and grasses and sedges per sq.m. and their respective weight per sq.m. as influenced by different treatments are given in Table 41 and 42. The major weed flora observed in groundnut + sweet corn intercropping system is as follows:

Broad leaved Weeds	Grasses and Sedges
1. <i>Amaranthus viridis</i>	1. <i>Cynodon dactylon</i>
2. <i>A. polygamous</i>	2. <i>Cyperus rotundus</i>
3. <i>A. spinosus</i>	3. <i>C. iria</i>
4. <i>Physalis minima</i>	4. <i>C. difformis</i>
5. <i>Mimosa pudica</i>	5. <i>Eleusine indica</i>
6. <i>Celosia argentea</i>	6. <i>Fimbristyllis miliaceae</i>
7. <i>Portulaca oleraceae</i>	7. <i>Digitaria sanguinalis</i>
8. <i>Ageratum conyzoides</i>	8. <i>Ischaemum rugosum</i>
9. <i>Euphorbia hirta</i>	

4.12.1 Weed count and dry matter of weeds (g/sq.m.) at 30DAS

4.12.1.1 Count of Broad Leaved Weeds per sq.m.

Data presented in Table 41 related to the count of broad leaved weeds indicated that the number of broad leaved weeds increased significantly due to sole cropping of sweet corn as compared to the sole cropping of groundnut. In case of intercropping treatments, the number of broad leaved weeds per sq.m increased as the proportion of sweet corn increased in the system. Sole sweet corn fertilized with 100% RDF (T₁) recorded significantly more number of broad leaved weeds per sq.m than all the remaining treatments except the treatments of sole sweet corn T₁ and T₆ and T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) which were at par the former treatment during the year 2003-04 while treatment T₁ recorded significantly more number of broad leaved weeds per sq.m

than all the remaining treatments except treatment T₅ (sole sweet corn with 100% RDF) during the year 2004-05 and in the mean of two years. In general, the count of broadleaved weeds decreased with increase in the proportion of groundnut in the intercropping combination.

Among the intercropping treatments, groundnut + sweet corn in 1:1 ratio with 75% RDF (T₇) recorded higher count of broadleaved weeds than majority of the intercropping treatments except, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) during 2003-04, groundnut + sweet corn in 1:1 ratio with 100 and 125% RDF (T₈ and T₉) and groundnut + sweet corn in 2:1 ratio with 75% RDF (T₁₀) during 2004-05 and groundnut + sweet corn in 1:1 and 2:1 ratios with 125 and 75% RDF (T₈ and T₁₀) respectively in the mean of two years. All these were at par with former treatment i.e. T₇. Further, groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁) recorded significantly less count of broadleaved weeds than all the intercropping treatments under 1:1 ratio i.e. T₇, T₈ and T₉ and groundnut + sweet corn in 2:1 ratio with 75% RDF (T₁₀) and it was at par with the remaining treatments. However, during 2004-05, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the other two intercropping treatments i.e. T₁₃ and T₁₄ and it recorded significantly less count of broadleaved weeds than the other intercropping treatments. Further, in the mean of two years, groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁) was at par with other two treatments in 3:1 ratio i.e. T₁₃ and T₁₅ and recorded significantly less count of broadleaved weeds than the remaining intercropping treatments.

4.12.1.2 Dry weight of broad leaved weeds (g/sq.m.)

Dry weight of broadleaved weeds generally increased with increase in the proportion of sweet corn in the intercropping combinations. Dry weight of broadleaved weeds under sole cropping of sweet corn was significantly higher than all the treatments of sole groundnut. Further, sole

Table 41 : Weed count and dry matter of weeds (g/sq.m.) at 30DAS

Sym.	Treatment	Broad Leaved Weeds						Grasses & Sedges					
		Count/sq.m.			Dry Wt.(g)/sq.m.			Count/sq.m.			Dry Wt.(g)/sq.m.		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	10.33	17.67	14.00	3.252	6.225	4.739	10.33	12.67	11.50	3.673	4.010	3.842
T ₂	Sole Groundnut with 100% RDF	9.33	9.10	9.22	3.011	4.871	3.941	8.67	9.01	8.84	2.907	3.650	3.279
T ₃	Sole Groundnut with 125% RDF	8.67	7.86	8.27	2.972	4.206	3.589	8.33	7.67	8.00	2.905	3.080	2.993
T ₄	Sole Sweet corn with 75% RDF	25.67	35.16	30.42	8.642	18.713	13.678	18.00	19.03	18.52	6.077	6.949	6.513
T ₅	Sole Sweet corn with 100% RDF	26.00	34.33	30.17	8.807	18.198	13.503	17.67	19.30	18.49	5.798	6.867	6.333
T ₆	Sole Sweet corn with 125% RDF	24.00	29.62	26.81	8.116	15.751	11.934	16.33	15.67	16.00	5.982	6.372	6.177
T ₇	G + S (1 : 1), 75%RDF	24.33	26.67	25.50	7.837	14.237	11.037	17.33	16.67	17.00	5.901	6.666	6.284
T ₈	G + S (1 : 1), 100%RDF	18.00	22.92	20.46	6.139	12.249	9.194	15.00	14.33	14.67	5.581	5.733	5.657
T ₉	G + S (1 : 1), 125%RDF	21.33	24.29	22.81	7.018	12.995	10.007	13.67	9.00	11.34	5.237	5.174	5.206
T ₁₀	G + S (2 : 1), 75%RDF	19.67	25.50	22.59	7.512	13.597	10.555	13.00	12.33	12.67	4.986	4.819	4.903
T ₁₁	G + S (2 : 1), 100%RDF	16.33	21.03	18.68	6.870	11.244	9.057	12.00	11.33	11.67	4.858	4.518	4.688
T ₁₂	G + S (2 : 1), 125%RDF	16.67	20.00	18.34	6.510	10.675	8.593	13.33	12.67	13.00	5.389	5.172	5.281
T ₁₃	G + S (3 : 1), 75% RDF	15.67	15.15	15.41	7.059	8.104	7.582	11.33	10.67	11.00	5.171	3.775	4.473
T ₁₄	G + S (3 : 1), 100%RDF	14.67	13.03	13.85	6.306	6.962	6.634	9.67	9.00	9.34	3.696	3.600	3.648
T ₁₅	G + S (3 : 1), 125%RDF	15.33	12.91	14.12	5.471	6.890	6.181	9.00	8.33	8.67	3.056	3.318	3.187
	S.E. +/-	1.49	1.45	1.16	0.486	0.753	0.611	1.25	1.17	1.21	0.395	0.483	0.413
	C.D. 5%	4.31	4.20	3.36	1.11	2.18	1.80	3.61	3.39	3.50	1.14	1.40	1.19

sweet corn with 75% RDF (T₄) at par with the remaining two treatments sole sweet corn as well as groundnut + sweet corn in 1:1 ratio with 75% RDF (T₇) during 2003-04; with sole sweet corn with 100% RDF (T₅), during 2004-05 and the remaining two treatments of sole sweet corn in the mean of two years and it (T₄) recorded significantly higher dry weight of broadleaved weeds than all the remaining treatments during the respective observations.

Among the intercropping treatments, groundnut + sweet corn in 1:1 ratio with 75% RDF (T₇) recorded significantly more dry weight of broadleaved weeds than groundnut + sweet corn in 1:1 ratio with 100% RDF (T₈), groundnut + sweet corn in 2:1 ratio with 125% RDF (T₁₂), groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁) and groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) However, it was at par with the remaining treatments during 2003-04. Further, during 2004-05, again the same treatment i.e. T₇ recorded significantly more dry weight of broadleaved weeds than all the treatments under 3:1 ratio i.e. T₁₅, T₁₁ and T₁₅ and 100 and 125% RDF and the treatments of 100 and 125% RDF at 2:1 ratio i.e. T₁₁ and T₁₂. Further, it (T₇) was at par with the remaining treatments.

However, in the mean of two years, though the same treatment i.e. T₇ recorded maximum dry weight of broadleaved weeds among the intercropping treatments, it was at par with only groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) and groundnut + sweet corn in 2:1 ratio with 75% RDF (T₁₀) and was significantly superior than the remaining treatments. On the other hand, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) recorded significantly less dry weight of broadleaved weeds than majority of the intercropping treatments except, groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁) during all the three observations and groundnut + sweet corn in 3:1 ratio with 75% RDF (T₁₃)

during 2004-05 and in the mean of two years and groundnut + sweet corn in 2:1 ratio with 125% RDF (T₁₂) during 2003-04 which were at par with the former treatment i.e. T₁₅.

4.12.1.3 Count of grasses and sedges per sq.m.

Data pertaining to the count of grasses and sedges revealed that the number of grasses and sedges increased significantly due to sole cropping of sweet corn as compared to the sole cropping of groundnut. The number of grasses and sedges per sq.m increased significantly under the sole cropping of sweet corn than all the treatments of sole groundnut during all the three observations except, sole sweet corn with 125% RDF (T₆) which was at par with sole groundnut with 75% RDF (T₁) during 2004-05. Further, sole sweet corn with 75% RDF (T₄) was at par with the remaining two treatments of sole sweet corn and the treatment of groundnut + sweet corn in 1:1 ratio with 75 and 100% RDF (T₇ and T₈) and it was significantly superior than the remaining treatments of intercropping during 2003-04. On the other hand, sole groundnut with 125% RDF (T₃) recorded the minimum count of grasses and sedges per sq.m. which was at par with the other two sole groundnut treatments i.e. T₁, T₂ as well as all the treatments of groundnut + sweet corn in 3:1 ratio i.e. T₁₃, T₁₄ and T₁₅ and it was significantly inferior than the remaining intercropping treatments. Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the remaining treatments of 3:1 ratio i.e. T₁₃ and T₁₄ and groundnut + sweet corn in 2:1 ratio with 100% RDF (T₁₁) and it recorded significantly less count of grasses and sedges than the remaining intercropping treatments during 2003-04.

Further, during 2004-05, sole sweet corn with 100% RDF (T₅) recorded significantly more number of grasses and sedges per sq.m than sole sweet corn with 125% RDF i.e. T₆, as well as all the intercropping treatments except groundnut + sweet corn in 1:1 ratio with 75% RDF (T₇)

which was at par with the former treatment. Further, sole sweet corn with 100% RDF (T₅) was at par with T₁. The lowest count of grasses and sedges was recorded at sole groundnut with 125% RDF (T₃) which was at par with sole groundnut with 100% RDF (T₂), groundnut + sweet corn in 1:1 ratio with 100% RDF (T₈) and all the treatments of groundnut + sweet corn in 3:1 ratio i.e. T₁₃, T₁₄ and T₁₅ and it (T₃) was significantly inferior to the remaining treatments.

Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the remaining treatments of 3:1 ratio i.e. T₁₃ and T₁₄ and groundnut + sweet corn in 2:1 and 1:1 ratios with 100 and 125% RDF (T₁₁ and T₉) and recorded significantly less number of grasses and sedges per sq.m. than the remaining intercropping treatments.

In the mean of two years, the trend in count of grasses and sedges per sq.m. was exactly the same as observed during 2004-05 with only one exception i.e. sole sweet corn with 75% RDF (T₁) which was at par with sole sweet corn with 100 and 125% RDF (T₅ and T₆) and groundnut + sweet corn in 1:1 ratio with 75% RDF (T₇) and it was significantly superior over the remaining intercropping treatments.

4.12.1.4 Dry weight of grasses and sedges (g/sq.m.)

Data related to dry weight of grasses and sedges under sole and intercropping of sole sweet corn recorded significantly higher dry weight of grasses and sedges per sq.m than that recorded under all the treatments of sole groundnut, during both the years of experimentation and in the mean of two years. Further, sole sweet corn with 75% RDF (T₁) was at par with the remaining two treatments of sole sweet corn i.e. T₄ and T₁₅ and groundnut + sweet corn in 1:1 ratio with 75 and 100% RDF (T₇ and T₈) during both the years and in the mean of two years. In addition to this, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) and groundnut + sweet corn in 2:1 ratio with 75% RDF (T₁₀) during 2003-04. The former

treatment of sole sweet corn with 75% RDF (T₄) recorded significantly higher dry weight of grasses and sedges than the remaining treatments of intercropping during the individual years and in the mean of two years.

On the other hand, sole groundnut with 125% RDF (T₃) recorded significantly less dry weight of grasses and sedges per sq.m than most of the intercropping treatments except, groundnut + sweet corn in 3:1 ratio with 100 and 125% RDF (T₁₄ and T₁₅) during all the three observations and groundnut + sweet corn in 3:1 ratio with 75% RDF (T₁₃) during 2004-05; which were at par with the former treatment T₃ and it (T₃) recorded significantly less dry weight of grasses and sedges than the remaining intercropping treatments during the respective observations.

In addition to this sole groundnut with 125% RDF (T₃) was also at par with other sole treatments of groundnut (T₁ and T₂) during all the three observations. Dry weight of grasses and sedges decreased with increase in the proportion of groundnut in respect of intercropping combinations during all the three observations.

Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the same ratio with 100% RDF i.e. T₁₄ during both the years as well as in the mean of two years and it (T₁₄) recorded significantly less dry weight of grasses and sedges per sq.m. than the remaining intercropping treatments and in the mean of two years except the treatment groundnut + sweet corn in 3:1 ratio with 75% RDF (T₁₃) and groundnut + sweet corn in 2:1 ratio with 100% RDF (T₁₁) which were at par with the former treatment during 2004-05.

4.12.2 Weed count and dry weight of weeds (g/sq.m.) after harvest of the crops

Data pertaining to the count and dry weight of broadleaved weeds and grasses and sedges after harvest of the crops have been presented in the Table 42.

Table 42: Weed count and dry matter of weeds (g/sq.m.) after harvest of the crops

Sym.	Treatment	Broad Leaved Weeds						Grasses & Sedges					
		Count/sq.m.			Dry Wt.(g/sq.m.)			Count/sq.m.			Dry Wt.(g/sq.m.)		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	19.03	16.87	17.95	25.599	25.825	25.712	17.07	23.73	20.40	14.146	14.168	14.157
T ₂	Sole Groundnut with 100% RDF	17.67	18.33	18.00	24.017	24.412	24.215	14.33	14.87	14.60	13.667	11.994	12.831
T ₃	Sole Groundnut with 125% RDF	15.77	14.38	15.08	21.413	21.825	21.619	12.20	14.80	13.50	12.608	11.716	12.162
T ₄	Sole Sweet corn with 75% RDF	47.20	44.33	45.77	63.847	59.160	61.504	32.03	29.33	30.68	25.277	23.492	24.385
T ₅	Sole Sweet corn with 100% RDF	48.27	41.33	44.80	65.099	55.731	60.415	31.37	26.00	28.69	24.994	20.815	22.905
T ₆	Sole Sweet corn with 125% RDF	44.43	40.67	42.55	60.216	52.672	56.444	28.07	21.93	25.00	22.540	17.626	20.083
T ₇	G + S (1:1), 75%RDF	37.60	30.67	34.14	50.981	46.170	48.576	31.17	25.00	28.09	24.548	20.004	22.276
T ₈	G + S (1:1), 100%RDF	33.10	32.79	32.95	44.936	43.669	44.303	26.63	23.67	25.15	21.000	18.947	19.974
T ₉	G + S (1:1), 125%RDF	32.27	32.46	32.37	43.731	41.910	42.821	24.40	22.00	23.20	19.157	17.607	18.382
T ₁₀	G + S (2:1), 75%RDF	34.60	33.67	34.14	46.794	44.836	45.815	23.83	20.67	22.25	18.345	16.518	17.432
T ₁₁	G + S (2:1), 100%RDF	30.67	30.00	30.34	40.363	40.731	40.547	21.13	21.67	21.40	16.645	17.380	17.013
T ₁₂	G + S (2:1), 125%RDF	30.37	31.67	31.02	40.924	42.241	41.583	23.03	19.60	21.32	17.983	15.665	16.824
T ₁₃	G + S (3:1), 75% RDF	25.73	27.32	26.53	34.986	33.766	34.376	21.13	18.67	19.90	17.394	14.931	16.163
T ₁₄	G + S (3:1), 100%RDF	24.33	23.00	23.67	33.151	30.712	31.932	14.07	17.73	15.90	13.561	14.201	13.881
T ₁₅	G + S (3:1), 125%RDF	22.53	19.71	21.12	30.496	30.390	30.443	14.10	16.33	15.22	12.755	13.048	12.902
	S.E. +/-	1.70	1.52	1.63	1.955	2.001	1.821	2.17	1.44	1.68	1.599	1.166	1.329
	C.D. 5%	4.93	4.39	4.78	5.66	5.79	5.32	6.30	4.18	4.74	4.63	3.38	3.92

4.12.2.1 Count of Broadleaved weeds per sq.m.

It was observed that all the three treatments of sole sweet corn recorded significantly higher count of broadleaved weeds per sq.m than all the treatments of sole groundnut as well as intercropping during both the years and in the mean of two years. However, all the three treatments of sweet corn sole cropping were at par.

On the other hand, sole groundnut with 125% RDF (T₃) recorded significantly less number of broad leaved weeds per sq.m than all the intercropping treatments during both the years and in the mean of two years. However, the former treatment T₃ was at par with two treatments of sole groundnut i.e. T₁ and T₂.

In general, the count of broadleaved weeds in the intercropping treatments decreased with increase in ground' proportion. Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the remaining treatments of groundnut + sweet corn in 3:1 ratio i.e. T₁₃ and T₁₄ and recorded significantly less count of broadleaved weeds than the intercropping treatments during 2003-04. However, during 2004-05 and in the mean of two years, again groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) and recorded significantly less count of broadleaved weeds than the other intercropping treatments.

4.12.2.2 Dry weight of broad leaved weeds (g/sq.m.)

In case of dry weight of broadleaved weeds, again all the treatments of sole sweet corn were significantly superior over the remaining treatments of sole groundnut as well as intercropping treatments during all the three observations. Further, all the treatments of sole sweet corn with were at par with each other during 2003-04 and in the mean of two years, however, during 2004-05, sole sweet corn with 75% RDF (T₁) was at par with sole sweet corn with 100% RDF (T₃) and it was significantly

superior over sole sweet corn with 125% RDF (T_6). On the other hand, sole groundnut with 125% RDF (T_3) recorded significantly less dry weight of broadleaved weeds than all the intercropping treatments and it was at par with the remaining two treatments of sole groundnut i.e. T_1 and T_2 during all the three observations.

In respect of intercropping, groundnut + sweet corn in 3:1 ratio with 125% RDF (T_{15}) recorded significantly less dry weight of broadleaved weeds than all the intercropping treatments under 1:1 and 2:1 ratios and it was at par with the remaining two treatments under 3:1 ratio i.e. T_{13} and T_{14} . Dry weight of broadleaved weeds increased with increase in the proportion of sweet corn in intercropping treatments during all the three observations.

4.12.2.3 Count of grasses and sedges per sq.m.

Data pertaining to the count of grasses and sedges revealed that the number of grasses and sedges per sq.m increased significantly under the sole cropping of sweet corn than all the treatments of sole groundnut during all the three observations. Sole sweet corn with 75% RDF (T_4) was at par with the other two treatments of sole sweet corn during 2003-04 and sole sweet corn with 100% RDF (T_5) during 2004-05 and in the mean of two years and it recorded significantly higher count of grasses and sedges per sq.m. than all the remaining treatments of sole and intercropping during the respective observations.

On the other hand, sole groundnut with 125% RDF i.e. T_3 was at par with the remaining two treatments of sole groundnut and groundnut + sweet corn in 3:1 ratio with 100 and 125% RDF (T_{14} and T_{15}) during 2003-04. However, during 2004-05 and in the mean of two years, sole groundnut with 125% RDF (T_3) was at par with sole groundnut with 100% RDF (T_2) and all the intercropping treatments under 3:1 ratio i.e. T_{13} , T_{14} and T_{15} and it recorded significantly less count of grasses and sedges than the remaining treatments.

Among the intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T_{15}) recorded statistically similar count of grasses and sedges under 3:1 ratio with 100% RDF i.e. T_{11} during 2003-04; groundnut + sweet corn in 3:1 ratio with 75 and 100 %RDF (T_{13} and T_{11}) in the mean of two years. However, it (T_{15}) recorded significantly less number of grasses and sedges than the remaining treatments under respective observations. The count of grasses and sedges decreased with increase in the proportion of groundnut in intercropping combinations.

4.12.2.4 Dry weight of grasses and sedges (g/sq.m.)

Sole sweet corn with 75% RDF (T_4) recorded significantly higher dry weight of grasses and sedges than the remaining treatments. However, it was at par with the other two treatments of sole sweet corn i.e. T_1 and T_2 and groundnut + sweet corn in 1:1 ratio with 75 and 100% RDF (T_7 and T_8) and was significantly superior than the remaining treatments of sole and intercropping during 2003-04. However, during 2004-05, it (T_4) was at par with sole sweet corn with 100% RDF (T_5) and in the mean of two years, it (T_4) was at par with T_5 as well as groundnut + sweet corn in 1:1 ratio with 75% RDF (T_7) and was significantly superior than the remaining treatments during the respective observations.

On the other hand, sole groundnut with 125% RDF (T_3) was at par with other two treatments of sole groundnut (T_1 and T_2) during all the three observations and groundnut + sweet corn in 3:1 ratio with 100% RDF (T_{14}) during 2003-04 and in the mean of two years and groundnut + sweet corn in 3:1 ratio under both the fertilizer levels i.e. T_{13} and T_{11} during 2004-05. Further, T_4 recorded significantly less dry weight of grasses and sedges than the remaining treatments under the respective observations.

In respect of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T_{15}) was at par with the other two treatments of 3:1 ratio i.e. T_{13} and T_{11} during all the three observations and groundnut +

sweet corn in 2:1 ratio with 125% RDF (T₁₂) during 2004-05 and in the mean of two years; and it (T₁₅) recorded significantly less dry weight of grasses and sedges than the remaining intercropping treatments during the respective observations. In general, the dry weight of grasses and sedges increased with increase in the proportion of sweet corn in intercropping combinations.

4.13 Bivariate analysis of yield of groundnut + sweet corn intercropping system

The actual pod yield of groundnut and cob yield of sweet corn as affected by different treatments were presented in Table 43 and plotted on rectangular axis as shown in Fig 25a, 25b, and 25c and presented graphically by drawing the circles around the point of treatment mean as center. The circles drawn were having radius equal to combined critical difference. The points which lied in the circle were treated as on par with each other and the points which lied outside the circumference of circle differ significantly from each other. It was observed that during both the years of experimentation and in the mean of two years, different ratios and fertilizer levels showed significant differences in the combined yield of groundnut and sweet corn.

From the graph, it was clear that during 2003-04, in case of 1:1 ratio, treatment T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF) was at par with the treatment T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and it was significantly superior over the remaining treatments of intercropping. On the other hand, during the year, 2004-05, treatment T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF), T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF) and T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) were at par with each other and significantly superior over the remaining treatments of intercropping in respect of combined pod and cob yield. In the mean of two years, the combined pod

Table 43 : Effect of different treatments on combined pod yield of groundnut and cob yield of sweet corn (q/ha)

Treatments	2003-04		2004-05		Mean	
	Groundnut	Sweet corn	Groundnut	Sweet corn	Groundnut	Sweet corn
	T ₇ G + S (1 : 1), 75% RDF	19.40	58.85	16.40	66.75	17.90
T ₈ G + S (1 : 1), 100% RDF	19.93	64.05	17.29	69.75	18.61	66.90
T ₉ G + S (1 : 1), 125% RDF	21.34	65.92	18.69	77.60	20.02	71.76
T ₁₀ G + S (2 : 1), 75% RDF	22.34	51.83	19.11	53.24	20.72	52.53
T ₁₁ G + S (2 : 1), 100% RDF	23.86	54.42	20.05	54.67	21.96	54.55
T ₁₂ G + S (2 : 1), 125% RDF	24.39	56.56	21.95	57.58	23.17	57.07
T ₁₃ G + S (3 : 1), 75% RDF	25.04	40.03	25.40	42.68	25.22	41.36
T ₁₄ G + S (3 : 1), 100% RDF	28.92	40.30	26.28	43.61	27.60	41.95
T ₁₅ G + S (3 : 1), 125% RDF	29.98	42.95	26.34	44.83	28.16	43.89
C.I.D. at 5%	4.59		4.90		6.26	

Fig. 25a. Yields of groundnut and sweet corn as influenced by fertilizer levels and row proportion for the year 2003-04

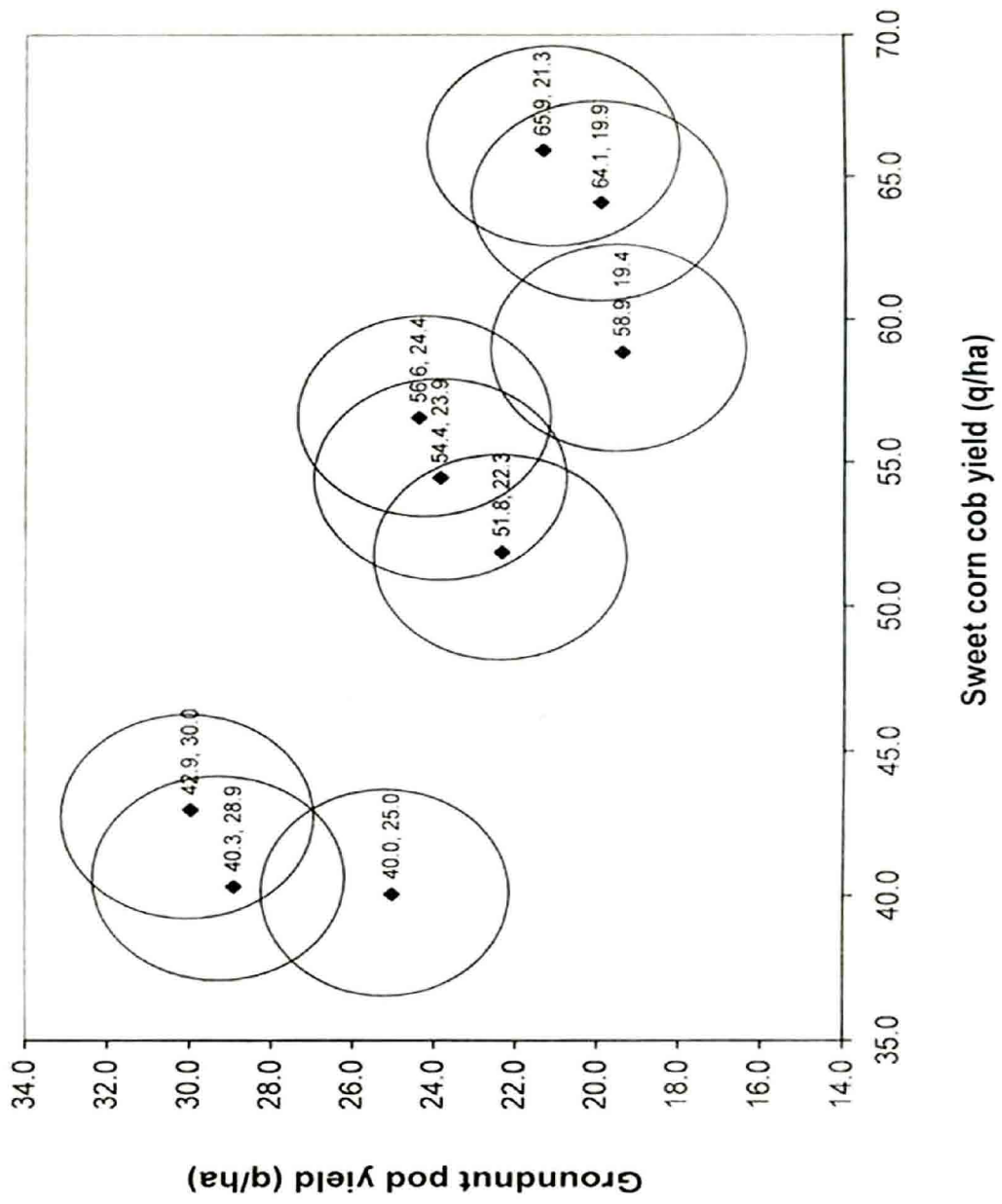


Fig. 25b. Yields of groundnut and sweet corn as influenced by fertilizer levels and row proportion for the year 2004-05

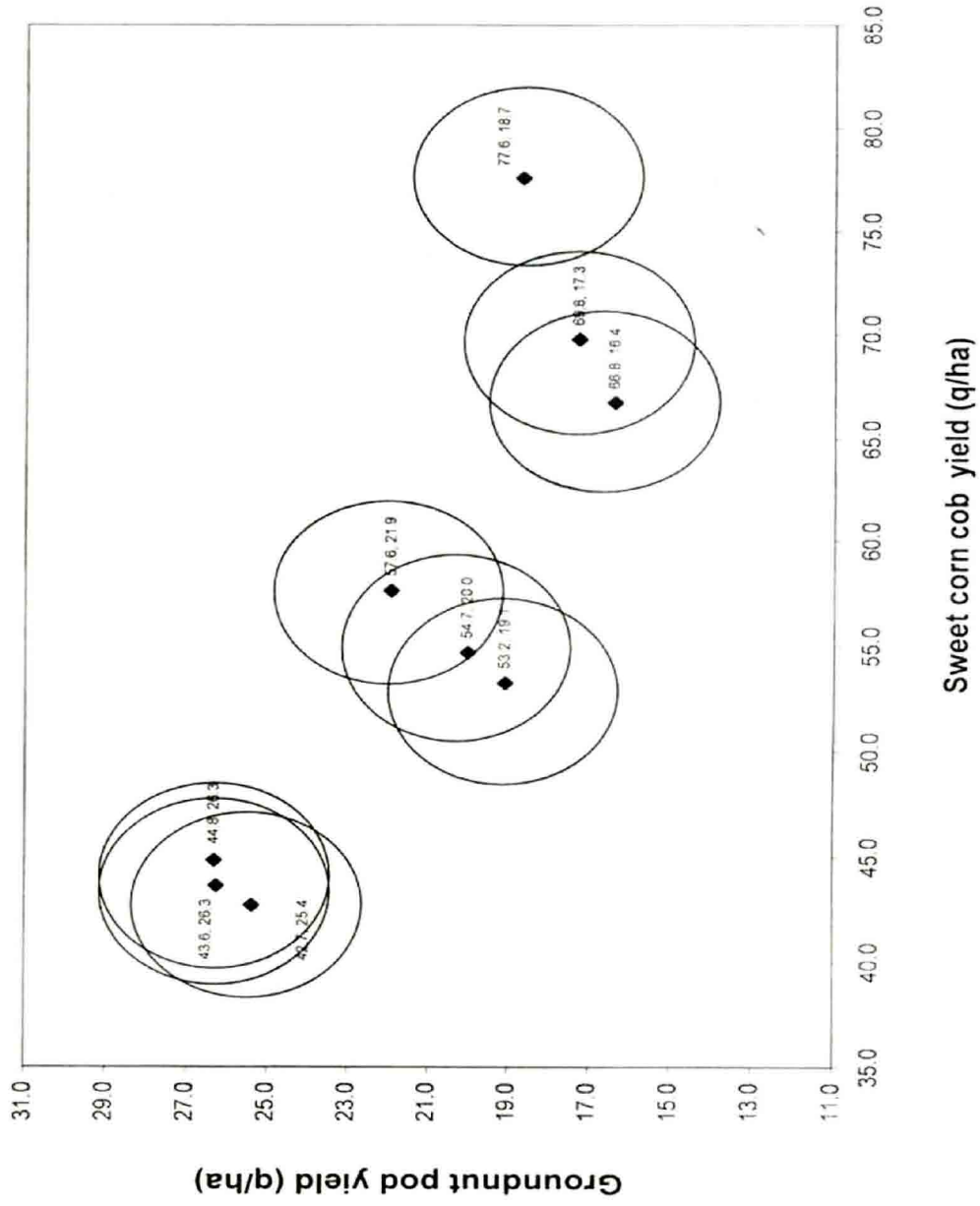
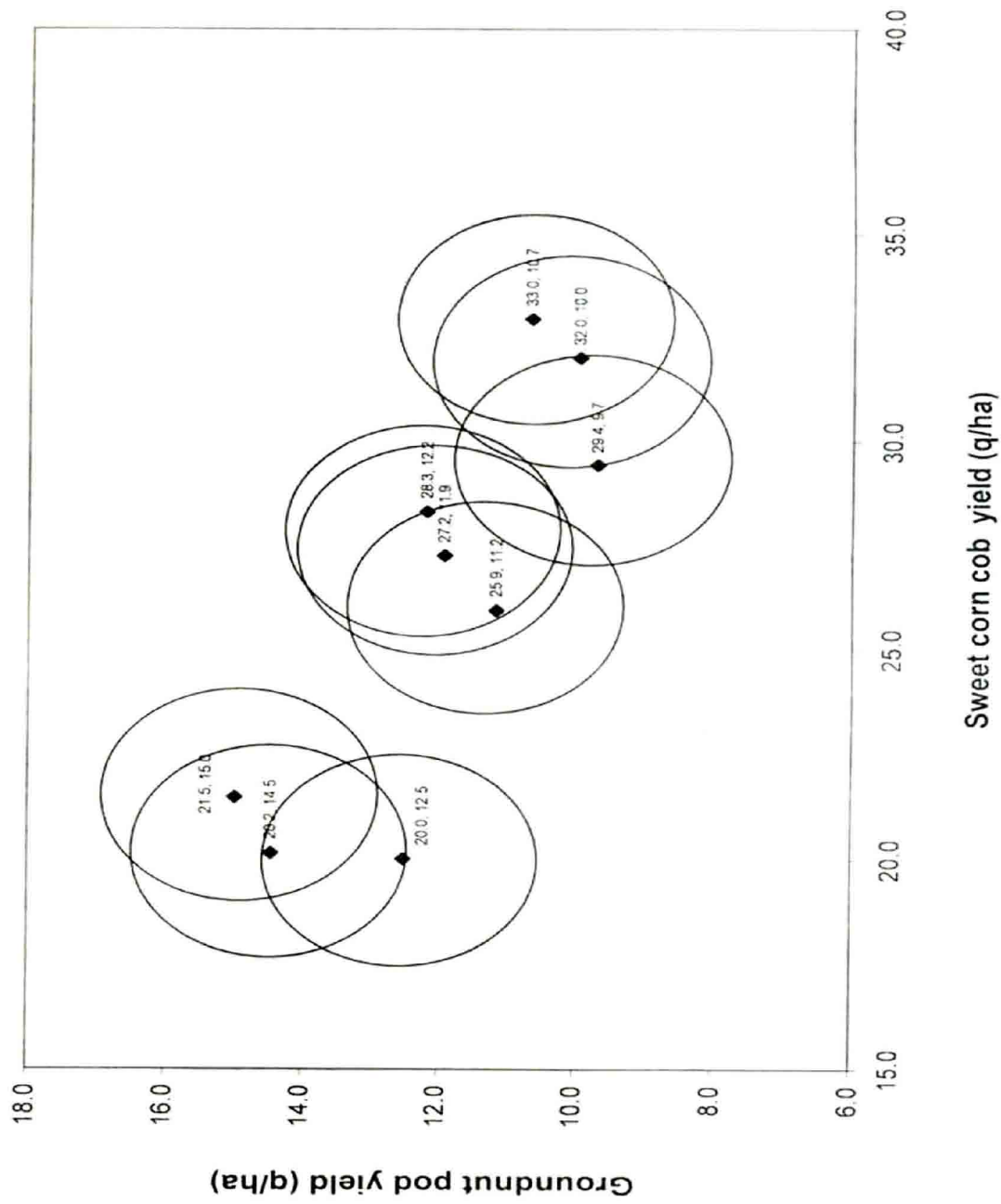


Fig. 25c. Mean yields of groundnut and sweet corn as influenced by fertilizer levels and row proportion



and cob yield recorded by the treatment T₆ (groundnut + sweet corn in 1:1 ratio with 125% RDF) was significantly higher than T₈ (groundnut + sweet corn in 1:1 ratio with 100% RDF), T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) and remaining intercropping treatments but the treatments T₇ and T₈ were at par with each other.

4.14 Effect of different treatments on competitive coefficients

4.14.1 Land equivalent ratio (LER)

Data presented in Table 44 indicated that the land equivalent ratio was more than 1.0 in case of all the intercropping treatments. Application of 125% RDF to the component crops at 3:1 ratio (T₁₅) recorded the highest LER during both the years of experimentation and in the mean of two years, which was closely followed by the treatment T₁₁ (groundnut + sweet corn in 3:1 ratio with 100% RDF). Treatments T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) recorded the lowest LER during 2003-04 and in the mean of two years. However, during 2004-05, treatment T₁₀ (groundnut + sweet corn in 2:1 ratio with 125% RDF) recorded the lowest value of LER.

4.14.2 Crop equivalent yield

4.14.2.1 Groundnut and sweet corn equivalent yield

Data depicted in Table 44 indicated that the trend in groundnut and sweet corn equivalent yield was similar. Treatment T₁ (sole sweet corn with 125% RDF) which registered significantly higher groundnut and sweet corn equivalent yield than all the remaining sole and intercropping treatments, was followed by T₃ (sole sweet corn with 100% RDF) and T₁ (sole sweet corn with 75% RDF) during both the years of experimentation and in the mean of two years. Among the intercropping treatments, treatment T₆ (groundnut + sweet corn in 1:1 ratio with 125% RDF) recorded significantly higher groundnut and sweet corn equivalent

Table 44 : LER and Crop Equivalent Yield (q/ha) as affected by different treatments (Mean of two years)

Treatments	LER			Groundnut equivalent yield			Sweet corn equivalent yield		
	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
	T ₁ Sole groundnut, 75% RDF	1.00	1.00	1.00	32.27	28.22	30.25	48.41	42.33
T ₂ Sole groundnut, 100% RDF	1.00	1.00	1.00	33.33	28.74	31.04	50.00	43.12	46.56
T ₃ Sole groundnut, 125% RDF	1.00	1.00	1.00	34.09	31.04	32.56	51.14	46.56	48.85
T ₄ Sole sweet corn, 75% RDF	1.00	1.00	1.00	72.60	84.83	78.71	108.89	127.25	118.07
T ₅ Sole sweet corn, 100% RDF	1.00	1.00	1.00	77.71	90.21	83.96	116.56	135.32	125.94
T ₆ Sole sweet corn, 125% RDF	1.00	1.00	1.00	83.02	100.29	91.65	124.52	150.44	137.48
T ₇ G + S (1:1), 75% RDF	1.14	1.11	1.13	58.63	60.90	59.77	87.95	91.36	89.65
T ₈ G + S (1:1), 100% RDF	1.15	1.12	1.14	62.63	63.79	63.21	93.95	95.68	94.81
T ₉ G + S (1:1), 125% RDF	1.16	1.12	1.14	65.29	70.43	67.86	97.93	105.64	101.79
T ₁₀ G + S (2:1), 75% RDF	1.17	1.10	1.14	56.89	54.60	55.75	85.33	81.91	83.62
T ₁₁ G + S (2:1), 100% RDF	1.18	1.10	1.14	60.14	56.50	58.32	90.22	84.74	87.48
T ₁₂ G + S (2:1), 125% RDF	1.17	1.12	1.15	62.10	60.34	61.22	93.15	90.50	91.83
T ₁₃ G + S (3:1), 75% RDF	1.14	1.24	1.19	51.73	53.85	52.79	77.59	80.78	79.19
T ₁₄ G + S (3:1), 100% RDF	1.21	1.24	1.23	55.79	55.35	55.57	83.69	83.03	83.36
T ₁₅ G + S (3:1), 125% RDF	1.22	1.25	1.24	58.61	56.22	57.42	87.92	84.34	86.13
S.E. +/-	--	--	--	1.48	2.16	1.20	2.21	3.24	1.79
C.D. 5%	--	--	--	4.28	6.26	3.47	6.41	9.39	5.20

yields than all the remaining intercrop combinations during both the years of experimentation and in the mean of two years except treatment T₈ (groundnut+ sweet corn in 1:1ratio with 100% RDF) and T₁₂ (groundnut + sweet corn in 2:1ratio with 125% RDF) which was at par with the former intercropping treatment, during 2003-04.

In general, the groundnut and sweet corn equivalent yields increased with increase in the proportion of sweet corn in the intercropping combinations and within the same ratio of intercropping, they were higher under higher fertilizer dose.

4.14.3 Relative crowding coefficient (RCC)

Relative crowding coefficient was worked out for different intercropping treatments and the mean values are presented in Table 45.

Relative Crowding Coefficient of both the crops was more than one. Groundnut recorded maximum RCC at 3:1 row proportion indicating that the groundnut yield was more than expected yield, while this crop showed low RCC at 2:1 and 1:1 row proportions. Sweet corn in combination with groundnut recorded maximum RCC under 2:1 row proportion indicating its more yield than expected one, followed by 3:1 and 1:1 row proportions.

4.14.4 Relative yield total (RYT)

It is clear from the values of relative yield total (RYT) of intercropping treatments given in Table 45, that RYT values were improved with increase in the groundnut proportion in the intercropping. Further, it also increased with increase in the level of fertilizer under all the three ratios. Therefore, the higher RYT value was recorded under T₁₂ (groundnut + sweet corn in 3:1ratio with 125% RDF).

Table 45 : Effect of different treatments on competitive coefficients (Mean of two years)

Treat.	Relative Crowding Coefficient (RCC)		RYT	Aggressivity		Competitive Ratio		Crop Performance Ratio (CPR)		Relative Yield Loss (%)	ATER			
	G	S		G	S	G	S	G	S			Total	G	S
T ₇	1.450	1.136	1.647	0.562	0.120	-0.120	1.113	0.899	1.184	1.064	1.088	-40.81	-46.81	0.934
T ₈	1.497	1.133	1.995	0.565	0.137	-0.137	1.129	0.886	1.199	1.062	1.089	-40.04	-46.88	0.941
T ₉	1.595	1.092	1.741	0.568	0.185	-0.185	1.178	0.849	1.229	1.044	1.079	-38.53	-47.80	0.950
T ₁₀	1.072	1.627	1.744	0.565	-0.326	0.326	0.758	1.318	1.023	1.348	1.237	-31.48	-55.51	0.971
T ₁₁	1.191	1.551	1.847	0.570	-0.257	0.257	0.804	1.243	1.056	1.312	1.227	-29.26	-56.69	0.986
T ₁₂	1.215	1.441	1.751	0.573	-0.196	0.196	0.844	1.185	1.062	1.258	1.194	-28.85	-58.49	0.988
T ₁₃	1.673	1.617	2.705	0.592	-0.289	0.289	0.794	1.260	1.112	1.401	1.275	-16.61	-64.97	1.059
T ₁₄	1.678	1.499	2.515	0.611	-0.147	0.147	0.890	1.124	1.186	1.332	1.270	-11.07	-66.69	1.104
T ₁₅	1.731	1.407	2.435	0.622	-0.124	0.124	0.903	1.108	1.153	1.277	1.225	-13.53	-68.08	1.169

4.14.5 Aggressivity (A)

As regards to mean values of aggressivity index presented in Table 45, it was observed that aggressivity index was maximum or positive for groundnut when grown in combination with sweet corn in 1:1 row proportion and it increased with increase in the level of fertilizer and therefore, the aggressivity index value was higher with groundnut + sweet corn in 1:1ratio with 125% RDF (T₉) than the other intercropping treatments. Further, the aggressivity index values were negative under 2:1 and 3:1 ratios. On the other hand, in respect of sweet corn, the aggressivity index values were positive under 2:1 and 3:1 ratios and they were negative under 1:1 ratio. Further, the aggressivity index values of sweet corn increased with decrease in the level of fertilizer under all the ratios. The highest aggressivity index value of sweet corn was noticed under groundnut + sweet corn in 2:1ratio with 75% RDF (T₁₀)

4.14.6 Competitive ratio (CR)

The competitive ratio of groundnut with sweet corn (Table 45) recorded due to different treatment combinations indicated that competitive ratio values for groundnut were less than 1 in 2:1 and 3:1 row proportions and it was the lowest under T₁₀ (groundnut + sweet corn in 2:1 ratio with 75% RDF). While on the other hand, they were more than one under 1:1 ratio and CR was higher under T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF). While in case of sweet corn, CR was less than one under all the treatments in 1:1 ratio. The CR value of sweet corn was the lowest under T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF). On the other hand, CR value of sweet corn was more than one under 2:1 and 3:1 ratios and it was maximum under T₁₀ (groundnut + sweet corn in 2:1 ratio with 75% RDF). Under the respective planting ratios, the value of CR of sweet corn decreased with increase in the level of fertilizer.

4.14.7 Crop performance ratio (CPR)

The crop performance ratio of groundnut was higher under the treatment T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF) whereas it was less under the treatment T₁₀ (groundnut + sweet corn in 2:1 ratio with 75% RDF). On the other hand, CPR value of sweet corn was higher under the treatment T₁₃ (groundnut + sweet corn in 3:1 ratio with 75% RDF) and it was less under the treatment T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF). As regards the combined crop condition of groundnut and sweet corn, the CPR was higher under 3:1 ratio with 75 and 100% RDF i.e. T₁₃ and T₁₄. While, it was the lowest under the treatment T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF). In general, the CPR values decreased with decrease in the level of fertilizer in case of groundnut and increased with decrease in the level of fertilizer in case of sweet corn.

4.14.8 Relative yield loss (RYL)

Data presented in Table 45 indicated the mean values of relative yield loss of intercropping treatments. As regards groundnut it is observed that % RYL values were negative under both the crops. In general, the RYL values increased with increase in the level of fertilizer in case of groundnut and in case of sweet corn, the trend was reverse. In case of groundnut, the higher RYL percentage was recorded under T₁₁ (groundnut + sweet corn in 3:1 ratio with 100% RDF) and the lowest value was recorded under T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF). On the other hand, in case of sweet corn, the higher RYL percentage was recorded under T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) and the lowest value was recorded under T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF).

4.14.9 Area- Time Equivalent Ratio (ATER)

The values of Area -Time Equivalent Ratio (ATER) recorded in relation to different intercrop combinations are given in Table 45. Higher area-time equivalent ratio was recorded with the treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) and it was the lowest under T₁ (groundnut + sweet corn in 1:1 ratio with 75% RDF). In general, the ATER values increased with increase in the proportion of groundnut as well as the level of fertilizer in the intercropping combination.

4.13 Economics of groundnut + sweet corn cultivation

Data on economics pertaining to cost of cultivation, gross returns, net returns and benefit cost ratio (B:C) under various treatments are furnished in Table 46 and depicted in Fig. 26.

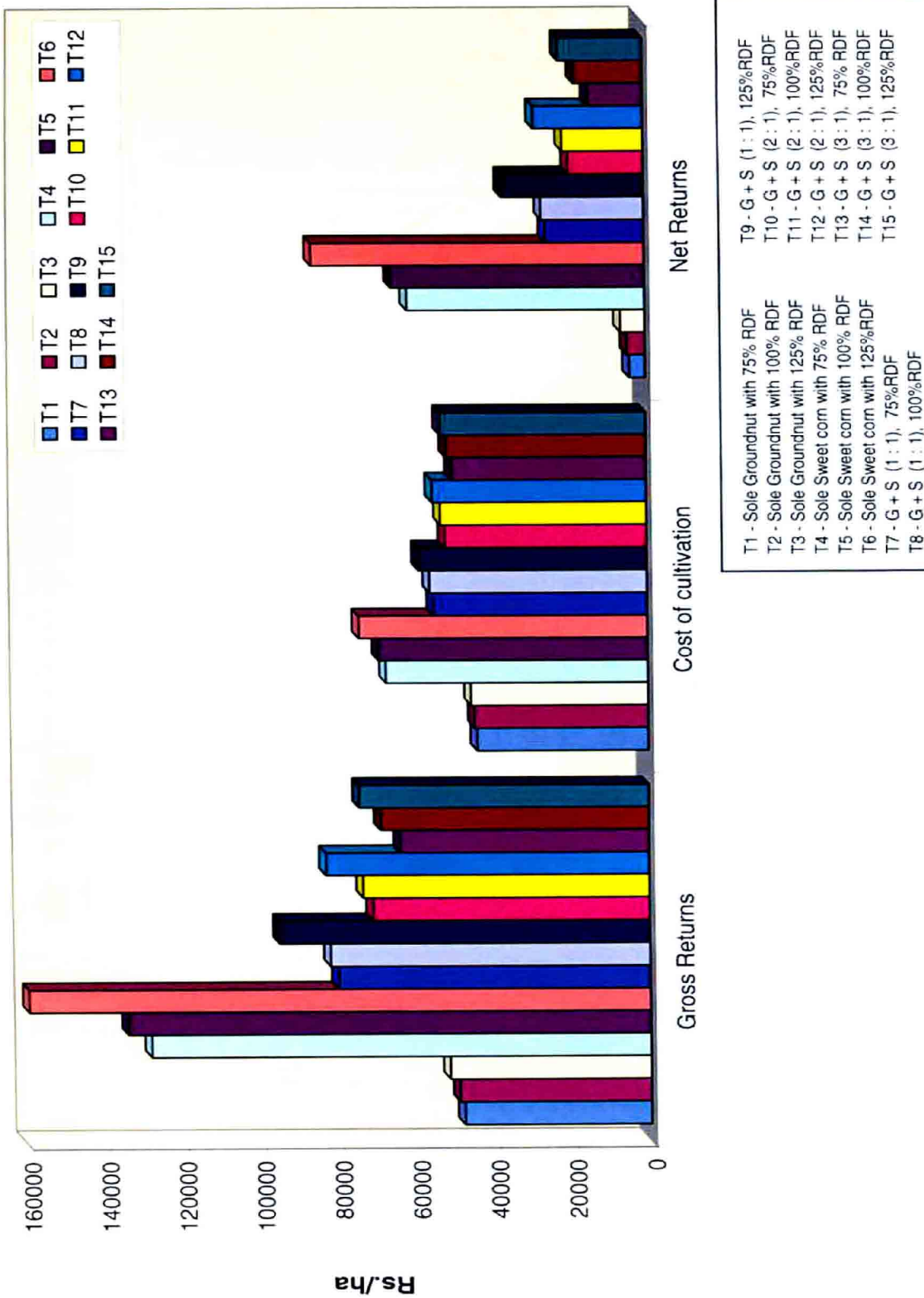
Data revealed that during both the years of experimentation and in the mean of two years, cost of cultivation, gross return and net return values were comparatively higher under sole sweet corn than sole groundnut as well as intercropping treatments. Further these values were comparatively less under sole groundnut than sole sweet corn as well as intercropping treatments. Under all the treatments, cost of cultivation, gross returns and net returns increased with increase in the fertilizer level. Further, in the intercropping treatments, all these values increased with increase in the proportion of sweet corn.

Similar trend was also observed in case of B:C ratio and the highest value was observed under the sole sweet corn with 125% RDF i.e. treatments T₆, during both the years of experimentation and in the mean of two years. Among the intercropping treatments, higher B:C ratio was recorded under groundnut + sweet corn in 1:1 ratio with 125 % RDF (T₉) during all the three observation.

Table 46 : Economics of sole cropping and intercropping treatments

Sym.	Treatment	Gross Returns (Rs/ha)			Cost of cultivation (Rs/ha)			Net Returns (Rs/ha)			B: C ratio		
		2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
T ₁	Sole Groundnut with 75% RDF	49943	45212	47578	43981	43193	43587	5962	2019	3991	1.14	1.05	1.10
T ₂	Sole Groundnut with 100% RDF	51643	46106	48875	44725	43802	44264	6918	2304	4611	1.15	1.05	1.10
T ₃	Sole Groundnut with 125% RDF	52875	49669	51272	45391	44857	45124	7483	4812	6148	1.16	1.11	1.14
T ₄	Sole Sweet corn with 75% RDF	126453	129046	127750	66738	67170	66954	59715	61875	60795	1.89	1.92	1.91
T ₅	Sole Sweet corn with 100% RDF	132469	134854	133662	68578	68976	68777	63891	65878	64885	1.93	1.96	1.95
T ₆	Sole Sweet corn with 125% RDF	157609	160766	159188	73606	74132	73869	84004	86634	85319	2.14	2.17	2.16
T ₇	G + S (1 : 1), 75% RDF	81368	78188	79778	54851	54321	54586	26517	23867	25192	1.48	1.44	1.46
T ₈	G + S (1 : 1), 100% RDF	82761	80798	81780	55732	55404	55568	27030	25394	26212	1.48	1.46	1.47
T ₉	G + S (1 : 1), 125% RDF	96120	93343	94732	58607	58144	58376	37513	35198	36356	1.64	1.61	1.63
T ₁₀	G + S (2 : 1), 75% RDF	72717	68872	70795	51951	51310	51631	20766	17562	19164	1.40	1.34	1.37
T ₁₁	G + S (2 : 1), 100% RDF	75568	71019	73294	53012	52254	52633	22556	18765	20661	1.43	1.36	1.40
T ₁₂	G + S (2 : 1), 125% RDF	83408	82335	82872	54905	54727	54816	28502	27609	28056	1.52	1.50	1.51
T ₁₃	G + S (3 : 1), 75% RDF	63067	64315	63691	49614	49822	49718	13453	14493	13973	1.27	1.29	1.28
T ₁₄	G + S (3 : 1), 100% RDF	69770	67616	68693	51285	50926	51106	18485	16690	17588	1.36	1.33	1.35
T ₁₅	G + S (3 : 1), 125% RDF	75955	72424	74190	52871	52283	52577	23083	20141	21612	1.44	1.39	1.42

Fig. 26. Economics of sole cropping and intercropping treatments



T1 - Sole Groundnut with 75% RDF
 T2 - Sole Groundnut with 100% RDF
 T3 - Sole Groundnut with 125% RDF
 T4 - Sole Sweet corn with 75% RDF
 T5 - Sole Sweet corn with 100% RDF
 T6 - Sole Sweet corn with 125% RDF
 T7 - G + S (1 : 1), 75% RDF
 T8 - G + S (1 : 1), 100% RDF
 T9 - G + S (1 : 1), 125% RDF
 T10 - G + S (2 : 1), 75% RDF
 T11 - G + S (2 : 1), 100% RDF
 T12 - G + S (2 : 1), 125% RDF
 T13 - G + S (3 : 1), 75% RDF
 T14 - G + S (3 : 1), 100% RDF
 T15 - G + S (3 : 1), 125% RDF

DISCUSSION

CHAPTER V

DISCUSSION

In this chapter efforts are made to discuss critically the important reasons and effects emerging out of the results of the investigation “Effect of levels of fertilizer and row proportions on sweet corn (*Zea mays saccharata*) and groundnut (*Arachis hypogaea*) intercropping,” carried out during 2003-2004 and 2004-2005 at the College of Agriculture, Farm, Dapoli.

Effect of weather

Weather is the most important factor governing the performance of any crop. The weather parameters during rabi-hot-weather season of 2003-2004 and 2004-2005 (Table 2a and 2b) were critically studied. The different weather parameter namely maximum and minimum temperature, relative humidity, sunshine hours, wind velocity, evaporation rate and sunshine hours showed distinct variation during the individual years. Among these, maximum temperature, minimum temperature, relative humidity, sunshine hours as well as wind velocity were at higher side during the *rabi* hot season of 2003-2004 than 2004-2005, however, regarding the rate of evaporation (mm/day) it was higher in the year 2004-2005 than 2003-2004 during the majority of the weeks. It was due to the lower relative humidity observed during *rabi* hot weather season of 2004-2005 than 2003-2004. Therefore, the evaporative demand was higher during 2004-2005 than 2003-2004.

On the other hand, comparatively higher sunshine hours were recorded during 2003-04 than 2004-05. This might have resulted in production of more photosynthate by the groundnut crop during 2003-04 than 2004-05. This is also evident from the better growth of this crop during 2003-04. Further, the better growth of groundnut during 2003-04

has resulted in to creation of more sources which has further resulted into production of more sink and therefore the yield of groundnut was higher during 2003-04 than 2004-05. On the other hand, the weather parameters seem to be more suitable for sweet corn during 2004-05 than 2003-04 and hence its performance in terms of growth, yield attributes and yield was better during the latter year than the previous one. In general, the weather conditions were very much suitable for cultivation of groundnut and sweet corn during both the years of experimentation.

Effect of fertilizer levels and row proportions on groundnut

It is evident from the data presented in Table 9 that, the groundnut crop under intercropping was significantly taller than sole cropping. It is attributed to the higher competition for light created under intercropping. When groundnut was intercropped with sweet corn, the light interception by the sweet corn was higher due to its erect growth habit and far more height than groundnut. Therefore, sweet corn created partial shading to the component crop of groundnut and therefore, in order to obtain more sunshine, groundnut crop under intercropping was taller than under sole cropping. Similar type of results was also reported by Zhou-SuMei (1998). Among the intercropping ratios, groundnut + sweet corn in 1:1 ratio produced more plant height than under the broader ratios of 2:1 and 3:1. It is also attributed to more competition for light created under 1:1 ratio than the broader ratios of 2:1 and 3:1. Among the individual ratios, the plant height was comparatively more under 125% RDF than the lower fertilizer levels. This was attributed to the availability of more nutrients under higher fertilizer dose, due to which the groundnut crop could synthesize more food material necessary for building up of the plant tissues. Desai and Prabhakar (2001), Sawant (1988), Gupta and Rathore (1995) reported the finding on the similar line.

As stated earlier, the sole crop of groundnut was fully exposed to the bright sunshine while, the groundnut crop intercropped with sweet corn experienced competition for sunlight; which is very vital for carrying out photosynthetic activities in the plant system. Therefore, the greater availability of sunshine under the sole cropping along with the maximum nutrient availability under 125% RDF (T₃) resulted into comparatively higher photosynthetic activities than the other treatments. Similar types of work have been reported by Singh and Arya (1995) and Jana and Saren (1998). This is clearly evident from the production of significantly higher dry matter (Table 12) by the sole groundnut crop provided with 125% RDF than the other treatments except groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) which was at par with the former treatment. This may be attributed to comparatively less competition for light created for the groundnut crop under the wider ratio of 3:1. In other words, the light intensity available for the groundnut crop under 3:1 ratio of groundnut + sweet corn intercropping was more or less similar that of sole cropping of groundnut. Sawant (1988) also confirmed such type of findings.

The higher availability of dry matter with sole groundnut provided with 125% RDF (T₃) resulted in creation of more vigour of the plants which is clearly reflected in production of more number of leaves (Table 11) and branches (Table 10) per plant than the other treatments. Similar findings were also reported by Kulkarni and Sojitra (1986) and Khola *et al.* (1999). Further, groundnut under all the three intercropping ratios supplied with 125% RDF (T₉, T₁₂, T₁₅) recorded statistically similar number of branches and leaves per plant as compared to the sole groundnut with 125% RDF (T₃), therefore, the higher fertilizer dose i.e. 125% RDF helped the groundnut crop to overcome the light competition created by intercropping of sweet corn in terms of number of branches and leaves per plant. Similar type of results were also reported by Desai and Prabhakar (2001). However, these results reported under groundnut +

sweet corn under 1:1 & 2:1 ratios with 125% RDF i.e. T₉ and T₁₂ were not reflected in the dry matter production. This may be due to the fact that though the number of leaves were higher, the solar radiation available to the leaves for carrying out photosynthetic activities was not enough to accumulate more dry matter.

Accumulation of significantly higher amount of dry matter of the source under sole crop of groundnut with 125% RDF i.e. T₃ resulted into production of higher sink in the form of number of pods per plant, weight of pods per plant as well as weight of kernels per plant (Table 13a and 13b) than the other sole cropping treatments with lower fertilizer dose as well as the intercropping treatments with lower fertilizer dose. As stated earlier, this was attributed to the higher availability of solar radiation as well as major nutrients to the groundnut crop supplied with 125% RDF i.e. T₃ than the other treatments. Similar findings were also reported by Gupta and Rathore (1995), Tomar *et al.* (1997) and Singh *et al.* (2000). Further, number of pods per plant and weight of pods per plant reported under groundnut + sweet corn in 3:1 ratio with 125% RDF i.e. T₁₅ was at par with sole groundnut provided with 125% RDF i.e. T₃. It was because of statistically at par dry matter accumulation under above referred two treatments i.e. T₃ and T₁₅. In other words, the competition created by intercropping for light and other factors was not severe enough to reduce the dry matter as well as other yield attributes namely number of pods, weight of pods and weight of kernels per plant, significantly when groundnut was grown in groundnut + sweet corn in 3:1 ratio and supplied with 125% RDF. Among the intercropping treatments as well as in sole groundnut crop, the entire yield attributed namely number of pods, weight of pods, weight of kernels per plant increased with increase in the levels of fertilizer and they were higher under 125% RDF in respect of the different planting ratios. It was due to the higher availability of nutrients under 125% RDF than the lower levels of fertilizer. The higher

availability of nutrients under 125% RDF made the crop more vigorous which was evident from more number of leaves, branches and dry matter accumulation per plant under 125% RDF than the lower levels of fertilizer under the respective planting ratios as well as sole cropping. These results are in line with those reported by Gupta and Rathore (1995) and Tomar *et al.* (1997). Further, the test weight of groundnut (Table 13b) was not influenced significantly due to different fertilizer levels or intercropping ratios. However, the shelling percentage (Table 13b) was higher under sole groundnut provided with 125% RDF i.e. T₃. This was attributed to the higher accumulation of dry matter under sole groundnut with 125% RDF i.e. T₃ and thereafter efficient translocation of food material to the kernels. These results are in line with the results reported by Hussaini and Mohammed (2003).

In respect of intercropping, the higher shelling percentage values were recorded under the treatments of 125% RDF in respect of 1:1, 2:1 and 3:1 ratios (T₉, T₁₂ and T₁₅). These values were statistically similar to that of sole groundnut with 125% RDF i.e. T₃. The reason for such type of results is that the higher availability of nutrients made the plants more active and the translocation of food material from source to sink was more efficient due to higher availability of potassium, which is having active role in translocation of food material. As stated earlier, the groundnut crop under sole cropping with 125% RDF (T₃) was photosynthetically more active and therefore it was more vigorous, which further resulted in creation of more source as well as sink than the other treatments. Therefore the dry pod yield, haulm yield and kernel yield (Table 14) of groundnut with 125% RDF (T₃) was higher than the other treatments except sole groundnut with 100% RDF (T₂) which was statistically at par with the former treatment. This was due to the fact that though the pod and haulm yield of sole groundnut was higher at 125% RDF i.e. T₃, it was not high enough to be statistically significant over 100% RDF i.e. T₂. In

other words the standard dose of fertilizer was enough for the groundnut crop for obtaining higher yield; in addition to this dry pod, kernel and haulm yield of groundnut under sole cropping with 100 and 125% RDF i.e. T₂ and T₃ was significantly higher than all intercropping treatments. This was due to 100% plant population of groundnut under sole cropping while the plant population under 1:1, 2:1 and 3:1 intercropping ratios was 50, 66.67 and 75%. Therefore, the reduced plant population resulted into significant reduction in dry pod, kernel and haulm yield under intercropping treatments in comparison with the sole cropping. Similar type of results were also reported by Kalághatgi *et al.* (1995), Eneji and Oko, 1997, Moorthy and Das (1999), Saren and Jana (1999), Maitra *et al.* (2001), Chandrika *et al.* (2001), Ramasamy *et al.* (2002) and Maitra *et al.* (2001).

In respect of intercropping, dry pod yield, haulm yield as well as kernel yield was significantly higher at 3:1 ratio of groundnut + sweet corn intercropping with 125% RDF (T₁₅) than the other intercropping treatments except groundnut + sweet corn at 3:1 ratio with 100% RDF (T₁₁) which was at par with T₁₅. The superiority of groundnut + sweet corn with 125% RDF (T₁₅) as compared to other intercropping treatments was attributed to higher availability of solar radiation as well as major nutrients which made the groundnut crop more vigorous under this treatment than the other intercropping treatments. This is evident from significantly higher dry matter accumulation per plant at aforesaid treatment i.e. T₁₅ than other treatments. The higher dry matter accumulation under T₁₅ further result into comparatively higher values of all the yield attributes than the other intercropping treatments. Further the higher yield attributes under T₁₅ (groundnut + sweet corn at 3:1 ratio with 125% RDF) resulted into production of higher dry pod yield, haulm yield as well as kernel yield than the other intercropping treatments. These findings are in line with the findings reported by Sawant (1988), Asokaraja

et al., (1987), Singh and Sharma (1987), Gupta and Rathore (1995), Tomar *et al.* (1997), Maiti *et al.* (1998) and Yakadri *et al.* (1998)

In respect of the qualitative aspects i.e. oil content & protein content (Table 15 and 16) in groundnut kernels, these parameters were not influenced significantly under sole as well as intercropping treatments. However, oil yield and protein yield were significantly higher at sole groundnut applied with 125% RDF than the remaining treatments of sole as well as inter cropping. This was mainly due to the production of significantly higher kernel yield under the same treatment as compared to other treatments and oil yield is a function of oil content and kernel yield.

Further, in respect of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) produced significantly higher oil and protein yield than the other intercropping treatments. It was also attributed to the higher kernel yield recorded under the aforesaid treatment than the remaining treatments. Similar types of results were also reported by Reddy *et al.* (1977) and Meena and Dayanand (2002) in case of oil yield.

The nutrient content in groundnut kernel, haulm and shell (Table 17, 19 and 21) was not influenced significantly due to the fertilizer levels as well as intercropping ratios. This is an indication of more or less similar concentration of the major nutrients in the different parts of the crop.

However, nitrogen, phosphorus and potassium uptake (Table 18, 20 and 22) by the groundnut crop in respect of kernel, shell and haulm was influenced significantly and the uptake of all the major nutrients in respect of kernel, shell and haulm was significantly higher under sole groundnut supplied with 125% RDF i.e. T₅. This was mainly due to significantly higher kernel, haulm and shell yield of groundnut under the above referred treatment as compared to the remaining treatments. Further,

uptake of nutrients by the different parts of a crop depends upon the concentration of nutrient in the given part and the yield of the respective part and therefore as the yield of kernel, shell and haulm was higher under sole groundnut with 125% RDF i.e. T₃, uptake of the major nutrients was bound to be higher under these parts. Similar trend was also observed in respect of total nitrogen, phosphorus and potassium uptake by the groundnut crop. It was attributed to the significantly higher uptake of these nutrients in the individual parts of kernel, shell and haulm during the individual years and therefore; the sum of all these figures, which accounts for the total uptake, was higher.

Further, in respect of intercropping treatments, the concentration of major nutrients in groundnut kernel, shell and haulm (Table 23) was not influenced significantly due to different fertilizer levels and ratios. This means that the concentration of major nutrients remains constant in the different parts of groundnut irrespective of the treatments. However, in case of nutrient uptake by the above referred parts of groundnut crop under intercropping, it was observed that nitrogen, phosphorus and potassium uptake recorded under groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₃) was at par with the treatment having similar intercropping ratio with 100% RDF i.e. T₁₁ and it was significantly superior over the remaining treatments. This was mainly because of the fact that the yield of all the above referred parts in case of groundnut did not differ significantly in respect of above referred treatment and the treatment ground+ sweet corn in 3:1 ratio with 125% RDF (T₁₃) which recorded significantly higher yield than the other intercropping treatments. Further, similar trend was also observed in respect of total nitrogen phosphorus and potassium uptake by the groundnut crop. It was attributed to the significantly higher uptake of these nutrients by the individual parts i.e. kernel, shell and haulm of the crop.

Effect of fertilizer levels and row proportions on sweet corn

Performance of sweet corn when cultivated as a sole crop and intercrop along with different fertilizer levels was influenced significantly. The related discussion in this regard is given below.

Plant height (Table 24) of sole sweet corn under 125% RDF irrespective of the intercropping ratios (T₉, T₁₂, T₁₅) or sole cropping (T₆) was not influenced significantly. However, sole sweet corn with 125% RDF (T₆) produced significantly taller plants than the lower fertilizers doses in sole cropping or intercropping. The height of sweet corn was higher under 125% RDF because of greater availability of major nutrients than the lower levels. Height is one the characters, which indicates vigour of the crop and therefore plants with greater nutrient supply, expressed their vigour in the form of height. There was no significant difference in the plant height of sole and intercropped sweet corn provided with 125% RDF; as for sole crop the plant population was optimum enough to eliminate the interplant competition while in intercropping ratios, there was negligible competition to sweet corn from groundnut and therefore, plant height was solely governed by nutrient availability. Similar results were reported by Chand (1978), Singh and Guleria (1979) and Rao and Willey (1983).

On the other hand, in respect of the plant height of intercropped sweet corn, it was statistically similar under all the three ratios provided with 125% RDF. Further, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₆) recorded significantly taller plants than the treatments with 100 and 75% RDF in 1:1, 2:1 and 3:1 ratios. Here also more availability of major nutrients under 125% RDF contributed in creation of greater plant height than the lower fertilizer doses. The extra nitrogen under 125% RDF helped in creation of more growth. Similar results were also reported by Desai and Prabhakar (2001)

In respect of dry matter accumulation per plant (Table 26) which is most important parameter in respect of growth and vigour of the plant, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the other treatments with 125% RDF both in sole or intercropping. Further, former treatment i.e. T₁₅ was significantly superior over the remaining treatments in sole or intercropping. The better performance of sweet corn in respect of dry matter under all the treatments receiving 125% RDF is because of greater availability of the major nutrients.

Nitrogen is the most important constituent of protoplasm and proteins, therefore, it has direct role in the plant growth. Hence, greater availability of nitrogen under 125% RDF has resulted into more plant growth of sweet corn which reflected into more dry matter accumulation. Further, phosphorus plays an important role in root growth, photosynthetic activities and nitrogen balance. Therefore, its greater availability was helpful to sweet corn in producing more growth in respect of dry matter. Secondly, lateritic soils are prone to phosphate fixation and therefore, when phosphorus is applied in more amounts the fixation is comparatively low. Therefore, availability of phosphorus under 125% RDF was greater to the sweet corn crop. Further, increased dose of potassium application was helpful for the sweet corn crop as potassium plays an important role in translocation of food material and for maintaining the water balance in the plant. Therefore, higher level of potassium supplied to sweet corn was beneficial in terms of growth and dry matter accumulation. These results corroborate the finding of Desai and Prabhakar (2001). Therefore, the combined effect of application of 125% RDF to the sweet corn was expressed in terms of better growth in respect of dry matter accumulation than the lower levels of fertilizer application i.e. 100 and 75% RDF either in sole or intercropping.

As far as number of leaves (Table 25) of sweet corn was concerned, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with 1:1 and 2:1 ratios with 125% RDF (T₉ and T₁₂) during 2003-04 and in the mean of two years and with sole sweet corn receiving 125% RDF during 2004-05. Further, the former treatment T₁₅ was significantly superior over other treatments. Higher number of leaves recorded under the treatments receiving 125% RDF was due to the more availability of major nutrients which made the plants photosynthetically more active than the treatments receiving lower dose of fertilizers which is evident from accumulation of more dry matter by the crop when supplied with 125% RDF either in sole or intercropping. The higher availability of dry matter under 125% RDF resulted in expression of the crop growth in terms of more leaves per plant. Similar findings were also reported by Desai and Prabhakar (2001)

The greater availability of the source with the sweet corn receiving 125% RDF (T₆, T₉, T₁₂ and T₁₅) clearly indicated that the crop was photosynthetically more active.

The sweet corn crop, which received 125% RDF in sole as well as intercropping was physiologically more active; which is evident from more number of leaves and dry matter accumulation per plant. Further, the better physiological activities under above referred treatments (T₆, T₉, T₁₂ and T₁₅) was attributed to the better root activities under these treatments which is evident from higher nitrogen and potassium uptake in the kernels, cob sheath and leaves as well as higher potassium content in cob axis. This higher concentration of nitrogen and potassium in the different parts of sweet corn (Table 30a, 30b, 34a, 34b) is an indication of efficient root and other physiological activities in the above referred treatment receiving 125% RDF. In respect of phosphorus concentration (Table 32a and 32b), it was not affected significantly in any treatment, however, concentration of phosphorus in different plant parts was

numerically higher where 125% RDF was applied in comparison with the lower doses of fertilizers under the same ratio in intercropping or sole cropping. Further, the higher concentration of the major nutrients helped in creating more source in the sweet corn crop that received 125% RDF than the lower levels. Generally, there is positive relation between source and sink and hence the higher availability of source with sweet corn crop that received 125% RDF created relatively more sink. Therefore, the cob length, weight of cob, number of kernel rows per cob, number of kernels per cob and weight of kernels per cob (Table 27a and 27b) were higher under the treatments receiving 125% RDF than the lower fertilizer levels in intercropping as well as sole cropping. These findings are in line with Jana and Saren (1998) and Singh *et al.* (2000).

However, the cob and stover yield (Table 28) was significantly higher under sole crop in sweet corn receiving 125% RDF than the remaining treatments including sole as well as intercropping. This was mainly due to 100% plant population of sweet corn and higher values of almost all yield attributes under this treatment. Though the yield attributes were statistically similar under all the treatments receiving 125% RDF including sole and intercropping, the cob yield and stover yield was higher with 125% RDF i.e. T₆ due to 100% population of sweet corn. While, in case of the intercropping treatments, the population under 1:1, 2:1 and 3:1 ratios was 50%, 33.33% and 25% respectively. Therefore, the cob yield and stover yield was higher under the sole cropping with 125% RDF. Similar findings were also reported by Singh and Arya (1995), Eneji and Oko, (1997), Moorthy and Das (1999) and Ramasamy *et al.* (2002). When the comparison was made among the treatments of sole cropping, cob and stover yields were higher under 125% RDF than 75 and 100% RDF i.e. T₁ and T₅. This was mainly because of superior yield attributes namely cob length, weight of cob, number of kernels per cob and number of kernel rows per cob under the higher fertilizer level i.e. 125% RDF with sole

cropping i.e. T₆ than the lower levels of fertilizer in sole cropping. Barik *et al.* (1998), Tomar *et al.* (1997), Sinha *et al.* (1999) reported similar results in case of wheat based intercropping system. Similar trend was also noticed in respect of total biomass yield (Table 28). This was mainly because of significantly higher cob and stover yield under sole crop with 125% RDF than the remaining treatments and the total biomass yield is the sum of cob yield and stover yield. Therefore, the total biomass yield was bound to be higher under the same treatment i.e. sole crop of sweet corn with 125% RDF (T₆) than the remaining treatments.

In case of intercropping treatments, ground nut + sweet corn in 1:1 ratio with 125% RDF (T₉) was significantly superior over the remaining treatments in respect of cob and stover yield. This was also due to the higher plant population of sweet corn under 1:1 ratio than 2:1 and 3:1 ratios. As expressed earlier, population of sweet corn under 1:1 ratio was 16.67 and 25% higher than under 2:1 and 3:1 ratios. Yield is a product of per plant yield and number of plants per unit area. Though, the values of yield attributes under all the three ratios with 125% RDF were statistically same, the greater plant population under the treatment groundnut + sweet corn in 1:1 ratio resulted into higher cob yield and stover yield with 125% RDF (T₉) than the remaining treatments. In respect of cob yield and stover yield, similar trend was also noticed in case of biomass yield of sweet corn. This was mainly because of the higher cob and stover yield values recorded under groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) than the other treatment of intercropping and the biomass yield is the sum of cob yield and stover yield. Similar finding were also reported by Das and Mathur (1980), Calavan and Weil (1987), Srivastava and Bohra (2006) and Giri *et al.* (2006).

As far as quality of sweet corn was concerned protein content and sucrose content (Table 29) was estimated. Protein content in the kernels

was significantly higher under groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) than all the sole cropping treatments as well as most of the intercropping treatments except groundnut + sweet corn in 2:1 and 1:1 ratios with 125% RDF i.e. T₁₂ and T₉. This was attributed to higher nitrogen content in the kernels of the same treatment. Nitrogen is a basic component in protein; therefore the higher nitrogen content in kernels resulted into higher protein content in the kernels. While calculating protein percentage, protein content is multiplied with a constant factor of 6.25. Therefore, when the nitrogen content is higher the protein content is also higher in the given part. Therefore, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) recorded higher protein content in sweet corn except groundnut + sweet corn in 1:1 and 2:1 ratios T₉ and T₁₂. Similar findings were also reported by Ayyangar and Aiyer (1942), Mirchandani and Misra (1956), Gangwar and Kalra (1988) and Gangwar (1976).

In case of the other quality parameters namely sucrose content; again ground + sweet corn in 3:1 ratio with 125% RDF (T₁₅) recorded higher sucrose content than most of the treatments including sole and intercropping except the treatment receiving 125% RDF i.e. T₆, T₉ and T₁₂; which were at par with the former treatment. This can be attributed to the higher availability of potassium under these treatments than the treatments with lower fertilizer dose. Potassium plays an important role in translocation of photosynthates and therefore, higher availability of potassium under above referred treatments resulted into efficient translocation of sugar into the kernels and therefore sucrose content in the kernels was higher under the treatments receiving 125% RDF (T₁₅, T₁₂, T₉ and T₆) than the other treatments. Similar type of findings were reported by Roodagi *et al.* (2001) in case of sugarcane.

In case of nutrient uptake by sweet corn (Table 36), it was observed that, sole sweet corn with 125% RDF i.e. T₆ recorded significantly higher

nitrogen and potassium uptake in the kernels, cob axis, cob sheath, stem and leaves than the other treatments of sole as well as intercropping. This was because of higher concentration of nitrogen and potassium in the above referred parts as well as higher output of kernels, cob axis, cob sheath, stem and leaves of sweet corn due to 100% plant population as well as higher fertilizer dose. As the nitrogen and potassium uptake of all the above referred parts of sweet corn was higher under sole sweet corn with 125% RDF (T_6) than the other treatments, the total uptake of nitrogen and potassium was also higher by the same treatment i.e. T_6 , as the total uptake by the crop is sum of the uptake made by the different parts of the crop. Similar results were reported by Gangwar (1976) in respect of nitrogen.

Further, in the intercropping treatments, ground nut + sweet corn in 1:1 ratio with 125% RDF (T_9) recorded more nitrogen and potassium uptake in the kernels, cob axis, cob sheath, stem and leaves of sweet corn than the remaining treatments and this was attributed to higher population of sweet corn under 1:1 ratio than the higher ratios of 2:1 and 3:1. Though nitrogen as well as potassium content in the sweet corn kernels, cob axis, cob sheath, stem and leaves was statistically similar in the treatments receiving 125% RDF in the intercropping treatments, the uptake of nitrogen and potassium was higher by the above referred parts under 1:1 ratio with 125% RDF i.e. T_9 , because of higher plant population of sweet corn and thereby higher yields of kernels, cob axis, cob sheath, stem and leaves under 1:1 ratio than 2:1 and 3:1 ratios. Therefore, the nitrogen and potassium content in above referred parts of sweet corn were higher under 1:1 ratio with 125% RDF than the other treatments of intercropping. Further, the total uptake of nitrogen and potassium by the sweet corn crop under intercropping also followed the similar trend as in case of uptake of these nutrients in kernels, cob axis, cob sheath, stem and leaves. As the total uptake of these nutrients i.e. nitrogen and potassium

was calculated by summing the uptake of these nutrients by the above referred plant parts.

On the other hand, phosphorus content (Table 32a and 32b) in the different parts of sweet corn was not influenced significantly due to the different fertilizer levels in sole as well as intercropping treatments. However, phosphorus uptake in the kernels, cob axis, cob sheath, stem and leaves was significantly higher under sole sweet corn with 125% RDF i.e. T₀ than the remaining treatments of sole as well as intercropping. This was attributed to higher availability of phosphorus under 125% RDF and higher yield of kernel, cob axis, cob sheath, stem and leaves due to 100% plant population (sole crop).

While in case of intercropping treatments, though the phosphorus content was not influenced significantly, phosphorus uptake in the kernels, cob axis, cob sheath, stem and leaves was higher under groundnut + sweet corn in 1:1 ratio with 125% RDF i.e. T₀ than the remaining treatments. This was again due to higher availability of phosphorus under 125% RDF and higher population of sweet corn under 1:1 ratio than 2:1 and 3:1 ratios of intercropping. As expressed earlier, the population of sweet corn was 16.67 and 25% higher under 1:1 ratio than 2:1 and 3:1 ratios respectively; and therefore the yield of kernels, cob axis, cob sheath, stem and leaves was proportionately higher under 1:1 ratio with 125% RDF i.e. T₀ than the wider ratios of 2:1 and 3:1. Further, the production of above referred parts i.e. kernels, cob axis, cob sheath, stem and leaves was higher under 125% RDF than 75 and 100% RDF under 1:1 ratio. Therefore, the uptake of phosphorus by the above parts under 1:1 ratio was more with 125% RDF than the lower fertilizer levels.

In respect of phosphorus uptake by the different parts of sweet corn, the pattern was same to that of nitrogen and potassium uptake. Phosphorus uptake in the kernels, cob axis, cob sheath, stem and leaves

was higher under groundnut + sweet corn in 1:1 ratio with 125% RDF i.e. T₉ than the other treatments except groundnut + sweet corn in 1:1 ratio with 100% RDF i.e. T₈ which was at par with the former treatment. The superiority of groundnut + sweet corn in 1:1 ratio with 125% RDF over the other treatments in respect of phosphorus uptake by the kernels, cob axis, cob sheath, stem and leaves can be attributed to the higher population of sweet corn and thereby higher yield of kernels, cob axis, cob sheath, stem and leaves under 1:1 ratio than 2:1 and 3:1 ratios of intercropping.

Regarding the total uptake of phosphorus (Table 36) by sweet corn crop, it was observed that sole sweet corn with 125% RDF i.e. T₆ recorded higher total phosphorus uptake than the other treatments. This was due to the higher availability of phosphorus under 125% RDF and thereby higher uptake of phosphorus in the individual parts of sweet corn i.e. kernels, cob axis, cob sheath, stem and leaves than the other treatments.

Further, the total phosphorus uptake by the sweet corn crop under intercropping treatment was higher under groundnut + sweet corn in 1:1 ratio with 125% RDF i.e. T₉ than other treatments. This was due to higher availability of phosphorus under 125% RDF and considerably higher plant population of sweet corn under 1:1 ratio than 2:1 and 3:1 ratios.

Total uptake of nitrogen, phosphorus and potassium by sole groundnut, sweet corn and intercropping combinations

As discussed earlier, the total uptake of nitrogen, phosphorus and potassium by groundnut (Table 23) and sweet corn (Table 36) was significantly higher when 125% RDF was applied. This was due to the higher availability of the above referred nutrients under 125% RDF as well as higher yield of the crops.

However, when the comparison was made between the individual crops i.e. groundnuts and sweet corn and different intercropping combinations, it was observed their groundnut + sweet corn in 3:1 ratio

with 125% RDF (T₁₅) recorded higher total nitrogen, phosphorus and potassium uptake than the other treatments of intercropping and sole cropping except groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₁), groundnut + sweet corn in 2:1 ratio with 125% RDF (T₁₂) and sole groundnut with 125% RDF (T₃) in respect of nitrogen and potassium uptake. Gangwar and Kalra (1988) observed increased nitrogen and protein content in maize grains and increased total protein yield of maize in association with legumes.

When the uptake of individual crops was compared, groundnut dominated sweet corn in case of nitrogen and potassium uptake, which was on an average 122 and 82% higher than sweet corn. While, in case of phosphorus, sweet corn dominated over groundnut and its average uptake was 20% higher than groundnut. Therefore, uptake of nitrogen and potassium by groundnut was considered higher than sweet corn. While, phosphorus uptake was slightly more in sweet corn than groundnut. When the total uptake of major nutrients in the sole cropping and intercropping was compared it was higher under groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) than the remaining treatments and it was attributed to higher proportion of groundnut in the intercropping along with higher nutrients availability i.e. 125% RDF and about 15.3% additional yield of groundnut along with 27.69% additional yield of sweet corn obtained under the aforesaid treatment i.e. groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅). In other words, groundnut + sweet corn in 3:1 ratio with 125% RDF i.e. T₁₅ has given comparatively higher yield of groundnut (15.3%) and sweet corn (27.69%), though the proportion of groundnut was reduced by 20% and that of sweet corn by 75% in comparison with sole cropping. Therefore, the 3:1 combination of intercropping with 125% RDF considerably enhanced the yield of both the crops. This is also evident from the higher LER of 1.24 (Table 45) under the same treatment. Similar findings were also reported by Gangwar (1976).

Nitrogen, phosphorus and potassium content in the soil after harvest of the crops

Nitrogen content in the soil (Table 38) after harvest of the crops influenced significantly due to the different treatments, however, phosphorus and potassium (Table 38) content in the soil after harvest of the crops was not influenced significantly. Sole sweet corn with 125% RDF (T_0) recorded significantly higher nitrogen content in the soil than the remaining treatments of sole and intercropping. It was mainly because of the higher amount of nitrogen dose i.e. 187.5 kg N/ha applied to the sweet corn and comparatively less uptake i.e. 73.04 kg N/ha the recorded under the above referred treatment i.e. T_0 . The less uptake of nitrogen in sweet corn (Table 31a and 31b) was attributed to the sweet corn variety Samadhur which is predominantly a dwarf variety with average height of 104.57 cm and with excessive higher harvest index i.e. 60%. Therefore, the total biomass produced by the cultivar Sumadhur was comparatively less than the other sweet corn cultivars and its harvest index is also very high in comparison with other cultivars and therefore, even though we call maize as heavy feeder crop, it was not exactly true with sweet corn cultivar Sumadhur as its stover production is less, and the cob yield is comparatively higher.

Among the intercropping treatments, groundnut + sweet corn in 1:1 ratio with 125% RDF (T_0) recorded comparatively higher nitrogen content in soil (Table 38) after harvest of the crops than other intercropping treatments. The reason is same as explained in the above paragraph. In case of treatment groundnut + sweet corn in 1:1 ratio with 125% RDF (T_0), the proportion of sweet corn was higher than the other ratios i.e. 2:1 and 3:1 and it was supplied with 125% RDF to the sweet corn crop (187.5 kg N/ha) .

In case of groundnut, the recommended nitrogen dose is only 25kg N/ha; as it is a leguminous crops and capable of fixing atmospheric nitrogen with the help of Rhizobium bacteria. The total nitrogen uptake of groundnut was considerably higher and it was 170.15kg N/ha under the recommended dose. However, because of its capacity to fix considerable amount of atmospheric nitrogen, which is higher than its requirements, there was positive balance of nitrogen (Table 39 and 40) in the soil after harvest of the crops. The additional amount of nitrogen fixed in the soil by groundnut increased with the increase in fertilizer dose and it was higher under 125% RDF i.e. T₅. Similar results were also observed by Dayal *et al.* (1967), Hegde and Saraf (1978), (Senaratne *et al.*, 1995), Suwanarit *et al.* (1998), Tomar *et al.* (1997) and Singh *et al.* (2000).

Further, in case of sweet corn, though the uptake of nitrogen was comparatively low than the added nitrogen, it has recorded net loss in the nitrogen balance. The net loss increased with increase in nitrogen dose and it was higher with 125% RDF. This was due to the comparatively higher yield of sweet corn (Table 28) with increase in the fertilizer dose. The net loss in nitrogen balance due to cultivation of sweet corn was due to the net removal of nitrogen by the crop from the soil. With the increase in the fertilizer dose to sweet corn the net loss in the nitrogen status of the soil can be attributed to the relatively higher yield obtained with increase in the nitrogen level.

In case of intercropping combinations, the nitrogen balance was negative under 1:1 and 2:1 ratios of intercropping. Among these two ratios, the nitrogen loss was maximum in soil under 1:1 ratio. This can be attributed to the higher proportion of sweet corn in the intercropping which accounts for net loss in the nitrogen balance of the soil. However when groundnut proportion was increased in intercropping treatment i.e. 3:1 ratio; there was net gain in the nitrogen balance of the soil, which

increased with increase in nitrogen dose applied to groundnut. This was due to the higher proportion i.e. 75% of groundnut and the least proportion of sweet corn i.e. 25% in the intercropping combination. Therefore the gain in higher nitrogen status of soil was contributed by 75% proportion of groundnut and was higher enough to compensate the loss of nitrogen resulted by 25% proportion of sweet corn.

Further, phosphorous and potassium content of the soil (Table 38) after harvest of crops was not influenced significantly due to the different treatments of sole and intercropping. However, groundnut + sweet corn in 3:1 ratio with 125% RDI (T₁₅) recorded numerically high phosphorous and potassium content of soil after harvest of the crops. In other words, with increase in proportion of legume and decrease in the proportion of cereal, the nitrogen balance became positive. Roodagi and Itnal (2001) reported the similar type of results.

Effect of sole cropping and intercropping on weed count and their dry matter production

In respect of weeds (Table 41 and 42), it was observed that the weed count as well as dry weight of broadleaved weeds and grasses and sedges was considerably higher under sole sweet corn and it was considerably lower under sole groundnut. This was mainly due to the growth habit of both the crops. In sweet corn, the canopy is erect with few leaves per plant therefore, it allows considerable amount of solar radiation to penetrate through its canopy during early growth stages. Therefore, the conditions in the vicinity of sweet corn are favourable for the growth of weeds and hence the count as well as dry weight of broadleaved and grasses and sedges was higher under sweet corn. Similar type of results were reported by Munoz *et al.* (2001) in case of sugarcane.

While in case of groundnut, it is called as cover crop as its canopy grows close to the ground and it has more leaves with spreading habit.

Therefore, it covers the allotted area in the short span of time and hence creates unfavourable conditions for the growth of weeds in its vicinity. Therefore, the weed count as well as dry weight of broadleaved weeds, grasses and sedges were comparatively less under sole groundnut in comparison with sole sweet corn. Similar type of results were reported by Munoz *et al.* (2001) in case of groundnut.

The weed count and dry weight of weeds declined with increase in the fertilizer level in respect of both the crops i.e. groundnut and sweet corn. It was mainly due to the application of fertilizers by band placement method. Thereby the root zone of the crops was enriched with the fertilizers and with higher availability of major nutrients at initial growth stages. The performance of the crops in terms of plant vigour (Table 11, 12, 25 and 26) was better under 125% RDF level than the lower levels. The better vigour of the crops under the higher fertilizer dose (125% RDF) at the initial growth stages created greater competition and thereby unfavourable conditions for the growth of weeds in the surrounding areas. Therefore, the performance of weeds was poor under higher level of fertilizers. Chalka and Nepalia (2005) reported the similar type of results.

In respect of intercropping, the weed count as well as dry weight of weeds reduced with increase in the proportion of groundnut and increase in the fertilizer dose. Therefore, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) recorded considerably less count as well as dry weight of broadleaved weeds along with grasses and sedges. This was due to the highest proportion of groundnut along with the highest dose of fertilizer under the above referred treatment i.e. T₁₅ which created comparatively less favourable conditions for the weeds. Musambasi *et al.*, (2002), Oswald *et al.*, (2002) and Baldev Ram *et al.* (2005) observed the similar results.

Statistical indices

The LER was more than 1.0 in case of all the intercropping ratios (Table 44), which ranged within 1.13 to 1.24. Application of 125% RDF to the component crops at 3:1 ratio (T₁₅) recorded the highest LER during both the years of experimentation and in the mean of two years. Similar results were also reported by Marshall and Willey (1983), Mehta *et al.* (1985), Kathmale *et al.* (1995) Krishna and Raikhelkar (1997) , Sarkar *et al.* (1998), Sarkar and Sanyal (2000) and Singh *et al.* (2000). Further, treatment T₆ (sole sweet corn with 125% RDF) registered significantly higher groundnut and sweet corn equivalent yield (Table 44) than all the remaining sole crop treatments and intercrop combinations irrespective of varying fertilizer levels. While comparing the intercrop treatments, treatment T₉ (groundnut+ sweet corn in 1:1ratio with 125% RDF) recorded significantly higher sweet corn equivalent yield than all the remaining intercrop combinations. These results are in line with those reported by Balyan (1997), Krishna and Raikhelkar (1997) and Patra *et al.* (1999) in case of groundnut and Ahlawat *et al.* (2005) in case of chickpea.

Relative Crowding Coefficient of both the crops was more than one (Table 45). Groundnut recorded maximum RCC at 3:1 row proportion indicating that the groundnut yield was more than expected yield, while this crop showed low RCC at 2:1 and 1:1 row proportion. Sweet corn in combination with groundnut recorded maximum RCC due to 2:1 row proportion indicating its more yield than expected one. Krishna and Raikhelkar (1997), Tripathy *et al.* (1997), Sarkar *et al.* (1998), Sarkar and Sanyal (2000), Sarkar *et al.* (2000) and Ahlawat *et al.* (2005) reported the similar type of results.

RYI values were more than 0.5 indicating that intercropping of groundnut + sweet corn was advantageous over sole groundnut and sweet corn (Table 45). As relative yield total index was more due to the

treatment T₁₅ (groundnut+ sweet corn in 3:1ratio with 125% RDF), it proved to be the best treatment combination than the remaining treatment combinations. These results corroborate the findings of Iofinga and Tukunga (1995) and Maiti *et al.* (1998).

As regards to mean values of aggressivity index (Table 45), it was observed that groundnut was aggressive when grown in combination with sweet corn in 1:1 row proportion while sweet corn was aggressive when grown in combination with groundnut in 2:1 and 3:1row proportions. Liphadzi *et al.*, (1997), Sarkar *et al.* (1998), Sarkar and Sanyal (2000) and Ahlawat *et al.* (2005) reported the similar type of results in case of maize. Further, the competitive ratio of groundnut with sweet corn (Table 45) indicated that competitive ratio values for groundnut were less than 1 in 2:1 and 3:1 row proportions, while that of sweet corn were more than 1 indicating dominance of sweet corn at these treatment combinations under study. Krishna and Raikhelkar (1997) and Sarkar *et al.* (1998) reported similar results.

As regards to crop performance ratio of groundnut (Table 45) it was observed that performance of groundnut was improved due to the treatment T₉ (groundnut + sweet corn in 1:1 ratio with 125% RDF) whereas performance of sweet corn was better due to the treatment T₁₃ (groundnut + sweet corn in 3:1 ratio with 125% RDF). As regards the combined crop condition of groundnut and sweet corn, the performance was comparatively better at 3:1 ratio with 75 and 100% RDF (i.e. T₁₃ and T₁₄).

As the RYL values (Table 45) were negative indicating that in all the intercropping treatments groundnut and sweet corn had performed better than their sole treatments. The maximum negative RYL value for groundnut was recorded due to the treatment T₇ (groundnut + sweet corn in 1:1 ratio with 75% RDF) while in case of sweet corn, the maximum

negative RYI. was observed in treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF) indicating their better performance in intercropped.

Higher area-time equivalent ratio (1.169) was recorded with the treatment T₁₅ (groundnut + sweet corn in 3:1 ratio with 125% RDF), indicating a more efficient use of area-time by the intercrops over other systems (Table 45). The values of ATER decreased with decreased proportion of groundnut in combination and decreasing levels of fertilizer. Barik (1997) and Sarkar *et al.* (2000) reported similar type of results.

Economics of sole cropping and intercropping treatments

From the economics of the treatments (Table 46) it can be seen that sweet corn was more profitable than groundnut. This was mainly due to the higher price obtained by the sweet corn cobs and comparatively lower price of groundnut dry pods. Further, the yield potential of sweet corn is also higher than groundnut in terms of economic yield. Therefore, the gross returns of sweet corn were more than groundnut. Regarding the cost of cultivation, it was considerably less in case of groundnut than sweet corn. It was mainly due to the low fertilizer dose (25:50:50kg N,P,K/ha) of groundnut and considerably higher fertilizer dose (150:50:50kg N,P,K/ha) of sweet corn. Therefore, in respect of sweet corn there was additional cost of 100kg N than groundnut. In addition to this, the cost of sweet corn seed was considerably higher (Rs. 1200/kg) than groundnut (Rs.50/kg) and the seed rate of sweet corn was 10kg/ha and that of groundnut was 125kg/ha. Therefore, the seed cost of sweet corn was also higher than that of groundnut. The higher cost of seed of and fertilizers required for sweet corn resulted into higher cultivation cost than groundnut.

Further, the net returns were also higher under sweet corn than groundnut as the gross returns obtained by cultivation of sweet corn were

considerably higher than the cost of cultivation. This fact is also supported by higher B:C ratio under sweet corn than groundnut.

The net returns under both the crops i.e. groundnut and sweet corn increased with increase in the fertilizer level and they were maximum under 125% RDF. This was attributed to comparatively higher yield under higher fertilizer dose than the cost involved in it. Therefore, the net returns under sole groundnut and sweet corn were maximum with the higher B:C ratio when 125% RDF was applied. Similar types of results were also reported by Sinha *et al.* (1999).

In case of intercropping combinations, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₀) recorded comparatively higher values of gross returns, cost of cultivation and net returns as well as B:C ratio than the other intercropping treatments. This was attributed to the higher proportion of sweet corn in 1:1 intercropping ratio than 2:1 and 3:1 ratios; which is the most profitable crop. Further, the higher fertilizer dose under this treatment i.e. 125% RDF enhanced the yield of both sweet corn and groundnut and therefore the net returns were higher under the above referred treatment groundnut + sweet corn in 1:1 ratio with 125% RDF (T₀). The B:C ratio was also higher under the above referred treatment i.e. T₀ than other intercropping treatments due to considerably higher gross returns obtained under this treatment as compared to the cost of cultivation. These findings are supported by the work reported by Kalra and Gangwar (1980), Balyan (1997), Jana and Saren (1998), Padhi (2002) and Dutta and Bandyopadhyay (2006).

SUMMARY AND CONCLUSION

CHAPTER VI

SUMMARY AND CONCLUSION

A field experiment was conducted during post rainy seasons during 2003-04 and 2004-05 at Agronomy farm, College of Agriculture, Dapoli to study the "Effect of levels of fertilizer and row proportions on sweet corn (*Zea mays saccharata*) and groundnut (*Arachis hypogaea*) intercropping." The experiment was laid out in randomized block design with three replications. The treatments consisted of two sole crops namely groundnut and sweet corn grown with three levels of fertilizer i.e. 75, 100 and 125% RDF (recommended dose of fertilizer) and intercropping combinations of groundnut and sweet corn in 1:1, 2:1 and 3:1 ratios with 75, 100 and 125% RDF; in all there were fifteen treatments in each replication.

During the course of the investigation, growth observations of groundnut and sweet corn were recorded periodically at an interval of 30 days and yield contributing characters and yield were recorded at harvest to evaluate the treatment effects. Quality of groundnut was determined in terms of oil and protein content and that of sweet corn in terms of protein and sucrose content. The uptake of major nutrients by both the crops in sole and intercropping was analyzed and balance sheet of nitrogen in the soil was worked out. The effect of sole cropping and intercropping on weed count and their dry matter production was studied. Similarly, economics of sole cropping and intercropping was worked out along with the statistical indices of intercropping system. The important findings emerged from this investigation are summarized below:

- 1) Height of groundnut crop in groundnut + sweet corn in 1:1 ratio was more than sole groundnut and under 2:1 and 3:1 ratios of

intercropping. When groundnut was intercropped with sweet corn, the light interception by sweet corn was higher due to its erect growth habit, this caused the groundnut plants under 1:1 ratio to grow taller.

2) Groundnut under all the three intercropping ratios supplied with 125% RDF (T_9 , T_{12} , T_{15}) recorded statistically similar number of branches and leaves per plant as compared to the sole groundnut with 125% RDF (T_3). Therefore, the higher fertilizer dose i.e. 125% RDF helped the groundnut crop to overcome the light competition created by intercropping of sweet corn in terms of number of branches and leaves per plant.

3) Sole groundnut provided with 100 and 125% RDF recorded significantly higher dry matter per plant than the other treatments except groundnut + sweet corn in 3 : 1 ratio with 125% RDF (T_{15}) which was at par with the former treatment.

4) Among the intercropping treatments as well as in sole groundnut crop, all the yield attributes namely number of pods, weight of pods, weight of kernels per plant increased with increase in the level of fertilizer and they were higher under 125% RDF.

5) The test weight of groundnut was not influenced significantly due to different fertilizer levels or intercropping ratios. However, the shelling percentage was higher under sole groundnut provided with 125% RDF i.e. T_3 . In respect of intercropping, the higher shelling percentage values were recorded under the treatments of 125% RDF in respect of 1:1, 2:1 and 3:1 ratios (T_9 , T_{12} and T_{15}). These values were statistically similar to that of sole groundnut with 125% RDF i.e. T_3 .

6) Dry pod, kernel and haulm yield of groundnut under sole cropping with 100 & 125% RDF i.e. T₂ and T₃ was significantly higher than all the intercropping treatments. In respect of intercropping, dry pod yield, haulm yield as well as kernel yield was significantly higher in 3:1 ratio of groundnut + sweet corn intercropping with 125% RDF (T₁₅) than the other intercropping treatments except groundnut + sweet corn at 3:1 ratio with 100% RDF (T₁₄) which was at par with T₁₅.

7) In case of quality aspects i.e. oil content and protein content in groundnut kernels were not influenced significantly under sole or intercropping treatments. However, oil yield and protein yield were significantly higher in sole groundnut applied with 125% RDF (T₃) than the other treatments. In respect of intercropping treatments, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) produced significantly higher oil and protein yield than the other intercropping treatments.

8) The major nutrient content in groundnut kernel, haulm and shell was not influenced significantly due to the fertilizer levels as well as intercropping ratios. However, total nitrogen phosphorus and potassium uptake by the groundnut crop in respect of kernel, shell and haulm was significantly higher under sole groundnut supplied with 125% RDF i.e. T₃. However, in case of intercropping treatments, nitrogen, phosphorus and potassium uptake recorded under groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was similar to that of groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄) and it was significantly superior over the remaining treatments.

9) Plant height of sweet corn under 125% RDF irrespective of the intercropping ratios (T₉, T₁₂, T₁₅) or sole cropping (T₆) was not influenced significantly. However, sole sweet corn with 125% RDF (T₆) produced

significantly taller plants than the lower fertilizers doses in sole cropping or intercropping. Further, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₉) recorded significantly taller plants than the treatments with 100 and 75% RDF in 1:1, 2:1 and 3:1 ratios.

10) As far as number of leaves of sweet corn was concerned, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with 1:1 and 2:1 ratios with 125% RDF (T₉ and T₁₂) during 2003-04 and in the mean of two years and with sole sweet corn receiving 125% RDF during 2004-05 and it (T₁₅) was significantly superior over the remaining treatments.

11) In respect of dry matter accumulation per plant, groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) was at par with the other treatments with 125% RDF both in sole or intercropping. Further, former treatment i.e. T₁₅ was significantly superior over the remaining treatments in sole or intercropping.

12) The cob length, weight of cob, number of kernel rows per cob, number of kernels per cob and weight of kernels per cob were higher under the treatments receiving 125% RDF than the lower fertilizer levels in intercropping as well as sole cropping.

13) Though the yield attributes were statistically similar under all the treatments receiving 125% RDF including sole and intercropping, the cob yield and stover yield was significantly higher under sole crop with 125% RDF i.e. T₆ than the remaining treatments due to 100% population of sweet corn and higher fertilizer dose. In case of intercropping treatments, ground nut + sweet corn in 1:1 ratio with 125% RDF (T₉) was significantly superior over the remaining treatments in respect of cob and stover yield, due to higher population and fertilizer

dose. Similar trend was also noticed in case of biomass yield of sweet corn.

14) As far as quality of sweet corn was concerned protein content in the kernels was significantly higher under groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) than all the sole cropping treatments as well as most of the intercropping treatments except groundnut + sweet corn in 2:1 and 1:1 ratios with 125% RDF i.e. T₁₂ and T₉ which were at par with the former treatment. In case of sucrose content; again groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) recorded higher sucrose content than most of the treatments including sole and intercropping, except the treatment receiving 125% RDF i.e. T₆, T₈ and T₁₃; which were at par with the former treatment.

15) In case of nutrient uptake by sweet corn, it was observed that, sole sweet corn with 125% RDF i.e. T₆ recorded significantly higher nitrogen, phosphorus and potassium uptake in the kernels, cob axis, cob sheath, stem and leaves than the other treatments of sole as well as intercropping.

16) Though nitrogen as well as potassium content in the sweet corn kernels, cob axis, cob sheath, stem and leaves was statistically similar in the treatments receiving 125% RDF in the intercropping treatments, the uptake of nitrogen and potassium in the above referred parts was significantly higher under 1:1 ratio with 125% RDF i.e. T₉ than the remaining intercropping treatments.

17) In case of intercropping treatments, though the phosphorus content was not influenced significantly, phosphorus uptake in the kernels, cob axis, cob sheath, stem and leaves was significantly higher

under groundnut + sweet corn in 1:1 ratio with 125% RDF i.e. 14 than the remaining treatments.

18) The total uptake of nitrogen, phosphorus and potassium by groundnut and sweet corn was significantly higher when 125% RDF was applied. This was due to the higher availability of the above referred nutrients under 125% RDF as well as higher yield of the crops.

19) When the comparison was made between the individual crops i.e. groundnut and sweet corn and different intercropping combinations, it was observed that groundnut + sweet corn in 3:1 ratio with 125% RDF (T₁₅) recorded higher total nitrogen, phosphorus and potassium uptake than the other treatments of intercropping and sole cropping except groundnut + sweet corn in 3:1 ratio with 100% RDF (T₁₄), groundnut + sweet corn in 2:1 ratio with 125% RDF (T₁₂) and sole groundnut with 125% RDF (T₃) in respect of nitrogen and potassium uptake.

20) When the uptake of individual crops was compared, groundnut dominated sweet corn in case of nitrogen and potassium uptake, which was on an average 122 and 82% higher than sweet corn. While, in case of phosphorus, sweet corn dominated over groundnut and its average uptake was 20% higher than groundnut. Therefore, uptake of nitrogen and potassium by groundnut was higher than sweet corn. While, phosphorus uptake was slightly more in sweet corn than groundnut.

21) In case of sweet corn, sole sweet corn with 125% RDF (T₆) recorded significantly higher nitrogen content in the soil than the remaining treatments of sole and intercropping. Among the intercropping treatments, groundnut + sweet corn in 1:1 ratio with 125%

RDF (T₀) recorded comparatively higher nitrogen content in the soil after harvest of the crops than other intercropping treatments. The phosphorus and potassium content in the soil after harvest of the crops was not influenced due to either sole cropping or intercropping treatments.

22) In case of sweet corn, though the uptake of nitrogen was comparatively low than the added nitrogen, it has recorded net loss in the nitrogen balance. The net loss increased with increase in nitrogen dose and it was higher with 125% RDF. This was due to the comparatively higher yield of sweet corn with increase in the fertilizer dose. With the increase in the fertilizer dose to sweet corn the net loss in the nitrogen status of the soil was observed.

23) In respect of weeds, it was observed that the weed count as well as dry weight of broadleaved weeds and grasses and sedges was significantly higher under sole sweet corn and it was considerably lower under sole groundnut. The weed count and dry matter of weeds decreased significantly with increase in the proportion of groundnut and fertilizer level.

24) The LER was maximum (1.24) due to groundnut+ sweet corn intercropping at 3:1 ratio with 125% RDF. Groundnut equivalent and sweet corn equivalent yields were the highest due to the sole cropping of sweet corn with 125% RDF (T₀). In case of intercropping combinations, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₀) recorded the higher values of groundnut equivalent and sweet corn equivalent yields. Relative Crowding Coefficient (RCC) values and Relative Yield Total (RYT) values were improved due to intercropping of groundnut + sweet corn in 3:1 ratio. Groundnut crop remained aggressive and more

competitive in 1:1 ratio of intercropping while, sweet corn was more dominant at 2:1 and 3:1 ratios. Crop Performance Ratio (CPR) was improved in 3:1 ratio of intercropping. Relative Yield Loss (%) values were negative for both the crops indicating the gain in yield due to intercropping which was maximum for groundnut at 1:1 ratio while, for sweet corn those were maximum at 3:1 ratio. Groundnut + sweet corn in 3:1 ratio showed its superiority in terms of Area- Time Equivalent Ratio (ATER).

25) From the economics of the treatments it can be seen that sweet corn was more profitable than groundnut. This was mainly due to the higher price obtained by the sweet corn cobs and comparatively lower price of groundnut dry pods. The yield potential of sweet corn is higher than groundnut in terms of economic yield. Therefore, the gross returns of sweet corn were more than groundnut. The higher cost of seed and fertilizers required for sweet corn resulted into higher cultivation cost than groundnut. The net returns were also higher under sweet corn than groundnut as the gross returns obtained by cultivation of sweet corn were considerably higher than the cost of cultivation. This fact is also supported by higher B:C ratio under sweet corn than groundnut. In case of intercropping combinations, groundnut + sweet corn in 1:1 ratio with 125% RDF (T₀) recorded comparatively higher values of gross returns, cost of cultivation and net returns as well as B:C ratio.

CONCLUSION

Sweet corn should be intercropped with groundnut in 1:1 ratio with 125% RDF (Groundnut- 31.25: 62.5: 62.5 kg NPK/ha, Sweet corn-187.5: 62.5: 62.5 kg NPK/ha) for obtaining higher yield and economic returns (Rs. 36,350/ha) during *rabi* season. Further, the growth and yield attributing characters of groundnut and sweet corn were of higher magnitude under 3:1 ratio with 125% RDF.

Groundnut+ sweet corn in 3:1 ratio with 125% RDF recorded higher mean NPK uptake (177.78, 28.41, 95.38 kg NPK/ha) and it has recorded higher average nitrogen balance (28.84 kgN/ha) in the soil after harvest. Further, the weed intensity in groundnut + sweet corn intercropping decreased with increase in groundnut proportion and fertilizer level and therefore it was minimum under groundnut + sweet corn in 3:1 ratio with 125% RDF.

Future line of research work

- 1) The sweet corn is observed to be a promising crop in Konkan region due to the development in tourism in recent time. The package of agronomical practices should be developed for sweet corn.
- 2) The variety of sweet corn used in the present investigations (Sumadhur) was having exclusively dwarf growth habit with high Harvest Index. There are many tall varieties of sweet corn available in the market; the performance of which in the intercropping system with groundnut needs to be tested.

LITERATURE CITED

LITERATURE CITED

- Adhikari, S. and Sarkar B. K. (2000). Pigeonpea (*Cajanus cajan*) intercropping with legumes in Bihar plateau at different levels of phosphate and cropping patterns. *Indian J. Agron.* **45** (2): 279 - 283.
- Adhikari, S., Chakraborty, T. and Bagchi, D.K. (2005). Bio-economic evaluation of maize (*Zea mays*) and groundnut (*Arachis hypogaea*) intercropping in drought-prone areas of Chotonagpur plateau region of Jharkhand. *Indian J. Agron.* **50** (2): 113- 115.
- Ahlawat, I.P.S., Gangaiah, B. and Singh Ompal (2005). Production potential of chickpea (*Cicer arietinum*)- based intercropping systems under irrigated conditions. *Indian J. Agron.* **50** (1): 27-30.
- Aiyer, A.K.Y.N. (1949). Mixed cropping in India. *Indian J. agric. Sci.*, **19** : 439-523.
- Allan, J.R. and Obura, R.K. (1983). Yield of corn, cowpea and soybean under different intercropping systems. *Agronomy J.* **75**: 1005-1009.
- Anikwe, M.A.N.; Obi, M.E. and Agbim, N.N. (2003). Effect of crop and soil management practices on soil compatibility in maize and groundnut plots in a Paleustult in Southeastern Nigeria. *Plant-and-Soil.* **253**(2): 457-465.
- Anonymous (1982). Mixed cropping in *Kharif* nagli with some important pulses and oilseed crops under high rainfall condition. Ann. Rep. Dept. of Agronomy, K.K.V., Dapoli. pp. 20-26.
- Ashokaraja, N.; Chamy, A. and Palaniappan, S. (1987). Studies on intercropping in groundnut. *Madras Agril. J.* **74** (8-9) : 355-359.
- Ayyangar, S.K. and Aiyer, A.K.Y.M. (1942). Cereal legume mixed cropping. *Indian J. agric. Sci.* **12** : 127-129.
- Azam Ali, S.N.; Mathews, R.B.; Williams, J.H. and Peacock, J.M. (1990). Light use, water uptake and performance of individual components of a sorghum/groundnut intercrop. *Exptl. Agric.* **26**: 413-427.

- Baldev Ram, Chaudhary, G.R., Jat, A.S. and Jat, M.L. (2005). Effect of integrated weed management and intercropping systems on growth and yield of pearl millet (*Pennisetum glaucum*). *Indian J. Agron.* **50** (3): 210-213.
- Balyan, J.S. (1997). Performance of maize (*Zea mays*) - based intercropping systems and their after effects on wheat (*Triticum aestivum*) . *Indian J. Agron.* **42**(1): 26-28.
- Balyan, J.S. and Seth, Jagdish(1989). Effect of cropping systems on maize production and their residual effect on succeeding wheat. *Indian J. Agron.* **34**(1): 57-60.
- Bandopadhyay, S.K. and De, Rajat (1986). Yield, nitrogen and water use efficiency and soil fertility imperative of sorghum based intercropping system with seed legumes, *Fert. News*, **31**(2) : 15-20.
- Banik,P. and Bagchi (1996).Aproposed index of assessmernt of row replacement intercropping system. *J. Agronomy and Crop Science.* **177**: 161-164.
- Barik A.K., Mukherjee A.K. and Mandal B.K. (1998). Growth and yield of sorghum (*Sorghum bicolor*) and groundnut (*Arachis hypogaea*) grown as sole and intercrops under different nitrogen regimes. *Indian J. Agron.* **43** (1): 27-32.
- Barik,K.C. (1997). Maize + legume intercropping for North Central Plateau of Orissa. *Legume Research.* **20**(3/4): 218-220.
- Black, C.A. (1965). Methods of soil analysis, Part II, Amer. Soc. Agron. Inc., Madison, Wisconsin, U.S.A.
- Bora, P.C. (1999). Competition studies in intercropping of wheat, rapeseed and pea. *Ind. J. Agron.* **44** (3): 509-513.
- Bouyoucos, G.J. (1962). A calibration of the hydrometer method of making mechanical analysis of soil. *Agron. J.* **43**:435-438.
- Bray, R.H. and Kurtz, L.T. (1945). Determining total, organic and available forms of phosphorus in soil. *Soil Sci. J.* **59**: 39-45.
- Calavan, K.M. and Weil, R.R. (1987). Peanut - corn intercrop performance as affected by within row corn spacing at a constant row spacing. *Agron. J.* **80**: 635-642.

- Chalka, M.K. and Nepalia, V. (2005). Production potential and economics of maize (*Zea mays*) intercropped with legumes as influenced by weed control. *Indian J. Agron.* **50**(2): 119- 122.
- Chand, P. (1978). Studies on the effect of maize with grain legumes and its impact on 'N' economy and yield in Kulu valley. M.Sc. (Agri.) Thesis, Agril. complex, Himachal Pradesh Agril. University.
- Chandrika V., Reddy K. Sankara and M.S. Soundararajan (2001). Economic evaluation of groundnut (*Arachis hypogaea*) based cropping systems in rainfed Alfisols. *Indian J. Agron.* **46**(1): 45-49.
- Chatterjee, B.N. and Maiti, S. (1972). Cropping system. Theory and Practice. pp.174.
- Chittapur B.M., Hiremath S.M. and Prabhakar A.S. (1993). Performance of grain maize (*Zea mays*) and forage cereal intercropping on black soils under rainfed condition. *Indian J. Agron.* **38**(4): 523-526.
- Das, Rekha and Dutta, S.K. (1996). Effect of intercropping on infestation of insect pests of green gram. *Journal of the Agricultural Science Society of North East India.* **9**(2): 220-223.
- Das, S.K. and Mathur, B.Y. (1980). Relative performance of different kharif legumes as pure and intercrops in maize and their residual effect on wheat. *Indian J. Agron.*, **25**(4) : 743.
- Dayal, R.; Singh, G. and Sharma, R.C. (1967). Growing of legume and cereal mixture under dry farming conditions. *Indian J. Agron.*, **12**(2) : 126-131.
- De Wit, C.T. (1960). On competition. *Versl. Land bouwk, Onderz.* **66**, 1-82.
- De Wit, C.T. and Van den Bergh, J.P. (1965). Competition among herbage plants. *Netherland J. Agric. Sci.* **13**: 212-221.
- Desai, B.K. and Prabhakar, A.S. (2001). Nutrient contributions of hedge row prunings of *Sesbania grandiflora* L. Poir in alley cropping system II yield and yield components of adjacent maize and groundnut. *Karnataka Journal of Agricultural Sciences.* **14**(4): 882-887.

- Dubey, D.N.; Kulmi, G.S. and Girish Jha (1995). Performance of sorghum (*Sorghum bicolor*) as influenced by intercropping and planting geometry. *Indian J. Agron.* **40**(3): 353-356.
- Dutta, D. and Bandyopadhyay, P. (2006). Production potential of intercropping of groundnut (*Arachis hypogaea*) with pigeonpea (*Cajanus cajan*) and maize (*Zea mays*) under various row proportions in rainfed Alfisols of West Bengal. *Indian J. Agron.* **51**(2): 103- 106.
- Dwivedi, R.K. and Bajpai, R.P. (1997). Productivity of pigeonpea (*Cajanus cajan*) - based cropping systems in northern hills zone of Chhattisgarh. *Indian J. Agron.* **42**(1): 50-52.
- El-Dessougi, H; Dreele, Azu and Claassen, N. (2003). Growth and phosphorus uptake of maize cultivated alone, in mixed culture with other crops or after incorporation of their residues. *Journal-of-Plant-Nutrition-and-Soil-Science.* **166**(2): 254-261.
- Eneji, A.E; Oko, B.D.F.(1997). Sole and intercropping of maize and groundnut: effects on yield and economic returns in northern Cross River State of Nigeria. *Global-Journal-of-Pure-and-Applied-Sciences.* **3**(3): 303-311.
- Enyi, A.C.(1973). Effects of intercropping maize or sorghum with cowpeas, pigeonpea or bean. *Expl. Agric.*, **9** : 83-90.
- Gangwar, B. (1976). Effect of different levels of nitrogen on yield and quality of pure and mixed crop of maize under rainfed conditions. Ph. D. Thesis submitted to Meerut university, Meerut (U.P.)
- Gangwar, B. and Kalra, G.S. (1988). Influence of maize legume association and nitrogen levels on maturity, grain quality and protein productivity. *Legume Res.*, **11** (1) : 6-10.
- Ghosh, P.K; Devi Dayal; Naik, P.R and Virendra Singh (1999). Resource-use efficiency and production potential in summer groundnut-cereal fodder associations: evaluation of a new concept. *International Arachis Newsletter.* **19**: 55-56.
- Ghosh, P.K. (2002). Agronomic and economic evaluation of groundnut (*Arachis hypogaea*)-cereal fodder intercropping during the post-rainy season. : *Indian J. Agron.* **47**(4): 509-513.

- Ghosh, P.K. (2004). Growth, yield, competition and economics of groundnut/cereal fodder intercropping systems in the semi-arid tropics of India. *Field Crops Research*. **88**(2/3): 227-237.
- Giri, A.N., Deshmukh, M.N. and Gore, S.B. (2006). Nutrient management in cotton (*Gossypium hirsutum*)- based cropping system. *Indian J. Agron.* **51**(2): 116- 1180.
- Guggari, A.K. and Kalaghatagi, S.B. (2005). Effect of fertilizer and biofertilizer on pearl millet (*Pennisetum glaucum*) and pigeonpea (*Cajanus cajan*) intercropping system under rainfed conditions. *Indian J. Agron.* **50** (1): 24-26.
- Gupta, I. N. and Rathore S.S. (1995). Effect of fertility in pigeonpea (*Cajanus cajan*) + sesame (*Sesamum indicum*) intercropping system under rainfed conditions. *Indian J Agron.* **40** (3): 390-393.
- Hall, R.L. (1974^a). Analysis of the nature of interferences between plants of different species. I. contents and extension of de wit analysis to examine effects. *Austr. J. Agric. Res.* **25**: 739-746.
- Hall, R.L. (1974^b). Analysis of the nature of interferences between plants of different species. II. nutrient relation in a Nandi Setaria and green leaf desmodium association with particular references to potassium. *Austr. J. Agric. Res.* **25**: 749-756.
- Hegade, D.M. (1978). Effect of integrated nutrient supply on crop productivity and soil fertility in rice-rice system. *Indian J. Agron.* **41**(1) : 1-8.
- Hegde, D.M. and Saraf, C.S. (1978). Effect of intercropping and phosphorus fertilization of pigeonpea on fertility status of Soil. *Indian J. Agron.* **23** (4) : 372-373.
- Hu-Fei and Kong Chui Hua (2002). Allelopathic potentials of *Arachis hypogaea* on crops. *Journal of South China Agricultural University.* **23**(1): 9-12.
- Hussaini, M.A. and Mohammed, S.G. (2003). Productivity of maize-groundnut mixture in relation to fertilizer and planting pattern in a Guinea Savanna ecology. *Journal of Sustainable Agriculture and the Environment.* **5**(1): 52-62.

- Isgiyanto, S.A.; Soemarjo, P. and Soewamo, N.D. (1980). Effect of plant population on the growth and yield of corn and peanut in an intercropping system. *Agrivita*, **3**(6): 43-52.
- Jackson, M.L. (1973). Soil Chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi, pp. 4-12.
- Jadhav, A. S., Kalbhor, P.M. and Deshpande, S.V. (1983). Intercropping of Moong and Groundnut in sorghum with different planting patterns under rainfed conditions. *J. Maharashtra Agric. Univ.*, **8** (1): 63-65.
- Jagannath, M. K. and Sunderaral, N. (1987). Productivity equivalent ratio and statistical testing of its advantage in intercropping. *J. Ind. Soc. Ag. Statistics*. **49**: 289-300.
- Jana, P.K. and Saren B.K. (1998). Dry matter accumulation, yield attributes and yield of summer maize (*Zea mays*) and groundnut (*Arachis hypogaea*) intercropping systems as influenced by irrigation. *Indian J. Agron.* **43** (1): 18-22.
- Jat, R.L., Gaur B.L., Kumar Suresh and Kulhari R.K. (1999). Effect of weed management, fertilizers and *Rhizobium* inoculation on growth, yield and yield attributes of maize (*Zea mays*) and soybean (*Glycine max*) under maize + soybean intercropping system. *Indian J. Agron.* **44** (1): 30-35.
- Kalghatgi, S.B.; Itnal, C.J.; Jiral, D. I. and Magad, M.S. (1995). Pearl millet (*Pennisetum glaucum*)- based intercropping system for northern dry zone of Karnataka. *Indian J. Agron.* **40** (3): 495-497.
- Kalra, G.S. and Gangwar, B. (1980). Economics of intercropping of different legumes with maize at different level of nitrogen under rainfed conditions. *Indian J. Agron.* **25** : 181-185.
- Karikari, S.K; Chaba,O and Molosiwa, B. (1999). Effects of intercropping Bambara groundnut on pearl millet, sorghum and maize in Botswana. *African Crop Science Journal*. **7**(2): 143-152.
- Kathmale, D.K.; Patil, R.C. and Mulik, B.B. (1995). Effect of intercropping of various oilseeds and pulses in groundnut on yield and economics in Western Plain Zone of Maharashtra. *J. Oilseeds Res.* **12**(2): 232-234.

- Kaushik M. K., Sharma G.L., Mahapatra B.S. and Chaubey A.K. (1998). Effect of spatial association of pearl millet (*Pennisetum glaucum*) and groundnut (*Arachis hypogaea*) on resource utilization and economic yield. *Indian J. Agron.* **43** (1): 33-37.
- Khistaria, M.K.; Khokhani, M.G. and Padmani, D.R. (1996). Intercropping of important pulses and oilseeds in sorghum under rainfed conditions. *J. Mah. Agric. Univ.* **21**(3): 288-390.
- Khistaria, M.K.; Khokhani, M.G.; Vekaria, P.D.; Akbari, K.N. and Yusufzai, A.S. (1997). Effect of intercropping of sesame with different row proportions on yield of groundnut. *J. Mah. Agric. Univ.* **14**(2): 243-244.
- Khola, O.P.S., Dube R.K. and Sharma N.K. (1999). Conservation and production ability of maize (*Zea mays*) legume intercropping systems under varying dates of sowing. *Indian J. Agron.* **44** (1): 30-35 (March 1999).
- Koli, S.E. (1975). Pure cropping and mixed cropping of maize and groundnut in Ghana. *J. Agric. Sci.*, **8** : 23-30.
- Krishna, A. and Raikhelkar, S.V.(1997). Crop complementarity and competition in maize (*Zea mays*) when intercropped with different legumes. *Indian J. agric. Sci.*. **67**(8): 291-294.
- Kuchinda, N.C; Kureh, I.; Tarfa, B.D; Shinggu, C. and Omolehin, R. (2003). On-farm evaluation of improved maize varieties intercropped with some legumes in the control of Striga in the Northern Guinea savanna of Nigeria. *Crop-Protection.* **22**(3): 533-538.
- Kulkarni, J.H. and Sujitra, V.K. (1986). Nodulation, growth and pod yield of groundnut under six intercropping systems. *Madras Agric., J.* **73** (7) : 366-369.
- Kumar Sunil, Rawat, C.R. and Melkania N.P. (2005). Forage production potential and economics of maize (*Zea mays*) and cowpea (*Vigna unguiculata*) intercropping under rainfed conditions. *Indian J. Agron.* **50** (3): 184-186.
- Lad, V.L. (1986). Effect of intercropping of maize (*Zea mays*) with legumes on yield, nitrogen economy and economics. A thesis submitted to K.K.V., Dapoli for M.Sc. (Agri.) degree.

- Lal, R.B. and Ray, S. (1976). Economics of crop production of different intensities. *Ind. J. Agric. Sci.* **46**: 93-96.
- Lingegouda, B.K.; Santhaveerbadrah, S.S.; Inamdar, Prithaviraj and Krishnamurthy, K.C. (1972). Studies of mixed cropping of groundnut and hybrid sorghum. *Ind. J. Agron.* **17**(1): 27-29.
- Liphadzi, M.S; Thomas, R.M and Hammes, P.S. (1997). Competition between intercropped maize (*Zea mays* L.) and groundnut (*Arachis hypogaea* L.). *Applied Plant Science.* **11**(2): 31-34.
- Lourduraj, A.C.; Pannerselvam, S. and Sanbagavalli, S. (1998). Intercropping in groundnut. *Agril. Sci. Digest, Karnal*, **18**(3): 195-197.
- Maiti, D.; Mahalanobis, D. and Ghosh, M. (1998). Competitive functions of groundnut and sesame with different fertilizers and cropping system in the Coastal Saline Zone of West Bengal. *Ind. J. Agron.* **43**(2): 234-235.
- Maitra S., Ghosh D.C., Sounda G. and Jana P.K. (2001). Performance of intercropping legumes in finger millet (*Eleusine coracana*) at varying fertility levels. *Indian J. Agron.* **46** (1): 38-44.
- Mandimba, G.R; Galandzou, C. and Guenguie, N. (1998). Effect of plant population densities on the growth of *Zea mays* L. and *Arachis hypogaea* L. in intercropping systems. *International Journal of Tropical Agriculture.* **16**(1/4): 33-50.
- Manuel, M.T.; Naboia, V.; Alcalde, C. and Arai, S. (2000). Yield responses of groundnut and maize to fertilization and soil physico-chemical properties in different classes of Philippine soils. : *Communications in Soil Science and Plant Analysis.* **31**(11/14): 2291-2299.
- Marshal, B. and Willey, R.W. (1983). Radiation interception and growth in an intercrop of pearl millet in groundnut. *Field Crops Res.* **7**: 141-160.
- Mc Gillchrist, C.A. (1965). Analysis of competition experiments. *Biometrics*, **21**: 975-985.
- Mc Gillchrist, C.A. and Trenbath, B.R. (1971). A revised analysis of plant competition experiments. *Biometrics.* **27**: 659-671.

- Meena, N.L. and Dayanand (2002). Performance of sesame intercropped with groundnut at different levels of sulphur. Extended summaries. 2nd *International Agronomy Congress*, Nov. 26-30, New Delhi, India, 1: 548-549.
- Mehetre, S.S; Bhondve, T.S and Dalvi, N.D. (1997). Intercropping of soybean in different crops - a review. *Crop Research J. Hisar*. 13(2): 519-531.
- Mehta, O.P.; Bholra, A.L.; Tomer, D.P.S. and Yadav, T.P. (1985). Studies on intercropping of groundnut. *J. Oilseed Res.* 2: 45-49.
- Mirchandani, T.J. and Misra, D.K. (1956). Associated growth of cereals and legume. *Indian J. Agron.*, 1 (4) : 237-245.
- Moorthy, B.T.S. and Das, T.K. (1999). Performance of intercropping systems of sesame with green gram and groundnut in Rice fallow in summer season under irrigated condition. *Ann. Agril. Res.* 20(3): 348-385.
- Munoz, E; Morales, C; Gonzalez, E. and Alfonso, F. (2001). Intercropping of peanuts or maize for the development of sugar cane for animal feeding. *Cuban Journal of Agricultural Science.* 35(3): 279-283.
- Musambasi, D; Chivinge, O.A and Mariga, I.K. (2002) Intercropping maize with grain legumes for Striga control in Zimbabwe. *African-Crop-Science-Journal.* 10(2): 163-171.
- Nagaraja, B. (1989). Effect of crop mixtures on income and employment: a cost study of Anantpur district. *Agril. Situations in India centre for planning and Development studies*, 43 (11) : 957-963.
- Nair, K.P.P.; Patel, U.K.; Singh, R.P. and Kaushik, M.K. (1979). Evaluation of legume intercropping in conservation of fertilizer nitrogen in maize culture *J. Agric. Sci., Camb.*, 93 : 189-194.
- Narang, S.D.; Kaul, N.J. and Gill, J.S. (1969). Intercropping of maize with soyabean. *Indian Fmg.*, 19(6): 21-22.
- Natarajan, M. and Zharare, G.E. (1995). Intercropping groundnut with maize and sunflower for enhancing the productivity of groundnut-based cropping on light textured soils in Zimbabwe. *Zimbabwe Journal of Agricultural Research.* 32(1): 23-32.

- Nayak,R.L. and Mandal, S.R. (1998). Evaluation of some rainfed kharif intercropping systems in the upper terraces of drought prone tracts of West Bengal. *Environment and Ecology*. 16(3): 603-606.
- Negi, S.K. and Singh,J.N. (1971). Mixed cropping of soyabean with maize and sorghum. Annual Report Expt. Sta. G.B. Pant Univ. of Agrilculture and Technology, Pantanagar, India. pp. 633.
- Odunze, A.C.; Tarawali, S.A and de Haan, N.C. (2004). Grain legumes for soil productivity improvement in the Northern Guinea savanna of Nigeria. *Journal of Food Agriculture and Environment*. 2(2): 218-226.
- Osiru,D.S.O and Ezumah, H.C. (1994). Genotype evaluation for intercropping systems. *Acta Horticulturae*. (380): 62-71.
- Oswald, A.; Ransom, J.K.; Kroschel, J. and Sauerborn, J. (2002). Intercropping controls Striga in maize based farming systems. *Crop Protection*. 21(5): 367-374.
- Padhi, A.K. (2002). Studies on productivity, economics and energetics of maize (*Zea mays* L.)-legume intercropping. *Annals of Agricultural Research*. 23(1): 38-45.
- Panse, V.G. and Sukhatme, P.V. (1967). Statistical method for agricultural workers. 2nd Ed. I.C.A.R., New Delhi.
- Parsons,.M.J. (2004). Successful intercropping of sugarcane. *Sugarcane International*. (January/February): 14-28.
- Patil, M.P. and Shelke, D.K. (1984). A note on dry matter accumulation pattern in forage maize as influenced by nitrogen fertilization. *J. Maharashtra Agric. Univ.*, 9 (2): 227-228
- Patra,B.C; Mandal, B.B; Mandal, B.K and Padhi, A.K (1999). Suitability of maize (*Zea mays*) based intercropping system. *Indian J.Agric. Sci*. 69(11): 759-762.
- Patra, B and Poi, S.C.(1998). Influence of intercropping on the nodulation in legumes. *Environment and Ecology*. 16(2): 418-423.
- Pearce, S.C. and Gilliver, B. (1978). The statistical analysis of data from intercropping system. *J. Agric. Sci. Cambridge*. 91:625-632

- Pillai, M.R., Shanmuga; Sondram Govindrajan, M. and Manamohan, S.L. (1957). Mixed cropping trials with cotton and groundnut. *Madras Agric. J.*, 44 (1) : 131-140.
- Piper, C.S. (1950). Soil and plant analysis. Interscience Publishers Inc. New York.
- Polthanee, A and Treloges, V. (2003). Growth, yield and land use efficiency of corn and legumes grown under intercropping systems. *Plant-Production-Science*. 6(2): 139-146.
- Prodhan, H.S. (2000). Year-round productivity of green maize and some crops in sole and intercrop systems in new alluvial zone of West Bengal. *Environment and Ecology*. 18(2): 447-450.
- Rai, P.K.; Kumar, Yogesh and Sarraf, Akhilesh (2005). Cultivation of sweet corn. *Indian Fmg.* 54 (10): 10-12.
- Raikhelkar, S.V. and Upadhyay, V.C. (1980). Economics of companion cropping in pearl millet on rainfed lands. *Indian J. agric. Sci.* 50(9): 673-674.
- Raji, L.D. and Oyekan, P. (2002). Agronomic evaluation and nutrient production of soybean + sorghum intercropping system. *Crop Science Journal*. 10(4): 369-374.
- Ramasamy, K.; Christopher, A. and Lourduraj (2002). Effect of intercrops and nutrients on yield attributes on yield attributes and yield of rainfed pearl millet. *Madras Agric. J.* 89(10-12): 631-633.
- Rana, K.S., Shivram, R.K. and Kumar, Ashok (2006a). Effect of moisture-conservation on productivity and water use in maize (*Zea mays*)-based intercropping systems under rainfed conditions. *Indian J. Agron.* 51 (1): 24- 26.
- Rana, N.S., Kumar, Sanjay, Saini, S.K. and Panwar, G.S. (2006b). Production potential and profitability of autumn sugarcane-based intercropping systems as influenced by intercrops and row spacing. *Indian J. Agron.* 51 (1): 31- 33.
- Rao, M.R. and Willey, R.W. (1983). Effect of pigeonpea plant population and row arrangement in sorghum/pigeonpea intercropping. *Field crops. Res.*, 7 (3) : 203-212.

- Reddy, P.R., Tarhalkar, P.P. and Rao, N.G.P. (1977). Improved pigeonpea varieties for mono and intercropping. *Indian Fmg.* **27** (9) : 3-5.
- Reddy, S.N.; Raju, M.S. and Reddy, A. (1986). Study of maize, groundnut intercropping systems under rainfed conditions. *Indian J. Agron.* **31** (2): 190 - 192.
- Reddy, S.R.V. and Reddy, M.R. (1981). Studies on intercropping of maize under varied row spacing. *Indian J. Agron.* **26** (3) ; 360-362.
- Roodagi, L.I.; Itnal, C.J. and Chetti, M.B. (2001). Impact of intercropping and planting methods on growth and yield of sugarcane. *Karnataka Journal of Agricultural Sciences.* **14**(2): 305-310.
- Roodagi, L.I.; Itnal C.J. and Khandagave, R.B. (2000). Influence of planting system and intercrops on sugarcane tillering and yield. *Indian Sugar.* **50**(9): 605-609.
- Roodagi, L.I.; Itnal, C.J. (2001). Sugarcane based intercropping. *Karnataka Journal of Agricultural Sciences.* **14**(3): 596-600.
- Roy, R.P.; Sharma, H.M. and Thakur, H.C. (1981). Studies on intercropping in long duration pigeonpea on sandy loam soil of North Bihar. *Indian J. Agron.* **26** (1): 77 - 82.
- Samui, R.C.; Roy, A. and Bhattacharya, P. (1984). Effect of intercropping on growth parameters of groundnut and sunflower. *Zeitschrift für Acker- und pflanzenbau.* **153**(3): 161-166.
- Saren, B.K and Jana, P.K (1999). Effect of irrigation and intercropping system on yield, water-use, concentration and uptake of nitrogen, phosphorus and potassium in maize (*Zea mays*) and groundnut (*Arachis hypogaea*) grown as sole and intercrop. *Indian J. Agric. Sci.* **69**(5): 317-320.
- Sarkar, R.K. and Sanyal A.R. (2000). Production potential and economic feasibility of sesame (*Sesamum indicum*) based intercropping system with pulse and oilseed crops on rice fallow land. *Indian J. Agron.* **45** (3): 545 - 550.
- Sarkar, R.S., Chakraborty A. and Bala B. (1998). Biological potential and economic feasibility of intercropping of sunflower (*Helianthus annuus*) with pulses and oilseeds under different planting patterns on rice fallow land. *Indian J. Agron.* **43** (4): 601 - 605.

- Sarkar, R.S., Shit D. and Maitra S. (2000). Competition functions, productivity and economics of chickpea (*Cicer arietinum*) based intercropping system under rainfed conditions of Bihar plateau. *Indian J. Agron.* **45** (4): 681- 686.
- Satapathy, N.; Balasubramanian, A.; Radhamani, S. and Subbian, P. (2003). Comparative performance of different maize based intercropping systems and planting patterns under rainfed situation. *Madras Agric. J.* **90**(7-9): 416 - 420.
- Sawant, V.K. (1989). Effect of intercropping of groundnut with maize, cowpea and mustard on growth, yield, quality and economics. M.Sc. (Agri.) thesis (unpub.) submitted to the K.K.V., Dapoli.
- Senaratne, R.; Liyanage, N.D.L.; Soper, R.J. (1995). Nitrogen fixation and N transfer from cowpea, mungbean and groundnut when intercropped with maize. *Fertilizer Research.* **40**(1): 41-48.
- Senthivel, S.; Solaiappan, U. and Subramanian, S. (1994). Possibility of intercropping and double cropping in rainfed red soil tract. *Agricultural Science Digest, Karnal.* **14**(3/4): 197-200.
- Shahu, Rajendra (1992). Pigeonpea+maize intercropping more advantageous than sole pigeonpea at Rampur, Chitawan, Nepal. *International Pigeonpea Newsletter.* (15): 11.
- Sharma, B.L. and Sharma P.K. (1995). Pearlmillet (*Pennisetum glaucum*) - based crop mixtures under rainfed conditions. *Indian J. Agron.* **40** (3): 362-365.
- Sharma, R.K. and Rajput, O.P. (1997). Production potential of pigeon pea (*Cajanus cajan*) intercropped with groundnut (*Arachis hypogaea*) followed by wheat (*Triticum aestivum*) in sequence. *Indian J. Agron.* **42**(1): 53-55.
- Shinde, V.S. and Ghanbahadur (2002). Cropping system - An approach for sustainable agriculture. Lecture notes of winter school on "Integrated nutrient management for sustainable agriculture", held at Dr. P.D.K.V., Akola, pp: 172-179.

- Shivay, Y.S.; Singh, R.P. and Shivakumar, B.G. (2002). Effect of nitrogen on yield attributes, yield and quality of maize (*Zea mays*) in different cropping systems. *Indian J. agric. Sci.*, **72**(3) : 161-163.
- Shivkumar, M.V.K. and Virmani, S.M. (1980). Growth and resource use of maize, pigeonpea and maize + pigeonpea intercrop in an operational research watershed. *Expt. Agric.*, **16**(4) : 377-386.
- Shrivastava, U.K. and Sinha, N.K. (1992). Response of maize (*Zea mays*) and wheat (*Triticum aestivum*) to azotobactor inoculation and fertilizer application. *Indian J. Agron.* **37**(2): 356-357.
- Singh, P.P.; Nema and Kaushal, P.K. (1972). A study of intercropping sesame with maize and mung. *Indian J. Agron.* **17**(4): 294-296.
- Singh, D.P., Rana, N.S. and Singh, R.P. (2000a). Growth and yield of winter maize (*Zea mays*) as influenced by intercrops and nitrogen application. *Indian J. Agron.* **45** (3): 515 - 519.
- Singh, G. and Singh, P. (1993). Intercropping compatibility of different crops with winter maize (*Zea mays*). *Indian J. Agron.* **38** (3): 519 -522.
- Singh, V.B. and Giri, Gajendra (2001). Influence of intercropping and weed control measures dry-matter accumulation and nutrient uptake by sunflower (*Helianthus annuus*) and groundnut (*Arachis hypogaea*) and their effect on succeeding maize (*Zea mays*). *Indian J. Agron.* **46** (1): 50-55.
- Singh, V.P. and Singh, V.K. (2001). Productivity potential and economics of maize (*Zea mays*) and soybean (*Glycine max*) intercropping patterns under rainfed low hill or valley situation of Uttaranchal. *Indian J. Agron.* **46** (1): 27-31.
- Singh, C.M. and Guleria, W.S. (1979). Effect of intercropping and fertility levels on growth, development and yield of maize (*Zea mays*). *Food Farming and Agriculture*, **10**(7) : 242-244.
- Singh, D.P., Rana, N.S. and Singh, R.P. (2000b). Dry matter production and nitrogen uptake in winter maize (*Zea mays*) based intercropping system under different levels of nitrogen. *Indian J. Agron.* **45** (4): 676 - 680.

- Singh, R.A. and Singh, A. K. (1994). Comparative performance of different intercropping systems with pigeonpea (*Cajanus cajan*) under rainfed conditions of Vindhyan region. *Indian J. Agron.* **39**(4): 613 - 615.
- Singh, R.V. and Arya, M.P.S. (1995). Effect of seed ratio on performance of finger millet (*Eleusine coracana*) based mixed cropping systems. *Indian J. Agron.* **40** (3): 366-370.
- Singh, R.V. and Arya, M.P.S. (1999). Nitrogen requirement of finger millet (*Eleusine coracana*) + pulse intercropping system. *Indian J. Agron.* **44** (1): 47-50.
- Singh, S.K. and Sarawgi, S.K. (1995). Effect of row ratio, nitrogen and irrigation in wheat (*Triticum aestivum*) and chickpea (*Cicer arietinum*) intercropping system. *Indian J. Agron.* **40** (3): 492-495.
- Singh, V. P. (2000). Planting geometry in maize (*Zea mays*) and black gram (*Phaseolus mungo*) intercropping system under rainfed low hill valley of Kumaon. *Indian J. Agron.* **45** (2): 274 - 278.
- Singh, Y.P. and Sharma, R.P. (1987). Intercropping in *rabi* maize for higher production. *Seeds and Farms.* **13** (12) : 12-147.
- Singh, J.P; Prasad, U.K and Singh, H. (2000). Effect of irrigation and drainage requirement on water-use efficiency and yield of pure [crops] and maize (*Zea mays*)-based intercrops. *Indian J. Agric. Sci.* **70**(2): 65-68.
- Singh, R.S and Rahman, A. (1999). Economic feasibility of pigeonpea (*Cajanus cajan* L.) based intercropping systems in Chotanagpur plateau. *Journal of Research, Birsa Agricultural University.* **11**(1): 27-30.
- Sinha, K.K., Mishra S.S. and Singh, S.J. (1999). Yield and economics as influenced by winter maize (*Zea mays*) based intercropping systems in North Bihar. *Indian J. Agron.* **44** (1): 30-35 (March 1999).
- Srivastava, R.K. and Bohra, J.S. (2006). Performance of wheat (*Triticum aestivum*) + Indian mustard (*Brassica juncea*) intercropping in relation to row ratio, Indian mustard variety and fertility levels. *Indian J. Agron.* **51** (2): 107- 111.
- Subbiah, B.V. and Asija, G.L. (1956). A rapid procedure for the estimates of available nitrogen in soil. *Current Sci.* **25**(8):259-260.

- Suwanarit, A.; Lekhasoonthrakorn, N.; Rungchuang, J. and Kritapirom, S. (1998). Effects of intercropping groundnut and green-manure legumes to corn on the yields of corn and productivity and chemical properties of soil. *Kasetsart-Journal, -Natural-Sciences*. 32(3): 374-384.
- Tarhalkar, P.P. and Rao, N.G.P. (1975). Changing concepts and practices of cropping system. *Indian Fmg. J.* 3-7.
- Thakur, H.C. and Sharma, N.N. (1988). Intercropping of maize (*Zea mays*) with short duration pigeon pea (*Cajanus cajan*) and groundnut (*Arachis hypogaea*). *Indian J. agric. Sci.*, 58(4): 259-262.
- Tiwari, K.P.; Tomar, R.K.S.; Namdeo, K.N. and Raghu, J.S. (1996). Intercropping studies in sesamum with different crops. *Bhartiya Krishi Anusandhan Patrika*. 11(3): 181-185.
- Tofinga, M.P. and Tukunga, T.M. (1995). The nature of competition between maize (*Zea mays* var. *rugosa*) and peanuts (*Arachis hypogaea*). *Journal of South Pacific Agriculture*. 2(2): 27-33.
- Tomar, S.K.; Singh, H.P. and Ahlawat, I.P.S. (1997). Dry matter accumulation and nitrogen uptake in wheat (*Triticum aestivum*) - based intercropping systems as affected by N fertilizer. *Indian J. Agron.* 42(1): 33-37.
- Tripathi, H.N., Chand, Subash and Tripathi, A.K. (2005). Biological and economical feasibility of chickpea (*Cicer arietinum*) + Indian mustard (*Brassica juncea*) cropping systems under varying levels of phosphorous. *Indian J. Agron.* 50 (1): 31- 34.
- Tripathy, R.K.; Pradhan, L. and Rath, B.S. (1997). Performance of maize (*Zea mays*) and cowpea (*Vigna unguiculata*) forage intercropping system in summer. *Indian J. Agron.* 42(1):38-41.
- Verma, S.P. and Modgal, S.C. (1983). Production potential and economics of fertilizer applications as resource constraints in maize-wheat crop sequence. *Him. J. Agric. Res.* 9: 89-92.
- Verma, S.S., Joshi, Y.P. and Saxena, S.C. (2005). Effect of row ratio of fodder sorghum (*Sorghum bicolor*) in pigeonpea (*Cajanus cajan*) intercropping system on productivity, economic functions and economics under rainfed conditions of North India. *Indian J. Agron.* 50 (2): 123- 125.

- Willey, R.W. and Osiru, D.S.O. (1972). Studies on mixtures of maize and bean (*Phaseolus vulgaris*) with particular reference to plant population. *J. Agric. Sci. (Camb.)* **79**: 519-527.
- Willey, R.W. and Rao, M.R. (1980). A competitive ratio for quantifying competition between intercrops. *Exptl. Agric.* **16**: 117-125.
- Williams, F.J. (1962). The analysis of competition experiments. *Austr. J. Biol. Sci.* **15**: 509-525.
- Wu, Ji Cheng; Kong, Xiang Xuan and Li, Xin Duan (1998). On the development trends in sustainable agriculture in the sandy area of Henan Province. *Journal of Henan Agricultural Sciences.* **4**: 14-16.
- Yadav, R.P.; Sharma R.K. and Shrivastava, U.K.(1997). Fertility management in pigeonpea (*Cajanus cajan*) -based intercropping system under rainfed conditions. *Indian J. Agron.* **42** (1): 46-49.
- Yakadri, M., Gautam R. G. and Kaushik S. K. (1994). Effect of intercropping and fertilizer levels on yield and quality of rainfed pearl millet (*Pennisetum glaucum*). *Indian J. Agron.* **39** (4): 528 - 531.
- Zhang, F.; Shen, J.; Li, L. and Liu, X. (2004). An overview of rhizosphere processes related with plant nutrition in major cropping systems in China. *Plant and Soil.* **260**(1/2): 89-99.
- Zhan, Wei Hua; Huang, Guan Hua; Feng, Shao Yuan and Wang, Feng Xin (1999). The interaction of water and fertilizer on intercropped groundnuts and maize with sprinkler irrigation. *Journal of China Agricultural University.* **4**(4): 35-39.
- Zhou SuMei; Ma, ShuQin; Li, Wen and Zhang, Shi Tou (1998). Analysis of superiority of maize and groundnut row intercropping. *Acta Agriculturae Universitatis Henanensis.* **32**(1): 17-22.