COMPARATIVE ECONOMICS OF VEGETABLE PRODUCTION UNDER ORGANIC AND INORGANIC FARMING IN BELGAUM DISTRICT

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1. INTRODUCTION

India is a leading vegetable producing country in the world. The country is blessed with a unique gift of nature of diverse climate and distinct seasons to make it possible to grow good number of vegetables in an area of 7.05 m.ha with the annual production of 108.20 m.t (Agriculture Today, 2008). Karnataka state is one of the leading vegetable producing state in the country with a production of 45,78,600 t, vegetables grown over an area of 3,82,200 ha (APEDA, 2005-06) of which, tomato occupies a major area of 47.2 thousand hectare with a production of 1,285.1 thousand tonne (National Horticulture Board, 2007-08), contributing 8.5 per cent production share of major vegetables in India and chilli occupies about 69,880 ha. The vegetable crops have been well advocated in solving the problem of food security, since they are rich source of minerals, vitamins, fibre and contain fair amount of protein as well as carbohydrates.

Karnataka is one of the leading states in Southern India with a great potential for horticultural development. The state is blessed with ten agro-climatic regions suitable for growing variety of fruits and vegetables round the year. The major districts growing horticultural crops in the state are Kolar, Hassan, Belgaum, Kodagu, Bangalore, Shimoga, Bijapur and Dharwad. The state stands at eighth position with respect to area and production of vegetables. Belgaum is the major vegetable producing district in the Northern Karnataka, with an area of 49,576 ha and production of 6,77,706.56 t respectively. The total area and production of tomato and chilli in Belgaum district is 4806.70 hectares and 1,61,170.00 tonnes and 7,237.40 hectares and 96,786.10 tonnes respectively (Source: DDH Office, Belgaum 2008-009).

Organic farming is practiced in India since thousands of years. The great Indian civilization thrived on organic farming and was one of the most prosperous countries in the world, till the British ruled it. In traditional India, the entire agriculture was practiced using organic techniques, where the fertilizers, pesticides *etc*. were obtained from plant and animal products. Organic farming was the backbone of the Indian economy and cow was worshipped (and till today done so) as a God. The cow, not only providing milk but also bullocks for farming and dung, which is used as manure.

The first use of the term *organic farming* is usually credited to Lord Northbourne, in his book, *Look to the Land* (1940), wherein he described a holistic, ecologically balanced approach to farming. The British botanist, Sir Albert Howard often called "the father of modern organic agriculture" studied traditional farming practices in Bengal, India. He came to regard such practices as superior to modern agricultural sciences and recorded them in his book, *An Agricultural Testament* (1940). In 1972, the International Federation of Organic Agriculture Movements (IFOAM) was founded in Versailis, France. IFOAM was dedicated to the diffusion of information on the principles and practices of organic farming across national and linguistic boundaries.

According to the International Fund for Agriculture Development (IFAD), organic production in India has been growing steadily. About 2.5 million hectares of land is under organic farming in India. Further there has been a remarkable growth in organic farming and 332 new organic certifications were issued during 2004.The Research Institute of Organic Agriculture reports a total 15,000 organic farms were operating in the country in 2004.

The Agricultural and Processed Food Products Exports Development Authority (APEDA) estimated 2,00,000 hectares of certified organic land, mainly cultivated by small holder producers. Recently, an increasing number of companies, NGO's, farmers' organizations and Government agencies have been promoting organic agriculture in India.

The growth in organic production has been developing mainly by the increasing international demand, but the domestic market is also strengthening due to a large population and increasing wealth (IFAD, 2005-06).

Organic farming is getting popular day by day. The pollution in general and poisoning of food, that we eat with harmful chemicals and their effect on human health and environment is making people to look for organic food. NGO's along with successful organic farmers had a big role to play in bringing organic farming to this level today. There are several states in

India, which have declared organic policy with intent to make the entire state organic in the near future.

Organic programme during X plan

During the tenth five-year plan, for the first time, organic farming was selected as one of the new areas for attention. Resources were allocated to launch a National Programme on Organic Production, which was being implemented by Ministry of Commerce. At the same time, Ministry of Agriculture, through National Centre of Organic Farming (NCOF) launched a major focus by implementing Rs 57 crores projects on improving organic input supplies and training with the objectives like to promote organic farming in the country and to promote production of organic inputs.

Under promotion for organic input production scheme, so far the capacity has been created for production of 13,000 MT of agro waste compost, 3150 MT of biofertilizers and 30,000 MT of vermi culture (for onward production of vermicompost).

Under promotional activities more than 1000 training programmes have been conducted and more than 22,000 personals have been trained in different aspects of organic farming, more than 2000 demonstrations on organic management and inputs have been arranged, out of 150 model organic farms sanctioned more than 60 farms have so far been developed and within next one year time they will come up as technology dissemination centers and with the help of over 200 service providers about 1,50,000 farmers have been identified and are being supported for conversion to organic farming. Out of these 50,000 farmers have already been registered with certification agencies and total registered area brought under conversion is over 52,000 ha.

The total export value of organic agro products during 2008-09 was accounted for about Rs 26900 crores, out of which value of organic fruits and vegetables was about Rs 3190 crores. The target for 2010-11 is about Rs 32815 crores for total organic agro products and for organic fruits and vegetables is about Rs 4115 crores. (APEDA, Ministry of Commerce, 2008-09).

Organic farming during XI plan

During XI plan it is a combined effect of farmer's efforts, NGOs work, Govt interventions and market forces push to organic that Indian organic movement has reached a stage where it can swiftly move to occupy desired space in Indian agriculture, which was left as a vaccum by the green revolution. National Commission on Farmers considers it as a tool for second green revolution in the rain fed and hilly areas of the country.

Nine states of India pushed either policies or programs on Organic Farming. Some states like Uttaranchal made organic a thrust area for improving mountain agriculture based farm economy and livelihoods. States like Karnataka formulated organic strategy and programmes to help spread organic in every block. In Maharashtra there were double efforts; the initiatives by the organic farmers associations across the state were supported by the state. The emerging examples of public private partnership for promoting organic farming are available from the states of Maharashtra, Karnataka, Tamil Nadu and Kerala. The role of NGOs and farmers associations is very strong in South India.

A survey conducted by the International Competence Centre for Organic Agriculture (ICCOA) in 2005 indicates there is already a ready market worth 1000 crores for organic products in the country. The domestic market for food & grocery is estimated to be about Rs 6,75,000 crores and is growing at the rate of 5 per cent to 6 per cent per annum. Planning Commission, in its working group report has proposed to develop all the rain fed areas (88.5 million ha.) in a period of 20 years (*i.e.* up to XIII Five Year Plan) at a cost of Rs. 72750 crore with peoples' participation.

The reports of the National Commission on Farmers have clearly highlighted that India is in the grip of an agrarian crisis. This multi dimensional crisis in agriculture has made it necessary for India to make a paradigm shift in agriculture development. The Farmers Commission in its report, has recognized Organic Farming as one of the potential options to help solve the agrarian crisis, Keeping in mind the need for scaled up public interventions to promote organic farming, the commission estimated the need for investing over Rupees 2500 crores during the XI Five Year Plan. The Commission has made a recommendation that

25,000 Organic Villages with niche commodities should be developed in the hills during the next five years, and the local farm graduates and youth be involved in it as entrepreneurs. The report also highlights that organic farming is specially suited to hill agriculture and for growing high value horticulture crops, as well as other cash crops, such as the medicinal and aromatic plants, and spices.

The major targets of Organic Farming Mission are to make India number one organic country in the world in next ten years, to convert five million hectares of farm land and 5 to 6 million inorganic farmers into organic during the XI Plan period and by the end of the XI Plan, produce Rs 15,000 crores worth of organic commodities; wherein 80 per cent production is for domestic and 20 per cent for export.

Role of Karnataka Government in organic farming

In Karnataka the area under organic farming is 4,050 ha (National Horticulture Mission Report, 2006-07). According to Ministry of Agriculture, Govt. of Karnataka there are certain policies and schemes to educate farmers about organic farming and various training programmes in districts and taluks in Karnataka and is providing funds to the Non-Governmental Organisations and each organisation has a target to cover 1500 farmers and for that they are paying Rs 200 per farmer per year to the NGO's to support the farmers. The Government of Karnataka has made separate cell called 'organic cell' especially for the farmers.

The Government of Karnataka is giving together of 100 hectares of area in each district and taluk, to be converted to organic farming for which state government has selected 29 Non- Governmental Organizations and given them the responsibility to work with farmers to make their farms organic and 50 per cent of the funding for organic farming has been given by the Government of Karnataka and rest will be incurred by farmer himself.

Organic Food Club (OFC) which was established in Yamakanmaradi village of Belgaum district is a unique voluntary service oriented organization. It identifies organic farmers from Northern Karnataka who are growing vegetables, fruits, pulses, cereals and other plant products without the use of chemical fertilizers, or chemical pesticides at any stage of cultivation. Its motto is to establish a fair marketing system with direct relationship between the producer and the consumers. Its aim is also to offer expert advice to the farmers who wants, to convert to organic farming by way of periodical visits to such farms.

Organic Food Club has successfully established organic farming practices by designing crop production systems for sustainability of the farmers involved in the following sites and programmes

1. One hundred and seven acres control union certification certified organic land which includes 24 farmers from Belgaum, Hukkeri and Chikkodi talukas of Belgaum district.
2. Govt. of Karnataka made Organic Village Site programme (2004-07) for 132 small farmers in 250 acres at Yamakanmaradi village of Belgaum district.
3. Govt. of Karnataka made Organic Village Site programme (2007-2010) for 90 farmers in 250 acres at Khanapur taluk of Belgaum district.
4. Integration of Medicinal, Aromatic and Dye Plants (MADPS) in the organic farming system to improve livelihoods of small farm holders in Hukkeri, Belgaum, Chikkodi talukas of Belgaum district in Karnataka (FAO) programme of United Nations in the year of 2007-10

Many farmers, researchers and policy makers believe that turning to organic farming would mean lower yields and lower profits. Therefore, argument for a premium price for organic produce and consumers on the other hand would, not want to pay higher price for organic produce. Hence, the challenge is to develop systems, which will facilitate acceptance of organic cultivation by the farmers and the consumers.

Talking of organic, a lot of chemical pesticide is used on the vegetables (7,216.20 m.t) resulting in the pesticides residue, which definitely affect human health. The study of Green Foundation revealed that, by following a mixed system always get an average price for the vegetables, which ensures regular average profit as opposed to a big loss and occasional big profit in case of monocropped vegetables grown with chemicals. As the price of the organic vegetables were set at the same market price of chemically grown vegetables, consumers from all walks of life; poor, middle and higher class have access to these vegetables. This organic farming system therefore, has potential for attracting more consumers.

As time went by, extensive dependence on chemical farming has shown its darker side. The land is losing its fertility and is demanding larger quantities of fertilizers to be used, pests are becoming immense requiring, the farmers to use stronger and costlier pesticides, due to increased cost of farming, farmers are falling into the trap of money lenders, who are exploiting them, no end and forcing many to commit suicide.

Both, consumers and farmers are now slowly and gradually shifting back to organic farming in India. It is believed by many that organic farming is healthier. Though the health benefits of organic food are yet to be proved, consumers are willing to pay higher premium for the same. Many farmers in India are shifting to organic farming due to the domestic and international demand for organic food. Further stringent standards for non-organic food in European and US markets have led to rejection of many Indian food consignments in the past. Organic farming therefore provides a better alternate to chemical farming.

Principles of organic farming

1. To produce food of high quality in sufficient quantity.
2. To encourage and enhance biological cycles within the farming system involving micro organisms, soil flora, plants and animals
3. To maintain and increase the long term fertility of soils.
4. To create a harmonious balance between crop production and animal husbandry.
5. To produce fully bio-degradable organic products.
6. To minimize all forms of pollution
7. To promote the healthy use proper care of water, water resources and all lives therein.

At present there is no adequate and proper documentation of organic practices being adopted by vegetable growers and also empherical studies have been hardly conducted on various aspects of organic vegetable production practices in Karnataka. Hence, there is need to study the causes for shifting to organic cultivation of vegetables and to compare the input use pattern, costs involved, yields, market, prices and the returns in organic cultivation of vegetables. The study also looks into the problems faced by the farmers of organic vegetables with the following objectives.

Specific objectives of the study

1. To ascertain the reasons for shifting from inorganic to organic cultivation of vegetables.
2. To study the type, pattern and levels of use of manures, fertilizers and plant protection measures and the cost involved under both the types of farming.
3. To compare the yields, market prices and returns of organic vegetables with that of inorganic vegetables.
4. To decompose the causes of yield/income difference between vegetables grown under organic farming and inorganic farming.
5. To enumerate the problems of organic vegetable growers.

The hypotheses outlined for the study are

1. The costs involved in production of organic vegetables are less compared to that of inorganic vegetables.
2. Net returns from organic vegetables are higher than that of inorganic vegetables

Need for the study

Today there is an increasing awareness about organic farming in view of energy shortages, food safety and soil and environment pollution arising out of inorganic farming. Thus organic farming will definitely help to create a healthy society and healthy people.

This study is an attempt to analyze causes for shifting to organic cultivation of vegetables and to compare the input use pattern, costs involved, yields, market prices and the returns in organic cultivation of vegetables. The study also looks into the problems faced by the farmers of organic vegetables.

Limitation of the study

Due to the limitation of the time and other resources, the present investigation has been restricted the selection of locale, sample size and the variables. Hence, the findings have to be viewed in the specific context of the conditions prevailing in the study area and cannot be generalized for wider geographical area. However, careful and rigorous procedures have been adopted in carrying out the research as objectively as possible. In spite of the individual bias made by the respondent farmers in eliciting the necessary responses, it is believed that the findings and conclusions drawn in the present study would form the basis for future research study.

2. REVIEW OF LITERATURE

A review of past research helps in identifying the conceptual methodological issues relevant to the study. This would enable the researcher to collect information and subject them to sound reasoning and meaningful interpretation. A brief review of the earlier research work related to the present study is presented in this chapter. Keeping in view of the objectives of the study, the reviews are presented under the following headings.

2.1 Reasons for shifting from inorganic to organic cultivation of crops

2.2 Type, pattern and levels of use of manures, fertilizers and plant protection measures and the cost involved under both organic and inorganic farming.

2.3 The yields, market prices and returns of organic and inorganic produce.

2.4 Decomposing the causes of yield/income difference between crops grown under organic farming and inorganic farming.

2.5 Problems of organic vegetable growers.

2.1 Reasons for shifting from inorganic to organic cultivation of vegetables

Anand Kumar (1998) found that increasing cost of chemical inputs (63 per cent), increase on the net return in organic farming (11 per cent), as the reasons behind shifting to organic farming.

Bruggen and Termorshuizen (2003) studied the integrated approaches to root disease management in organic farming systems in Marijkeweg, Netherlands and they concluded that conventional agriculture has had major environmental impacts, in particular with respect to soil degradation. Soil structure, fertility, microbial and faunal biodiversity have declined, and root diseases are common unless genetic resistance, soil fumigation and/or seed treatments are used. Primarily for environmental reasons and increasing demands for safe and healthy food from the public, farmers have switched over to organic production at an increasing rate.

Loganandan and Singh (2003) observed that more number of respondents (54 per cent) in Erode district of Tamil Nadu had the motive of environment safety to shift to organic farming followed by financial motives (40 per cent), soil health oriented motives (34 per cent), motivation by significant others viz neighbouring organic farmers, environmental activists etc (30 per cent), quality of output related motives (24 per cent), motivation by media (24 per cent) and philosophical motives (18 per cent).

Anjugam *et al.* (2006) studied the economics of usage of bio-inputs in sugarcane to identify the determinants of adoption of bio-inputs and suggest alternate measures for their increased use in sugarcane cultivation in the western zone of Tamil Nadu. The results have revealed that access to bio-inputs, adequate information from the sugar mill; no health hazards have significant positive influence on profitability of adoption of bio-inputs usage in sugarcane.

Anita (2006) conducted a study of Agrocel Industries Ltd., in the Kutch district of Gujarat in reference with promotion of organic cotton cultivation. The study revealed that the farmers are enjoying a net gain of 14 to 20 per cent, resulting from higher revenues and lower costs. The motivation of the farmers to take up organic farming on contract is not based on returns alone; there are benefits like supply of seeds, bio-pesticides, bio-fertilizers, etc. on credit at their door step and that too at subsidized rates; hassle free marketing of output, regular visits of field staff for guidelines and timely payment by the company.

Jaswinder and Kalra (2006) conducted a case study on organic farming in Punjab (India) among 60 farmers. Majority of the respondent farmers were satisfied with contract organic farming. Technical guidance and inputs were provided by firms. Most of the farm operations were done by respondents manually. The total area under organic farming in selected districts was 14.98 per cent of the total operational land holding of the selected respondents and was likely to be increased marginally to 15.14 per cent in next year. The major reasons for opting organic farming reported by the respondents were: easy marketing, additional benefits (certification of farm and premium price), availability of inputs and technical guidance from firms.

Kalamkar (2006) studied the progress, possibilities and constraints of organic farming in India and he revealed that organic farming systems have attracted increasing attention world over due to wide adverse effects of conventional agricultural practices on human diet, environment and sustainability of agricultural production.

Olgun *et al.* (2006) studied the economic evaluation of organic cherry production in Manisa, Turkey and they revealed that transition from conventional to organic cherry production in Turkey is mainly due to increasing the net return and protecting the environment.

Rios *et al.* (2007) looked at how switching to organic production has impacted on health and child nutrition in La Frailesca. It also outlines the reasons behind farmers' decisions to make the switch in this high altitude region. The health of 8-14 year olds in the organic coffee region was compared with those in a more highly-intensive tomato-growing area where farmers use large amounts of agricultural chemicals. This work showed that levels of chronic malnutrition are significantly higher in the organic coffee areas than in the tomato-growing area, but levels of anaemia are lower, as well as the number of children with below normal body mass index. The study of organic coffee production suggests that low external input and sustainable agriculture can contribute to the alleviation of nutritional problems, disease and health related issues, even if the motivation to switch to organic production may be driven by economic rather than health concerns.

Murthy *et al.* (2008) studied the organic farming practitioners and their perception in Dakshin Kannada and Udupi districts of coastal Karnataka. The main reasons expressed by the organic farmers for adoption were increased pest and disease infestation through chemical fertilizers, loss of soil characters, less profit in chemical farming and health hazard.

2.2 Type, pattern and levels of use of manures, fertilizers and plant protection measures and the cost involved under both inorganic and organic farming

Engyndenyz (2000) studied the economic feasibility of organic greenhouse cucumber production in Bornova, Turkey and the study revealed that total costs of organic, greenhouse cucumber production were determined to be 1334 US dollars. Net return per square meter was 0.98 dollar and net return per kilogram was 0.07 dollar.

Nagarajan (2000) conducted a case study on economics of organic farming at Dr.K.V. Muralidharan Farm, Nungambakkam and observed that Dr.Muralidharan incurred a cost of Rs. 6600 to cultivate paddy crop in one acre of land and he obtained 15 quintals of rice yield and earned a net profit of Rs. 8729.

Jitendra Singh *et al* (2006) studied the present status and economics of organic farming in the district of Udham Singh Nagar in Uttaranchal. The study has revealed that cost of cultivation for organic paddy *i.e.* cost A_1 and cost C_3 has been found as Rs 18786/ha and Rs 31651/ha and for non-organic paddy as 19106/ha and Rs 35947/ha.

Sujatha *et al* (2006) studied the comparative analysis of efficiency of organic farming and inorganic farming in Karimnagar district of Andhra Pradesh. The study revealed that the cost on human labour has been found higher in organic cultivation of rice and cotton as organic farming is labour intensive, where as in inorganic farming, the cost of manures, fertilizers and pesticides are high compared to organic cultivation of rice and cotton. The net returns have been found higher in organic farming in both the crops compared to inorganic farming though the total cost of cultivation has been more in inorganic farming compared to organic farming.

Sushil Kumar *et al* (2006) studied the impact of drought on cost and returns from cereal crops under different organic and inorganic farming system in Himachal Pradesh. The study has revealed the cost of cultivation right from cost C_1 to cost C_2 to be less on organic farming system than inorganic farming system farms. The cost of production per quintal of produce has also been lower on organic farming system than inorganic farming system farms.

Waykar *et al* (2006) studied the economics of grape production under organic and inorganic farming in the Nasik district of Maharastra. The study revealed that, per hectare total cost of cultivation has been found Rs 14675/- for organic grapes and Rs 209035/- for inorganic grapes.

Sale and Yadav (2008) studied the sugarcane cultivation with an integrated approach in Kolhapur District of Maharashtra. This study was conducted to examine the per hectare resource use structure in organic and inorganic sugarcane farming, calculate the per hectare cost of cultivation in organic and inorganic sugarcane farming and compare the economics of the two farming systems. Results showed that the per hectare cost of suru sugarcane with inorganic and organic farming were Rs. 66,572.73 and Rs. 57,275.72, respectively and the per tonne cost of cultivation of sugarcane were estimated as Rs. 660.83 and Rs. 712.42 in inorganic and organic farming, respectively.

2.3 The yields, market prices and returns of organic and inorganic produce

Bennet (1999) examined the financial performance of a series of 24 case studies on organic vegetable holdings in southern England (1996). Whilst it is difficult to generalize due to the heterogeneity of organic holdings, some growers obtained high returns due to the achievement of high yields and (relatively) very high premium price, especially when compared to non-organic production.

Bharadwaj *et al.*(2000) conducted a field experiment at a Regional Horticultural Research Station, Jchh during 1995-98, to find out the effect of organic sources of nutrients i.e. farm yard manure, neem cake, rape seed cake as partial or complete alternative to chemical fertilizers on yield of tomato, okra, cabbage and its economic feasibility. Application of sole sources of nutrients recorded 11-17 percent lower yield in different vegetable crops. However, application of 50 percent recommended NPK plus 50 percent rape seed cake (0.72 tonnes per ha) in tomato, 50 percent recommended NPK plus 50 percent neem cake (0.72 tonnes per ha) in okra, 33.3 percent recommended NPK plus 33.3 percent farm yard manure (6.66 tonnes per ha) + 33.3 percent neem cake (0.8 tonnes per ha) in cauliflower recorded higher yields which were statistically at far with 100 percent recommended doses of chemical fertilizers. Net returns in organic produce of different vegetables were higher as the produce received higher price in the market.

Dixit and Gupta (2000) conducted a field experiment during two consecutive kharif seasons of 1993 and 1994 at Kanpur to know the effect of farm yard manure, chemical and biofertilizers on yield, quality of rice and soil properties. The results revealed that grain and straw yields of rice increased significantly with increasing levels of NPK fertilizers. Application of FYM @ 10 tonnes per ha and blue green algae (BGA) inoculations either alone or in combination increased the economic yield. The average increase in the grain yield due to BGA was 0.24 tonnes per ha (7.5 per cent) while combined use of FYM and BGA showed the increase at 0.60 tonnes per ha (19.2 per cent). There was an economy of 30 kg N, 1.5 kg P and 15 kg K due to FYM and BGA in first crop of rice. Highest economic yield of 4.43 and 4.61 tonnes per ha during first and second year respectively was obtained in the treatment combination of 120 kg N +60 kg P+60 kg K per ha and FYM+ BGA.

Suresh (2001) in the study on performance of organic farming in Shimoga district of Karnataka reported that per acre net income obtained in organic farms (Rs.19367.96) was more than inorganic farms (Rs.13691.02). This was due to 18.10 per cent higher yields obtained on organic farms over the inorganic farms. And the B:C ratio in case of organic method of cultivation (2.04) was noticed to be higher than inorganic method of cultivation.

Yadav, *et al*. (2004) conducted an experiment in Jaipur, Rajasthan, to determine the suitable combination of organic manure with inorganic fertilizer to increase the tomato production. Treatments comprised: two levels of farmyard manure (FYM; 20 and 40 t/ha) alone or with one-half and full dose of recommended NPK (180:120:80 kg/ha), green manure (sunn hemp) alone and with one-half dose of recommended NPK on tomato. Application of FYM at 20 t/ha + full dose of NPK recorded the highest fruit yield (327.69 q/ha) with benefit:cost ratio of 1:1.49 and was at par with full dose of NPK alone. The lowest yield (113.5 q/ha) was observed in the treatment receiving only FYM at 20 t/ha. Slightly higher yield levels were obtained when the plants were supplied with FYM at 40 t/ha (184.66 q/ha) and green manuring (141.44 q/ha). The total soluble solids percent was highest (4.6 per cent) upon treatment with 40 t FYM alone and lowest (3.5 per cent) upon treatment with NPK alone. The maximum net return was obtained with full dose of NPK, followed by 20 t FYM + full dose of NPK, with cost:benefit ratios of 1:1.85 and 1:1.49, respectively.

Franco *et al*. (2005) made an analysis of the organic hazelnut sector with particular reference to the Monti Cimini area in Italy. The analysis focused on: technical and economic aspects at the farm level; industry and market situations; and the evolution of prices. The study shows that, with an integrated and well-managed technique, organic hazelnut production can equal, and even exceed, that of conventional production. Furthermore, it has been shown that, on average, organic hazelnut prices tend to be 15-20 per cent higher than those for conventional products over and they tend to remain more stable time.

Jadhav *et al*. (2006) studied the profitability of organic and inorganic farming of suru sugarcane in Maharastra. The study was conducted in Walwa and Tasgaon of the Sangli district. The organic farming of sugarcane has lower yield (82.47/ha) than that in inorganic farming (93.58/ha), but the quality of sugarcane was better in the former. The per hectare net profit of organic farming of suru sugarcane has been observed as Rs 98,979 which is higher than that in the inorganic farming (Rs 62,008).

Pandey *et al*. (2006) conducted a field experiment in Almora, Uttaranchal, India, to find out the effect of different sources and rates of organic manures (farmyard manure, vermicompost and poultry manure) on yield of organically grown garden pea (*Pisum sativum* subsp. hortense). Based on the pooled data, all the treatments except vermicompost 1.5 tonnes/ha recorded significantly higher green pod yield of garden pea (39-181.5 per cent) compared with the control. The highest increase in pod yield (181.5 per cent) over the control was recorded with the application of farmyard manure 20 tonnes/ha followed by 15 tonnes/ha (166.2 per cent). These 2 treatments being statistically similar to each other gave significantly higher green pod yields (8.65-9.15 tonnes/ha) compared to other treatments. Application of farmyard manure 20 tonnes/ha gave the highest nest returns (Rs 74 202/ha) followed by 15 tonnes/ha (Rs 70 712/ha).

Solanki *et al*. (2006) studied the effects of organic manures on the yield attributes of rainfed groundnut as well as on the soil nutrient status in Junagadh, Gujarat. Application of farmyard manure (FYM) at 10 t/ha recorded significantly higher pod yield (2785 kg/ha) and gross return (Rs. 314 471/ha) with the maximum net return of (Rs. 17 597/ha), followed by the application of the recommended dose of fertilizer.

Hile *et al*. (2008) studied the economics of organic banana production in Sangali, Maharastra and the study revealed that the per-hectare total cost was Rs. 103 279.09. The maximum per-hectare average yield obtained from the cultivation of organic bananas was 457.28 quintals, which is less (15 per cent) than that in inorganic banana cultivation. The per-quintal cost of production of organic bananas was Rs.225.85, while the net return was Rs.104 064.91 and the benefit-cost ratio was 2:1.

2.4 Decomposing the causes of yield/income difference between crops grown under organic and inorganic farming

Bisaliah (1977) decomposed the yield difference between the two wheat production technologies in Punjab into its constituent sources. He found that improved production technology contributed 15 per cent of the total change in output (40.50 per cent). The increased use of inputs under Mexican wheat contributed about 25.50 per cent to the total difference in output. Among the different inputs the contribution of fertilizer, capital and labour was 15, 8 and 2 per cent, respectively.

Indusekharan (1982) estimated the contribution of different inputs like labour, chemical fertilizer and capital to cotton productivity under Intensive Cotton District Programme (ICDP). He reported that the decomposition analysis showed about 12.50 per cent of the total increase in cotton output was accounted by these three inputs.

Sisodiya *et al*. (1999) studied temporal analysis of decomposition of pigeonpea production in different agro climatic regions of Madhya Pradesh. They found that decomposition analysis of output of pigeonpea crop in different agro climatic regions clearly indicate that after introduction of soybean in the state, contribution of acreage towards total output of pigeonpea crop decreases, even it was negative in some regions. This was positive and high before the introduction of soybean in the state. Although total output of pigeonpea crop increases at higher rate (59.73 per cent) after the introduction of soybean crop in the state due to high take off (78.49 per cent) in productivity of this crop.

Lalwani and Koshta (2000) studied the decomposition analysis of milk yield in members and non-members of Milk Producers Cooperative Societies in Raipur district, Madhya Pradesh, India. It also attempted to decompose the differentiated milk yield between members and non-members of MPCSs. Data for three periods (September-February, March-August, and the overall period) were obtained from a sample of 60 farmers (30 members and 30 non-members).Results of decomposition analysis showed that milk yield was higher in members of MPCSs than in non-members at the same level of inputs.

Vinod Kumar (2001) decomposed the output change under new production technology in dairy farming. He found that the total change in milk yield gave an 8.21 per cent neutral and non-neutral technological change contribution while a 24.92 per cent difference in the value of milk output was found between crossbred cows and buffaloes. Concentrates (18.48 per cent) had the highest contribution followed by labour input (3.43 per cent), miscellaneous costs (2.87 per cent) and green fodder (0.61 per cent). It is concluded that crossbred cows were better allocators of all the inputs compared to local cows and buffaloes as milk producers.

Gaddi *et al.* (2002) using output decomposition model, estimated contribution of different sources to yield gap in cotton. The variables included in the model explained more than 87 per cent of the variation in cotton production in demonstration field. Human labour, bullock labour and seeds turned out to be the most important variables governing production. Capital input did not exert any significant influence in cotton production, while the plant nutrients were excessively used. The production elasticities of all inputs on all the farmers' fields were invariably lower than unity implying diminishing marginal productivity with respect to each of these inputs.

Kunnal *et al.* (2004) studied the effects of technical change in cotton production on output and employment generation in Karnataka using production function analysis and decomposition analysis. Results of the study revealed that bullock labour, machine labour and capital in case of hybrids and seeds, FYM and capital in local varieties were the important inputs conditioning cotton output. Cultivation of hybrids resulted in 121 per cent more cotton output than under local varieties. The contribution from the increased input use was 99.28 per cent and that of technology was 21.72 per cent.

Radha and Chowdry (2005) studied comparative economics of seed production vis-a-vis commercial production of cotton in Andhra Pradesh. The study reported that about 64.5 per cent of the change in gross returns was purely due to technical change.

Ravichandran *et al.* (2006) studied the economics of bio-inputs usage in paddy cultivation in Tamil Nadu and the use of chemical and biological inputs in rice production has been compared. The decomposition analysis has revealed a difference of 12.30 per cent in gross return per hectare of paddy crop between adopters and non-adopters of bio-inputs.

Mohan (2009) studied the impact of IPM technology on cotton and paddy production in Haveri district, Karnataka. The results of decomposition analysis indicated that total difference in output between IPM and non-IPM was 26.47 in cotton and 17.59 per cent in paddy and IPM technology component alone contributed 29.86 and 28.32 per cent in cotton and paddy respectively.

2.5 Problems of organic farmers

Benvenuti and Nasolini (1996) studied organic farming practice of citrus fruit in Emilia-Romagna, Veneto, Trentino-Alto Adige and Sicily of Italy. The study revealed that important factor limiting production is the lack of scientific support from researchers.

Restrepo and Rivera (1997) studied the contribution of the university to the development of organic farming in Latin America. The study revealed that though there was increasing interest in organic farming in Latin America, it has not yet reached the agenda at national policy-making level due to lack of knowledge or opposition. Some of the limitations affecting the widespread adoption of organic farming include lack of human resources, resistance to this method, commercial and economic pressure, land tenure problems, and lack of vision from the universities who could be training organic farming professionals

Chothe and Borkar (2000) observed that more number of respondents (61.33 per cent) in Nagpur district of Maharashtra had the problem of lack of knowledge about biofertilizers, followed by lack of knowledge about benefits of biofertilizers (56.66 per cent) and lack of knowledge about application methods of biofertilziers (52.00 per cent), extension workers never show method and result demonstration (41.33 per cent), no evidence by agricultural department (25.32 per cent) and non-availability of agriculture guidance in village (20.00 per cent).

Jain and Bhattacharya (2000) reported that five types of constraints, which includes social, financial, situational, technological and operational. A majority of respondents (68 per cent) reported unawareness about biofertilizer practices. Other constraints were lack of practical oriented training (64 per cent), lack of relevant literature (60 per cent), lack of handling skill (56 per cent), lethargy due to cumbersome technique (54 per cent), lack of confidence in biofertilziers (50 per cent), few (44 per cent) reported lack of biofertilziers supply center in village and lack of storage facility.

Saxena and Singh (2000) reported that, a high per cent of organic farmers in Malwa region of Madya Pradesh (70.90 per cent) had the problem of non-availability of biofertilizer culture of good quality, followed by lack of knowledge and skill about improved methods of compost making (63.40 per cent). Similarly lack of awareness about the time, concentration and method of biofertilizer application (59.10 per cent) and non-availability of vermicompost in adequate quantity (43.63 per cent) were the other problems noticed with organic growing farmers.

Thimmareddy (2001) reported that the majority of the farmers (70.00 per cent) of North Karnataka expressed the problem of no separate market for organically grown produce, followed by 40.00 per cent of the respondents expressed the problem of decline in returns in the initial period (3-4 years) of organic farming. Similarly, the labour problem was expressed by 30.00 per cent of the respondents whereas 20.00 per cent of the respondents expressed the problem of non-availability of organic pesticides and lack of published literature on organic farming and a less per cent (10.00 per cent) of respondents expressed the problem of non-availability of good quality compost, no support and encouragement from sugarcane factory management to produce sugarcane by organic methods, no remunerative price for organic produce and discouragement by people in continued adoption of organic cultivation.

Venkatram and Mani (2006) studied the prospects and constraints in adoption of organic farming in Tamil Nadu. The study revealed that the major obstacles in practicing pure organic agriculture have been identified as limited technological options, large marginal costs and risk in shifting to a new system from the conventional farming, low awareness about the organic farming system, lack of marketing and technical infrastructure and added cost by way of inspection, certification.

Mallikarjun (2008) studied the production and marketing management behavior of organic vegetable growers in Belgaum district, Karnataka. The study revealed that all the respondents expressed that problems of non-availability of labour and lack of research support for providing rationality of traditional organic practices, fluctuation in prices of the commodities, lack of minimum support price and inaccurate weighing instruments used by vegetable venders. While, majority of them expressed the need for fixing profitable minimum support price for organic produce (77.14 per cent) and establishing separate market for the sale of organic produce (72.14 per cent).

3. METHODOLOGY

This chapter deals with the characteristics of the area selected for the study, the methods adopted in the selection of the samples, the nature and sources of data and the various statistical tools and techniques employed in analyzing the data. The methodology is presented under the following headings:

3.1 Description of the study area

3.2 Sampling procedure

3.3 Nature and source of data

3.4 Analytical techniques employed

3.5 Definition of terms and concepts used

3.1 Description of the study area

Belgaum district comes under northern transitional zone of Karnataka and consists of ten taluks namely Athani, Bailhongal, Belgaum, Chikkodi, Gokak, Hukkeri, Khanapur, Raibag, Ramdurg and Savadatti. Belgaum district is located at North –West region of Karnataka state between 15-23° to 16-58° N' latitude and 74.05° to 75.28°E longitude. It is surrounded by Bijapur, Bagalkot, Dharwad and Karwar Districts of Karnataka and Sangli, Kolhapur, Ratnagiri Districts of Maharashtra state.

The total geographical area of the district is 13,44,382 ha of which 10,14,549 ha is cultivable area. The average rainfall is 808 mm. The total population of the district is 42.07 lakhs with the literacy rate of 75.89 per cent. The major rivers flowing in the district are Krishna, Malaprabha and Ghataprabha. The main irrigation sources for the district are canals, followed by wells, bore-wells and lift irrigation.

Geographically the district is divided into three regions, *i.e.,* 1.Hilly region, 2.North Semi malnad, 3.North dry zone. The Khanapur taluk lies under Hilly region, Chikkodi, Hukkeri, Bailhongal and Belgaum taluks fall under North semi-malnad region, while Athani, Raibag, Gokak, Ramdurg and Savadatti taluks fall under the north dry region. The major soils of these regions are medium to deep black, reddish sandy and red sandy loam.

The climate is generally dry and healthy, except during the monsoon season. The hot season begins by March with the maximum temperature of 38 º C and minimum temperature of 14°C during December, which is generally the coldest month.

Belgaum district is known for vegetable cultivation next to Hasan and Kolar districts with an area of 49,576 ha and production of 6,77,706.56 t. This is because of congenial climatic conditions and assured supply of water through river and canal and also there is a comparatively assured market. The major vegetables grown in this district are potato, tomato, brinjal, chilli, capsicum, carrot, bhendi, gourds and cole crops. The total area and production of tomato and chilli in Belgaum district is 4,806.70 hectares and 1,61,170.00 tonnes and 7,237.40 hectares and 96,786.10 tonnes respectively.

3.2 Sampling procedure

3.2.1 Selection of the study area

Belgaum is the major vegetable producing district in the Northern Karnataka, the total area and production of vegetable is 49,576 ha and 6,77,706.56 t respectively. Organic cultivation of vegetable is practiced largely in the district. Hence the Belgaum district was purposively selected for the study. Two major vegetables largely grown namely tomato and chilli was selected for the study. The total area and production of tomato and chilli in Belgaum district is 4,806.70 hectares and 1,61,170.00 tonnes and 7,237.40 hectares and 96,786.10 tonnes respectively. And also large number of farmers practice the organic cultivation of tomato and chilli in the district.

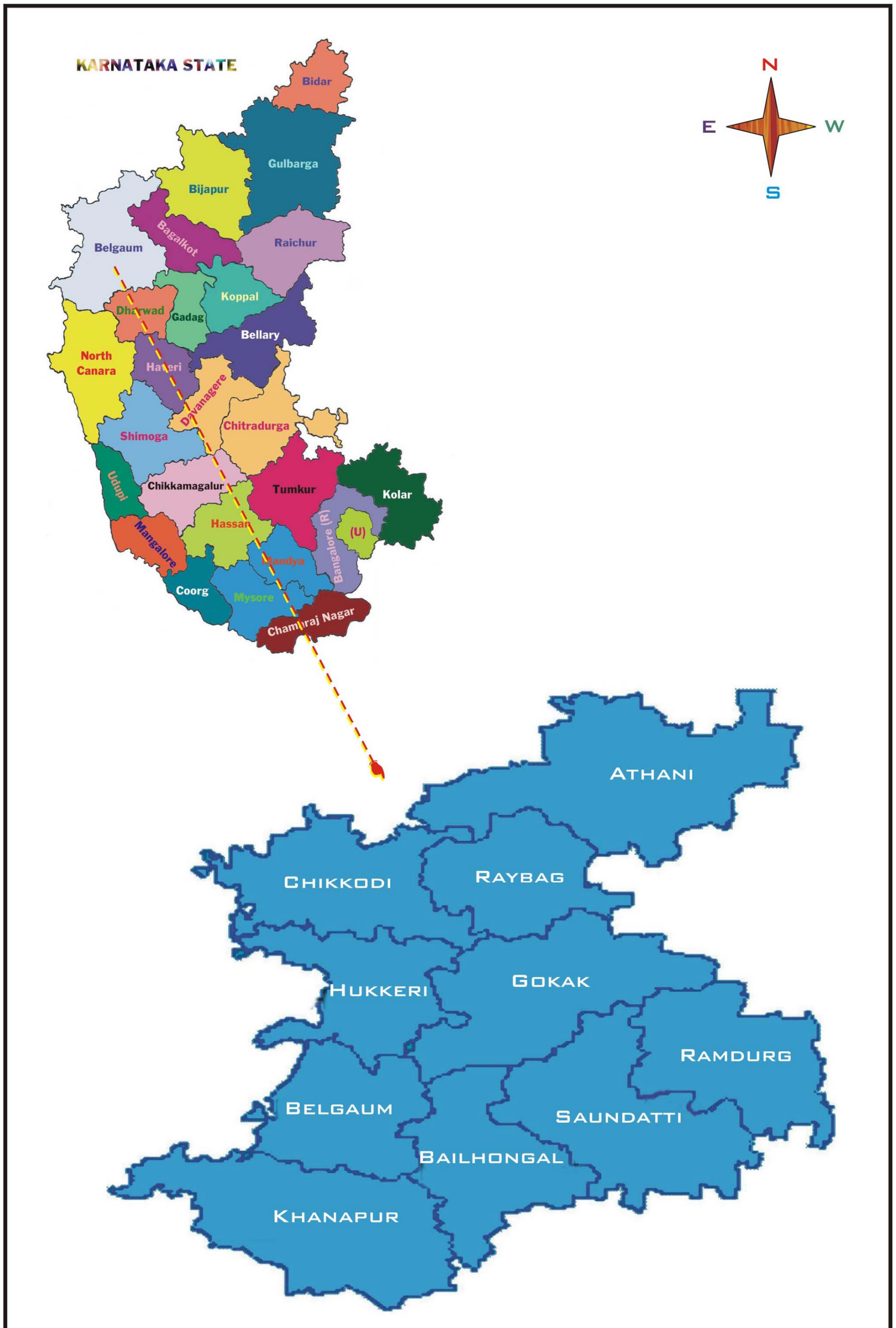

Fig. 1: Map of Karnataka showing the study area

Fig. 1: Map of Karnataka showing the study area

3.2.2 Selection of the sample respondents

Organic farming is emerging trend and practiced throughout the district in cultivation of vegetables. In order to study the causes for shifting to organic cultivation of vegetables and to compare the input use pattern, costs involved, yields, market prices and the returns in organic cultivation of vegetables and problems faced by the farmers of organic vegetables, 30 farmers each practicing organic cultivation of tomato and chilli and 30 farmers each practicing inorganic cultivation of tomato and chilli spread over the district of Belgaum were selected randomly for the study.

3.3 Nature and source of data

For evaluating the specific objectives designed for the study, required primary data were collected from the sample farmers. Majority of the respondents did not maintain records of the cost and returns from the cultivation of both the crops. Hence, data collected was based on the memory of the respondents. At the time of interview, personal bias of the sample farmers was minimized by convincing them about the genuinety of the purpose for which the data were collected. The data collected from the selected respondents were to fulfill the objectives of the study. Data were based on the entire operations practicing in the cultivation of both the crops by organically and also by inorganically. The data on the type, pattern and levels of use of manures, fertilizers and plant protection measures and the cost, yields, market prices and returns involved under both the types of farming were collected by personal interview method with the help of structured pre-tested schedule. Similarly, the reasons for shifting from inorganic to organic cultivation of vegetables and the problems of organic vegetable growers were collected through opinion survey. The data pertained to the year 2009-10.

3.4 Analytical techniques employed

To fulfill the specific objectives of the study, based on the nature and extent of data, the following analytical tools and techniques were adopted.

Tabular presentation method

Output decomposition model

3.4.1 Tabular presentation

The tabular presentation method was followed to study the general characteristics of sample farmers, reasons for shifting over to organic farming and costs and returns and problems faced by the organic farmers. The averages and percentages were worked out.

3.4.2 Output decomposition model

3.4.2.1 Structural break in production relation

Before going to the decomposition analysis of the productivity difference between the organic vegetable and inorganic vegetable, one must ensure whether there is structural break or not in the production relations between organic and inorganic farming. To identify the structural break, if any, in the production relations with the adoption of organic farming, output elasticities were estimated by ordinary least square method by fitting log linear regression, separately for organic and inorganic farmers. The pooled regression was run in combination with organic and inorganic farmers including dummy variable for organic farmers. The dummy variable was quantified as one for organic and zero for inorganic farmers.

The following log linear estimable forms of equations were used for examining the structural break in production relation.

$$\ln y_1 = \ln A_1 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + U_i \quad \ldots\ldots\ldots(1)$$

$$\ln y_2 = \ln A_2 + b'_1 \ln X_1 + b'_2 \ln X_2 + b'_3 \ln X_3 + b'_4 \ln X_4 + b'_5 \ln X_5 + b'_6 \ln X_6 + U_i \quad \ldots\ldots\ldots(2)$$

$$\ln y_3 = \ln A_3 + b''_1 \ln X_1 + b''_2 \ln X_2 + b''_3 \ln X_3 + b''_4 \ln X_4 + b''_5 \ln X_5 + b''_6 \ln X_6 + e_3 d + U_i \quad \ldots\ldots\ldots(3)$$

Where,

Y = Gross return in rupees/ac

a = Intercept

x_1 = Seed cost/acre

x_2 = FYM cost/acre

x_3 = Organic manure cost/acre or chemical fertilizers cost/acre

x_4 = Human labour cost/acre

x_5 = Bullock labour and machine labour cost/acre

x_6 = Organic plant protection measures cost/acre or inorganic plant protection measures cost/acre

e_i = Error term

b_i = Elasticities coefficient of respective inputs and summation of these gives returns to scale

Equations 1, 2 and 3 represent inorganic farmers, organic farmers and pooled regression function with organic farming as dummy variables, respectively.

$b_1, b_2, b_3, b_4, b_5, b_6, b'_1, b'_2, b'_3, b'_4, b'_5, b'_6, b''_1, b''_2, b''_3, b''_4, b''_5, b''_6,$

represent individual output/income elasticity of respective input variable in equation (1), (2) and (3), 'd' in equation (3) represent dummy variable. If the regression coefficient of dummy variables is significant, then there is structural break in production relations with the adoption of organic farming.

3.4.2.2 Output decomposition model

For any production function, the total change in output/income is affected by the change in the factors of production and in the parameters that define the function. This total change in per acre output/income is decomposed to reflect on adoption of organic and the change in input levels. The output decomposition model developed by Bisaliah (1977) is used in the study, which is depicted below.

The output decomposition equation used in this study can be written as

$\ln Y\ OF - \ln Y\ IOF = [\text{intercept } OF - \text{intercept } IOF] +$

$[(b_1' - b_1) \times \ln X_1\ IOF + \ldots\ldots\ldots\ldots\ldots + (b_6' - b_6) \times \ln X_7\ IOF] +$

$[\{(b_1' (\ln X_1\ OF - \ln X_1\ IOF + \ldots\ldots\ldots\ldots + (b_6' (\ln X_6\ OF - \ln X_6\ IOF)\}]$ …. (4)

The decomposition equation (4) is approximately a measure of percentage change in output/income with the adoption of organic farming in the production process. The first bracketed expression of the right hand side is the measure of percentage change in output/income due to shift in scale parameter (A) of the production function. The second bracketed expression is the difference between output elasticities each weighted by natural logarithms of the volume of that input used under non adopter category, a measure of change in output/income due to shift in slope parameters (output elasticities) of the production function. The third bracketed expression is the sum of the natural logarithms of the ratio of each input of adopters (OF) to non-adopters, each weighted by the output elasticity of that input. This expression is a measure of change in output due to change in the per acre quantities of seeds, organic manures, human labour, bullock and machine labour, chemical fertilizers, organic plant protection measures, plant protection chemicals.

3.5 Terms and concepts used in the study

The terms and concepts used in the study and the procedure used to calculate the cost of different items are given below.

1. Organic farms

The farms on which organic materials were used as nutrients and/or plant protection for soil called as organic farms.

2. Inorganic farms

The farms on which organic materials were not used as nutrients and/or plant protection for soil called as inorganic farms.

3. FYM

Farm yard manure was charged as per the prevailing market rates during the period of study in the study area.

4. Fertilizers

The fertilizer cost was calculated at the actual price paid by the farmer.

5. Green manure

The cost of green manure was estimated in terms of bundles and the market price was considered for accounting

6. Vermicompost

The quantity of vermicompost used in the calculation of crops was measured in quintals and the cost was included by taking the actual market price.

7. Variable costs

The variable costs include cost of seed, organic manure, fertilizers, wages of human and bullock labour, plant protection components and interest on operational capital at the rate of 7 per cent per annum.

8. Interest on working capital

This was calculated on the entire working cost of the enterprise at the prevailing rate of interest of 7 per cent per annum on short term loans for the duration of the crop by financial institutions.

9. Fixed costs

These include depreciation on farm implements and machinery, interest on fixed capital and land revenue.

10. Depreciation charges

Depreciation on each capital equipment and machinery owned by the farmers and used for cultivation of land was calculated for individual farmer based on the purchase value using the straight line method.

$$\text{Annual depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Economic life of the asset}}$$

11. Interest on fixed capital

Interest on fixed capital was calculated at 11 per cent per annum, which is the prevailing rate of investment credit. The items considered under fixed capital are implements and machinery.

12. Land revenue

Actual land revenue paid by the farmers was considered.

13. Land rent

The prevailing land rent for agricultural enterprises were imputed for the sample farmers, since all land holdings were observed to be owner operated.

4. RESULTS

The necessary data were collected from the sample farmers spread over Belgaum District of Northern Karnataka. The data were subjected to various statistical tools and techniques to draw meaningful conclusions. The major findings of the study are presented in this chapter under the fallowing heads.

4.1 General characteristics of the sample farmers in the study area

4.2 Reasons for shifting from inorganic to organic cultivation of vegetables

4.3 Type, level, pattern of input use and cost involved in both organic and inorganic farms

4.4 Labour use pattern in both organic and inorganic farms

4.5 Cost involved in both organic and inorganic farms

4.6 Yield, market price and returns in both organic and inorganic farms

4.7 Decomposition analysis

4.8 Problems of organic vegetable growers

4.1 General characters of the sample farmers

An understanding of general characters of the sample farmers is expected to provide a bird's eye view of the general features prevailing in the study area. Therefore, an attempt has been made in the study to analyze some of the important characters of the sample farmers. The general characters of the respondents are presented in Table 4.1

In case of tomato growers, the average age of the organic tomato growers was 40.8 years where as that of inorganic farmers was 44.7 years and in both the cases the main occupation of them was agriculture. It could be further observed that majority of the sample farmers both organic (83.33 per cent) and inorganic farmers (93.33 per cent) were literate having their education ranging from primary to college level.

Form the table it could also be seen that the average size of the family of both organic and inorganic tomato farmers was about six members and average land holding was 8.45 acres, of which 5.58 acres was irrigated and remaining 2.87 acres was dry land in case of organic tomato growers where as in case of inorganic tomato growers the average land holding was 8.40 acres, of which 4.23 acres was irrigated and remaining 4.17 was under dry land. And average area under organic and inorganic tomato was 0.84 acres and 1.19 acres respectively. The tomato varieties grown by the organic farmers in the study area were Namadhari, Sankranti and Champakali and the average numbers of pickings were about seven where as the varieties grown by the inorganic farmers were Namadhari, Ustav and Anand and the average numbers of pickings were about nine.

In case of chilli growers, the average age of the organic chilli growers was 41.9 years where as that of inorganic farmers was 45.9 years and in both the cases the main occupation of them was agriculture. It could be further revealed that majority of the sample farmers both organic (96.67 per cent) and inorganic farmers (90.00 per cent) were literate having their education ranging from primary to college level.

The average size of the family of both organic and inorganic chilli farmers was about five members and average land holding was 8.23 acres, of which 4.82 acres was irrigated and remaining 3.42 acres was dry land in case of organic chilli growers where as in case of inorganic chilli growers the average land holding was 7.4 acres, of which 3.97 acres was irrigated and remaining 3.43 was under dry land. And average area under organic and inorganic chilli was 0.81 acres and 1.15 acres respectively. The chilli varieties grown by the organic farmers in the study area were Disha, Local, and Sankeshwar and the average numbers of pickings were about six where as the varieties grown by the inorganic farmers were Disha, Trishul, and Sitara and the average numbers of pickings were about seven.

Table 4.1: General characteristics of sample farmers

Sl. No.	Particulars	Unit	Tomato		Chilli	
			Organic	Inorganic	Organic	Inorganic
			n=30	n=30	n=30	n=30
1	Age	Years	40.8	44.7	41.9	45.9
2	Education					
	Illiterate	No.	5	2	1	3
	Primary	No.	7	5	7	5
	High school	No.	6	14	12	10
	College	No.	12	9	10	12
3	Occupation					
	Agriculture as main occupation	No.	27	25	28	23
	Agriculture as subsidiary occupation	No.	3	5	2	7
4	Family size	No.	6.3	5.7	5.1	5.4
5	Land holdings					
	Irrigated	Acres	5.58	4.23	4.82	3.97
	Dry land	Acres	2.87	4.17	3.42	3.43
	Total	Acres	8.45	8.40	8.23	7.40
6	Average area under tomato and chilli	Acres	0.84	1.19	0.81	1.15
7	Varieties used		Namadhari, Sankranti, Champakali	Namadhari, Ustav, Anand	Disha, Local, Sankeshwar	Disha, Trishul, Sitara
8	Average number of pickings	No.	7.3	8.67	6.37	6.9

4.1.1 Cropping pattern and major crops grown

As could be seen from Table 4.2 that all categories of farmers are growing a number of crops on their farm. Sugarcane, maize, tomato, chilli and other vegetables were the major crops grown, where as sorghum, soybean, wheat and ground nut were the other crops grown by the sample farmers.

The major crops grown during *kharif* by the organic tomato sample farmers were vegetables, tomato, soybean and groundnut. Among these crops the area under soybean was found to be highest (1.62 acres), followed by other vegetables (1.52 acres), groundnut (1.22 acres) and tomato (0.84 acre).

During *rabi* season wheat, cotton and other vegetables were the major crops grown. The average area under these crops was 0.61 acre, 0.82 acres and 1.33 acres respectively. During summer season the average area under other vegetable was 1.43 acres. The annual crop includes sugarcane with an average area of 2.15 acres. The horticulture crops include mango (0.71 acre) and fig (0.48 acre).

In case of inorganic tomato farmers the major crops grown during *Kharif* by the sample farmers were maize (1.03 acres), tomato (1.19 acres), soybean (1.06 acres), other vegetables (1.38 acres) and groundnut (0.91 acre). During rabi season wheat (0.51 acre) sorghum (0.61 acre) and other vegetables (1.25 acres) were grown. During summer season irrigation was available for vegetables and maize. The maize crop was grown on an area of about 0.85 acre while other vegetables were grown on an area of about 1.35 acres. The annual crop includes sugarcane with an average area of 2.04 acres. The horticulture crop that is mango was grown on an area of about 0.20 acre.

In case of organic chilli farmers the major crops grown during *Kharif* by sample farmers were chilli (0.81 acre), soybean (1.38 acre), groundnut (1.33 acres) and other vegetables (1.85 acres). In rabi season wheat (0.88 acre) cotton (0.74 acre) and other vegetables (0.81) were grown. During summer season the average area under other vegetable was 0.98 acres. The annual crop includes sugarcane with an average area of 1.82 acres. The major horticulture crops grown were fig (0.42 acre) and guava (0.85 acre).

In case of inorganic chilli farmers the major crops grown during *kharif* season by the sample farmers were maize (0.82 acre), chilli (1.15 acres) soybean (1.01 acre) and other vegetables (1.28 acres). In rabi season wheat (0.61 acre), chickpea (0.32 acre), cotton (1.05 acres) and other vegetables (0.62 acre) were grown. During summer maize is grown in an area of about 0.50 acre while other vegetables were grown on an area of about 0.78 acres. The annual crop includes sugarcane with an average area of 1.34 acres. The horticulture crops include mango (0.42 acre) and guava (0.18 acre).

It was noticed that the cropping intensity was high on the farms of organic tomato farmers (150.65 per cent), followed by inorganic tomato farmers (147.38 per cent), organic chilli farmers (144.23 per cent) and inorganic chilli farmers (137.02 per cent).

4.2 Reasons for shifting from inorganic to organic cultivation of vegetables

The reasons for shifting from inorganic cultivation of vegetables to organic cultivation of vegetables were obtained from the sample farmers by conducting opinion survey and the results are presented in the Table 4.3.

It was observed that high per cent of the sample farmers expressed the reason of increasing return from organic vegetables (73.3 per cent), followed by reason of quality of organic vegetables (71.6 per cent), soil health oriented motives (63.3 per cent), increasing cost of inorganic chemicals (61.6 per cent), environmental concern (56.6 per cent), motivation by neighbouring organic farmers (46.6 per cent) and motivation by media (33.33 per cent) as the reasons for shifting over to organic cultivation of vegetables from inorganic cultivation.

Table 4.2: Cropping pattern of the sample farmers

Crops/season	Tomato growers		Chilli growers	
	Organic (n=30)	Inorganic (n=30)	Organic (n=30)	Inorganic (n=30)
Kharif	Area (acres)	Area (acres)	Area (acres)	Area (acres)
Maize	-	1.03 (18.49)	-	0.82 (18.98)
Tomato	0.84 (16.15)	1.19 (21.36)	-	-
Chilli	-	-	0.81 (15.08)	1.15 (26.62)
Soybean	1.62 (31.15)	1.06 (19.03)	1.38 (25.70)	1.01 (23.38)
Ground nut	1.22 (23.46)	0.91 (16.34)	1.33 (24.77)	-
Other vegetables	1.52 (29.23)	1.38 (24.78)	1.85 (34.45)	1.28 (31.01)
	5.20 (100)	5.57 (100)	5.37 (100)	4.32 (100)
Rabi				
Wheat	0.61 (22.10)	0.51 (21.52)	0.88 (36.21)	0.61 (23.46)
Sorghum	-	0.61 (25.74)	-	-
Chickpea	-	-	-	0.32 (12.31)
Cotton	0.82 (29.71)	-	0.74 (30.45)	1.05 (40.38)
Other vegetables	1.33 (48.19)	1.25 (52.74)	0.81 (33.33)	0.62 (23.85)
	2.76 (100)	2.37 (100)	2.43 (100)	2.6 (100)
Summer				
Maize	-	0.85 (38.64)	-	0.50 (39.06)
Other vegetables	1.43 (100)	1.35 (61.36)	0.98 (100)	0.78 (60.94)
	1.43 (100)	2.2 (100)	0.98 (100)	1.28 (100)
Annual crop				
Sugarcane	2.15 (100)	2.04 (100)	1.82 (100)	1.34 (100)
Horticultural crops				
Mango	0.71 (59.66)	0.20 (100)	-	0.42 (70.00)
Fig	0.48 (40.34)	-	0.42 (33.07)	-
Guava	-	-	0.85 (66.93)	0.18 (30.00)
	1.19 (100)	0.20 (100)	1.27 (100)	0.6 (100)
Gross cropped area	12.73	12.38	11.87	10.14
Size of land holding	8.45	8.40	8.23	7.40
Cropping intensity (%)	150.65	147.38	144.23	137.02

Note: Figures in the parentheses indicate the percentage to the respective total
Other vegetables includes the area under brinjal, pea, beans *etc*

Table 4.3: Reasons for shifting over to organic farming

(n=60)

Sl. No.	Reasons	No	Percent
1	Increasing cost of inorganic chemicals	37	61.6
2	Increasing return from organic vegetables	44	73.3
3	Quality of organic vegetables	43	71.6
4	Soil health oriented motives	38	63.3
5	Environmental concern	34	56.6
6	Motivation by neighbouring organic farmers	28	46.6
7	Motivation by media	20	33.3

4.3 Type, level, pattern of input use and cost involved on both organic and inorganic farms

4.3.1 Type, level, pattern of input use and cost involved in organic cultivation of tomatoes

The type, level, pattern of inputs used and cost involved on each input are presented in the Table 4.4. It was observed that in the study area following inputs were used in the organic cultivation of tomatoes.

i. Seeds
ii. Farm yard manure
iii. Green manuring
iv. Vermicompost
v. VAM
vi. Biopesticides which included neem seed cake, neem seed kernel extract, panchagavya and trichoderma.

Table 4.4: Type, level, pattern of input use and cost involved in organic cultivation of tomatoes

Sl. No.	Type of input	Unit	Quantity used (per acre)	Time of application	Method of application	Used to control	Per acre cost of inputs (Rs)
1	Seeds	gm	107.55				541.95
2	FYM	Tractor loads	1.83	At the time of transplanting	Broadcasting		1829.03
3	Green manuring	kg of seeds	15.86	Two weeks before transplanting	Insitu application		396.62
4	Vermicompost	Tonnes	0.45	At the time of transplanting	Broadcasting		898.61
5	VAM	kg	7.55	Nursery stage	Soil application		302.19
				At the time of transplanting	Root dipping		
6	Biopesticides						
a	Neem seed cake	kg	12.49	At the time of transplanting	Mixing with FYM and Broadcasting	Nematodes and root diseases	74.91
b	NSKE	lit	0.875	15 days interval after transplanting	Spraying	Fruit borer, mites	115.77
c	Panchagavya	lit	14.00	18-20 days interval after transplanting	Spraying	Fungal diseases	69.98
d	Tricoderma	kg	0.83	At the time of sowing	Seed treatment	Fusarium wilt	33.00
				20-25 days interval after transplanting	Spraying	Spodopteran larvae, Fruit borer	

Tomato seedlings were raised in the nursery and then transplanted to the main field. About 107.53 gm seeds were used to raise the nursery required for an acre of area.

The farmers used about 1.83 tractor loads of farm yard manure, which was applied at the time of transplanting by the way of broadcasting method. In case of green manuring about 15.86 kg seeds were used for an acre of area, which was applied two weeks before transplanting by the method of in situ application. In case of vermicompost about 0.45 tonne per acre was applied at the time of transplanting by following the broadcasting method. VAM was used at the rate of 7.55 kg per acre, which was mainly applied at the nursery stage by the way of soil application and also at the time of transplanting by following the root dipping method. In case of biopesticides namely neem seed cake which was used at the rate of 12.49 kg per acre, which was applied at the time of transplanting by mixing with FYM to control nematodes and root diseases, neem seed kernel extract was used at the rate of 0.875 lit per acre, which was applied at 15 days interval after transplanting by the way of spraying to control incidence of fruit borer and mites, panchagavya was used at the rate of 14.00 lit per acre, sprayed at 18-20 days interval after transplanting to control fungal diseases and about 0.83 kg of trichoderma was used, which was applied at the time of sowing by the way of seed treatment to control fusarium wilt disease and also spryed at 20-25 days interval after transplanting to control spodopteran larvae and fruit borer. The maximum per acre cost of input involved (Rs 1829.03) was in the use of FYM followed by vermicompost (Rs 898.61), seeds (Rs 541.95), green manuring (Rs 396.62), VAM (Rs 302.19), neem seed kernel extract (Rs 115.77), neem seed cake (Rs74.91), panchagavya (Rs 69.98) and trichoderma (Rs 33.00).

4.3.2 Type, level, pattern of inputs used and cost involved in inorganic cultivation of tomatoes

The type, level, pattern of inputs used and cost involved on each input in the inorganic cultivation of tomato are presented in the Table 4.5. It was observed that in the study area following inputs were used in the inorganic cultivation of tomatoes.

i. Seeds

ii. Farm yard manure

iii. Urea

iv. DAP

v. Single super phosphate

vi. Complex fertilizers

vii. Plant protection chemicals which included monocrotophos, mancozeb, chloropyriphos and dimethoate

Under the inorganic cultivation also the tomato seedlings were raised in the nursery and then transplanted to the main field. About 73.77 gm of seeds were used to raise the nursery for an acre of area.

The farmers used about 1.93 tractor loads of FYM per acre which was applied at the time of transplanting by the way of broadcasting. In fertigation to the crop 94 kg of urea per acre was used, in that 50 per cent was applied as basal dose at the time of transplanting and remaining 50 per cent was top dressed at the flowering stage by the way of broadcasting. In case of DAP, about 83.5 kg per acre was applied at 5-6 weeks after transplanting by following the broadcasting method. About 38.5 kg single super phosphate per acre was broadcasted after 5-6 weeks after transplanting. In case of complex fertilizers about 13.5 kg per acre was used after flowering by the way of broadcasting.

In case of plant protection chemicals, monocrotophos was used at the rate of 0.51 lit per acre to spray at 10-15 days interval after transplanting mainly to control leaf eating caterpillar, mancozeb was used at the rate of 0.82 kg to spray for an acre area at 8-10 days interval after transplanting to control blight and leaf spot diseases, chloropyriphos was used at the rate of 0.27 lit to spray for an acre of area at 20-25 days interval after transplanting to control lepidopterans insects and about 0.68 lit of dimethoate was sprayed at 3 weeks interval to control mites and fruit borer.

Table 4.5: Type, level, pattern of inputs used and cost involved in inorganic cultivation of tomatoes

Sl. No.	Type of input	Unit	Quantity used (per acre)	Time of application	Method of application	Used to control	Per acre cost of inputs (Rs)
1	Seeds	gm	73.77				626.33
2	FYM	Tractor loads	1.93	At the time of transplanting	Broadcasting		1928.47
3	Urea	kg	94	50% as basal and 50% at flowering stage	Broadcasting		471.73
4	DAP	kg	83.5	5-6 weeks after transplanting	Broadcasting		809.47
5	Single super phosphate	kg	38.5	5-6 weeks after transplanting	Broadcasting		212.13
6	Complex	kg	13.5	After flowering	Broadcasting		113.79
7	Plant protection chemicals						
a	Monocrotophos	lit	0.51	10-15 days interval after transplanting	Spraying	Leaf eating caterpillar	166.37
b	Mancozeb	kg	0.82	8-10 days interval after transplanting	Spraying	Blight, Leaf spot	350.49
c	Chloropyriphos	lit	0.27	20-25 days interval after transplanting	Spraying	Lepidopterans	69.28
d	Dimethoate	lit	0.68	3 weeks interval after transplanting	Spraying	Mites, fruit borer	259.55

In all these inputs maximum per acre cost of input involved (Rs 1928.47) was on FYM, followed by DAP (Rs 809.47), seeds (Rs 626.33), urea (Rs 471.73), mancozeb (Rs 350.49), dimethoate (Rs 259.55), single super phosphate (Rs212.33), monocrotophos (166.37), complex fertilizer (Rs113.79) and chloropyriphos (Rs 69.28).

4.3.3 Type, level, pattern of inputs used and cost involved in organic cultivation of chilli

The type, level, pattern of inputs used and cost involved on each input in organic cultivation of chilli are presented in the Table 4.6. It was observed that in the study area following inputs were used in the organic cultivation of chilli.

i. Seeds
ii. Farm yard manure
iii. Green manuring
iv. Vermicompost
v. VAM
vi. Biopesticides which included neem seed cake, neem seed kernel extract, panchagavya and trichoderma.

Chilli seedlings were raised in the nursery and then transplanted to the main field. About 117.60 gm seeds were used to raise the nursery for an acre of area.

The farmers used about 1.82 tractor loads of farm yard manure, which was applied at the time of transplanting by the way of broadcasting method. In case of green manuring, about 17.76 kg seeds were used for an acre of area, which was applied two weeks before transplanting by the method of insitu application. In case of vermicompost, about 0.72 tonne was applied at the time of transplanting by following the broadcasting method. VAM was used at the rate of 4.06 kg per acre, which was mainly applied at the nursery stage by the way of soil application. In case of biopesticides namely neem seed cake which was used at the rate of 90.68 kg per acre, which was applied at the time of transplanting by mixing with FYM and vermicompost to control nematodes and root grubs, neem seed kernel extract was used at the rate of 0.727 lit per acre, which was applied at 10-12 days interval after transplanting by the way of spraying to control incidence of thrips and mites, panchagavya was used at the rate of 14.70 lit per acre, sprayed at 18-20 days interval after transplanting to control fungal diseases and about 0.93 kg of trichoderma was used, which was applied at the time of sowing by the way of seed treatment to control seedling rot disease and also sprayed at 20 days interval after transplanting to control fruit borer.

The maximum per acre cost of input involved (Rs 1821.95) was in the use of FYM followed by vermicompost (Rs 1436.85), neem seed cake (Rs 544.10), green manuring (Rs 444.10), seeds (Rs 372.34),VAM (Rs 162.32), neem seed kernel extract (Rs 90.06), panchagavya (Rs 73.50) and trichoderma (Rs 37.27).

4.3.4 Type, level, pattern of inputs used and cost involved in inorganic cultivation of chilli

The type, level, pattern of inputs used and cost involved on each input in the inorganic cultivation of chilli are presented in the Table 4.7. It was observed that in the study area following inputs were used in the inorganic cultivation of chilli

i. Seeds
ii. Farm yard manure
iii. Urea
iv. DAP
v. Single super phosphate
vi. Complex fertilizers
vii. Plant protection chemicals which included monocrotophos, mancozeb, carbandizam and dimethoate.

Table 4.6: **Type, level, pattern of input used and cost involved in organic cultivation of chilli**

Sl. No.	Type of input	Unit	Quantity used (per acre)	Time of application	Method of application	Used to control	Per acre cost of inputs (Rs)
1	Seeds	gm	117.60				372.34
2	FYM	Tractor loads	1.82	At the time of transplanting	Broadcasting		1821.95
3	Green manuring	kg of seeds	17.76	Two weeks before transplanting	Insitu application		444.10
4	Vermicompost	Tonnes	0.72	At the time of transplanting	Broadcasting		1436.85
5	VAM	kg	4.06	Nursery stage	Soil application		162.32
6	Biopesticides						
a	Neem seed cake	kg	90.68	At the time of transplanting	Mixing with FYM and vermicompost and Broadcasting	Nematodes and root grubs	544.10
b	NSKE	lit	0.727	10-12 days interval after transplanting	Spraying	Thrips and mites	90.06
c	Panchagavya	lit	14.70	18-20 days interval after transplanting	Spraying	Fungal diseases	73.50
d	Trichoderma	kg	0.93	At the time of sowing	Seed treatment	Seedling rot	37.27
				20 days interval after transplanting	Spraying	Fruit borer	

Table 4.7: Type, level, pattern of inputs used and cost involved in inorganic cultivation of chilli

Sl. No.	Type of input	Unit	Quantity used (per acre)	Time of application	Method of application	Used to control	Per acre cost of inputs (Rs)
1	Seeds	gm	106.38				491.45
2	FYM	Tractor loads	2.26	At the time of transplanting	Broadcasting		2260.87
3	Urea	kg	120.29	50% as basal and 50% at flowering stage	Broadcasting		603.86
4	DAP	kg	81.16	5-6 weeks after transplanting	Broadcasting		787.25
5	Single super phosphate	kg	38.41	5-6 weeks after transplanting	Broadcasting		211.23
6	Complex	kg	33.33	After flowering	Broadcasting		284.67
7	Plant protection chemicals						
a	Monocrotophos	lit	0.61	10-15 days interval after transplanting	Spraying	Fruit borer and thrips	197.36
b	Mancozeb	kg	1.03	8-10 days interval 3 weeks after transplanting	Spraying	Leaf spot	439.78
c	Carbandizam	kg	0.47	15-20 days interval after transplanting	Spraying	Powdery mildew	188.41
d	Dimethoate	lit	0.75	3 weeks interval after transplanting	Spraying	Thrips and mites	284.72

Under the inorganic cultivation also the chilli seedlings were raised in the nursery and then transplanted to the main field. About 106.38 gm of seeds were used to raise the nursery for an acre of area.

The farmers used about 2.26 tractor loads of FYM per acre which was applied at the time of transplanting by the way of broadcasting. In fertigation to the crop 120.29 kg of urea per acre was used, in that 50 per cent was applied as basal dose at the time of transplanting and remaining 50 per cent was top dressed at the flowering stage by the way of broadcasting. In case of DAP, about 81.16 kg per acre was applied at 5-6 weeks after transplanting by following the broadcasting method. About 38.41 kg single super phosphate per acre was broadcasted after 5-6 weeks after transplanting. In case of complex fertilizers about 33.33 kg per acre was used after flowering by the way of broadcasting.

In case of plant protection chemicals, monocrotophos was used at the rate of 0.61 lit per acre to spray at 10-15 days interval after transplanting mainly to control fruit borer and thrips, mancozeb was used at the rate of 1.03 kg to spray for an acre area at 8-10 days interval 3 weeks after transplanting to control leaf spot disease, carbandizam was used at the rate of 0.47 kg to spray for an acre of area at 15-20 days interval after transplanting to control powdery mildew disease and about 0.75 lit of dimethoate was sprayed at 3 weeks interval to control thrips and mites.

In all these inputs maximum per acre cost of input involved (Rs 2260.87) was on FYM, followed by DAP (Rs 787.25), urea (Rs 603.86), seeds (Rs 491.45), mancozeb (Rs 439.78), dimethoate (Rs 284.72), complex fertilizer (Rs 284.67), single super phosphate (Rs 211.23), monocrotophos (Rs 197.36), and carbandizam (Rs 188.41).

4.4 Labour use pattern in both organic and inorganic farms

4.4.1 Labour use pattern in the production of organic and inorganic tomato

The quantity of labour used, costs involved in the different operations of organic and inorganic tomato for an acre area are presented in the Table 4.8.

In case of organic tomato production, for ploughing about 1.3 machine hours were used for an acre, for transportation of FYM about 1.83 trips of machine were used. In case of harrowing operation about 2.78 pair days of bullock labour were used. About 3.38 man days of human labour were used for spreading of FYM. In case of seed bed preparation, about 1.19 pair days of bullock labour and also 3.3 man days of human labour were used. In case of transplanting operation about 4.41 man days, for organic manures and biofertilizers application 2.82 man days and for hand weeding about 10.42 man days of human labour were used. In case of intercultivation operation about 2.9 pair days of bullock labour were used. About 12.52 man days for spraying of biopesticides, for irrigation 5.09 man days and for harvesting 29.78 man days of human labour were used.

The maximum cost involved (Rs 1853.88) was in case of harvesting operation followed by intercultivation (Rs 1161.03), harrowing (Rs 1113.32), spraying of biopesticides (Rs 939.36), seed bed preparation (Rs 704.77), transportation of FYM (Rs 594.43), irrigation (Rs 381.71), ploughing (Rs 338.77), transplanting (Rs 283.30), spreading of FYM (Rs 253.48), and organic manures and biofertilizers application (Rs 211.73).

In case of inorganic tomato production, for ploughing operation about 1.03 hours of machine labour were used and for transportation of FYM 1.93 trips of machine labour were used. In case of harrowing operation 1.8 pair days of bullock labour were used. About 3.09 man days of human labour in spreading of FYM, 3.48 man days of human labour and also 1 pair day of bullock labour were used in seed bed preparation. About 4.8 man days for transplanting, 2.66 man days for fertilizer application and 12.31 man days of human labour for hand weeding were used. For intercultivation about 2.05 pair days of bullock labour were used. About 12.79 man days for spraying of plant protection chemicals, 4.1 man days for irrigation operation and 38.54 man days of human labour for harvesting were used.

Table 4.8: Labour use pattern in the production of organic and inorganic tomato production

(Per acre)

Sl. No.	Particulars	Units	Tomato			
			Organic		Inorganic	
			Quantity	Cost	Quantity	Cost
1	Ploughing	Machine hours	1.3 (1.59)	338.77	1.03 (1.15)	304.21
2	Transportation of FYM	No of trips	1.83 (2.24)	594.43	1.93 (2.15)	627.25
3	Harrowing	Pair days	2.78 (3.40)	1113.32	1.8 (2.01)	718.09
4	Spreading of FYM	Man days	3.38 (4.14)	253.48	3.09 (3.45)	218.79
5	Seed bed preparation	Pair days	1.19 (1.46)	477.14	1 (1.12)	400
		Man days	3.3 (4.04)	227.63	3.48 (3.88)	232.82
6	Transplanting	Man days	4.41 (5.40)	283.3	4.8 (5.36)	314.17
7	Fertilizer /organic manure application	Man days	2.82 (3.45)	211.73	2.66 (2.97)	199.86
8	Hand weeding	Man days	10.42 (12.75)	638.17	12.31 (13.74)	751.75
9	Inter cultivation	Pair days	2.9 (3.55)	1161.03	2.05 (2.29)	819.07
10	Spraying PPC/Biopesticides	Man days	12.52 (15.32)	939.36	12.79 (14.28)	959.33
11	Irrigation	Man days	5.09 (6.23)	381.71	4.1 (4.58)	307.15
12	Harvesting	Man days	29.78 (36.44)	1853.88	38.54 (43.02)	2394.11
	Total	**-**	**81.72 (100.00)**	**8473.95**	**89.58 (100.00)**	**8246.60**

Note: Figures in the parentheses indicate percentage to the respective total

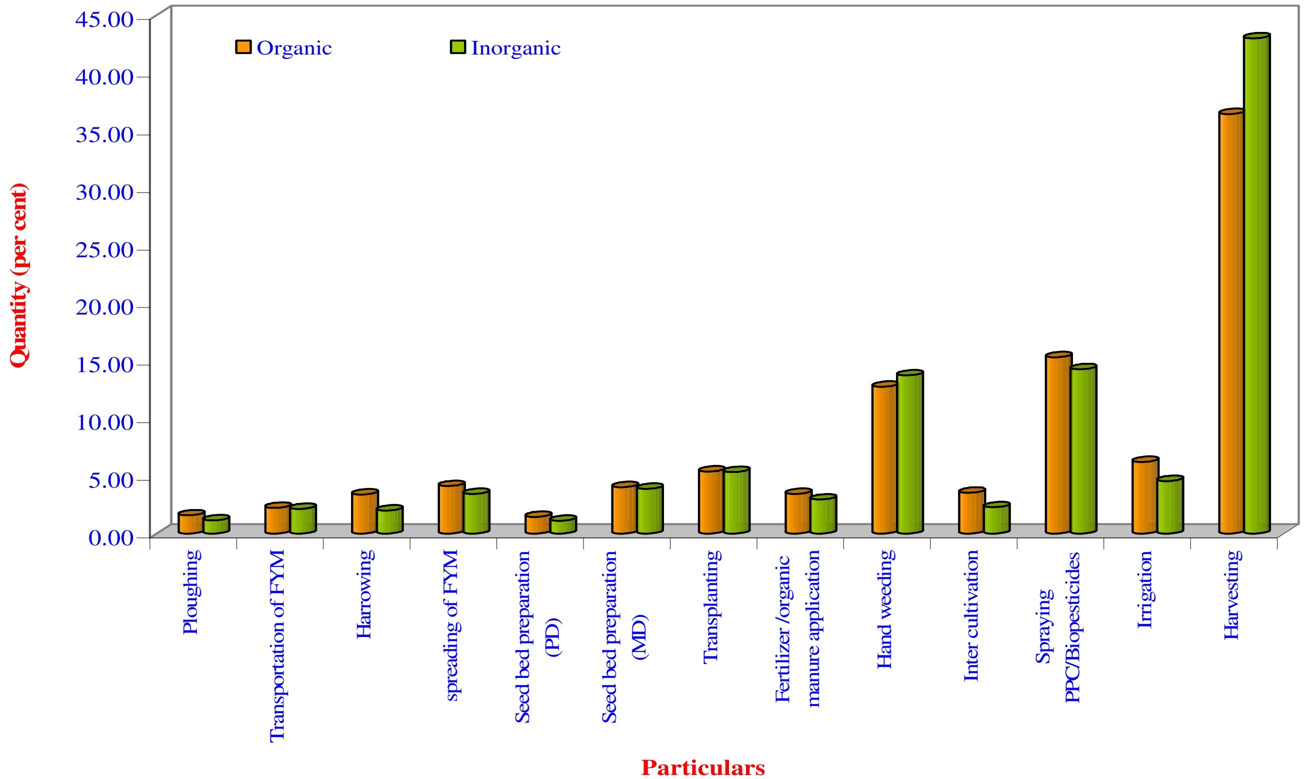

Fig. 2: Labour use pattern in the production of organic and inorganic tomato production

Fig. 2: Labour use pattern in the production of organic and inorganic tomato production

The maximum cost involved (Rs 2394.11) was in harvesting operation, followed by spraying of plant protection chemicals (Rs 959.33), intercultivation (Rs 819.07), hand weeding (Rs 751.75), harrowing (Rs 718.09), seed bed preparation (Rs 632.82), transportation of FYM (Rs 627.25), transplanting (Rs 314.17), irrigation (Rs 307.15), ploughing (Rs 304 .21), spreading of FYM (Rs 218.79) and fertilizer application (Rs 199.86).

4.4.2 Labour use pattern in the production of organic and inorganic chilli

The quantity of labour used, costs involved in the different operations of organic and inorganic chilli for an acre area are presented in the Table 4.9.

In case of organic chilli production, for ploughing about 1.03 machine hours were used for an acre, for transportation of FYM about 1.82 trips of machine were used. In case of harrowing operation about 3.19 pair days of bullock labour were used. About 3.69 man days of human labour were used for spreading of FYM. In case of seed bed preparation, about 1.24 pair days of bullock labour and also 3.98 man days of human labour were used. In case of transplanting operation about 4.97 man days, for organic manures and biofertilizers application 2.53 man days and for hand weeding about 12.84 man days of human labour were used. In case of intercultivation operation about 2.69 pair days of bullock labour were used. About 13.79 mandays for spraying of biopesticides, for irrigation 5.26 man days and for harvesting 29.73 man days of human labour were used.

The maximum cost involved (Rs 1841.61) was in case of harvesting operation followed by harrowing (Rs 1275.36), intercultivation (Rs 1076.6), spraying of biopesticides (Rs 1034.16), seed bed preparation (Rs 777.43), hand weeding (Rs 776.4), transportation of FYM (Rs 592.13), irrigation (Rs 394.41), transplanting (Rs 320.91), ploughing (Rs 312.42), spreading of FYM (Rs 276.4) and organic manures and biofertilizers application (Rs 189.44).

In case of inorganic chilli production, for ploughing operation about 1.00 hour of machine labour was used and for transportation of FYM 2.26 trips of machine labour were used. In case of harrowing operation 2.35 pair days of bullock labour were used. About 3.59 man days of human labour in spreading of FYM, 4.43 man days of human labour and also 1 pair day of bullock labour were used in seed bed preparation. About 5.10 man days for transplanting, 3.22 man days for fertilizer application and 13.01 man days of human labour for hand weeding were used. For intercultivation about 1.86 pair days of bullock labour were used. About 15.77 man days for spraying of plant protection chemicals, 4.12 man days for irrigation operation and 36.14 man days of human labour for harvesting were used.

The maximum cost involved (Rs 2276.81) was in harvesting operation, followed by spraying of plant protection chemicals (Rs 1182.61), harrowing (Rs 939.13), hand weeding (Rs 802.17), intercultivation (Rs 742.03), transportation of FYM (Rs 734.78), seed bed preparation (Rs 695.65), transplanting (Rs 328.26), irrigation (Rs 308.70), ploughing (Rs 300.00), spreading of FYM (Rs 254.35) and fertilizer application (Rs 241.30).

4.5 Cost involved in the cultivation of tomato and chilli on both organic and inorganic farms

4.5.1 Cost involved in the cultivation of tomato on organic and inorganic farms

Per acre cost of cultivation of tomato crop on organic and inorganic farms is presented in the Table 4.10.

Perusal of the table indicated that the total cost of tomato cultivation on organic farms was less than that of inorganic farms. The average cost of cultivation per acre of tomato on organic farm was Rs 17157.97 as against Rs 17702.53 on inorganic farms. The cost of chemical fertilizers and cost of plant protection chemicals on inorganic farms were the differing factors in the cost. In the total cost, variable costs accounted for a major share. The proportion of variable cost was Rs 13267.53 and Rs 14182.01 accounting for 79.42 per cent and 80.11 per cent of the total cost of cultivation of tomatoes on organic and inorganic farms respectively.

Table 4.9: Labour use pattern in the production of organic and inorganic chilli production

(Per acre)

Sl. No.	Particulars	Units	Chilli			
			Organic		Inorganic	
			Quantity	Cost	Quantity	Cost
1	Ploughing	Machine hours	1.03 (1.19)	312.42	1.00 (1.07)	300.00
2	Transportation of FYM	No of trips	1.82 (2.10)	592.13	2.26 (2.41)	734.78
3	Harrowing	Pair days	3.19 (3.68)	1275.36	2.35 (2.50)	939.13
4	Spreading of FYM	Man days	3.69 (4.25)	276.4	3.59 (3.83)	254.35
5	Seed bed preparation	Pair days	1.24 (1.43)	496.89	1.00 (1.07)	400.00
		Man days	3.98 (4.59)	280.54	4.43 (4.72)	295.65
6	Transplanting	Man days	4.97 (5.73)	320.91	5.10 (5.43)	328.26
7	Fertilizer /organic manure application	Man days	2.53 (2.92)	189.44	3.22 (3.43)	241.30
8	Hand weeding	Man days	12.84 (14.80)	776.4	13.01 (13.86)	802.17
9	Inter cultivation	Pair days	2.69 (3.10)	1076.6	1.86 (1.98)	742.03
10	Spraying PPC/Biopesticides	Man days	13.79 (15.89)	1034.16	15.77 (16.80)	1182.61
11	Irrigation	Man days	5.26 (6.06)	394.41	4.12 (4.39)	308.70
12	Harvesting	Man days	29.73 (34.27)	1841.61	36.14 (38.51)	2276.81
	Total	**-**	**86.76 (100.00)**	**8867.27**	**93.85 (100.00)**	**8805.79**

Note : Figures in the parentheses indicate percentage to the respective total

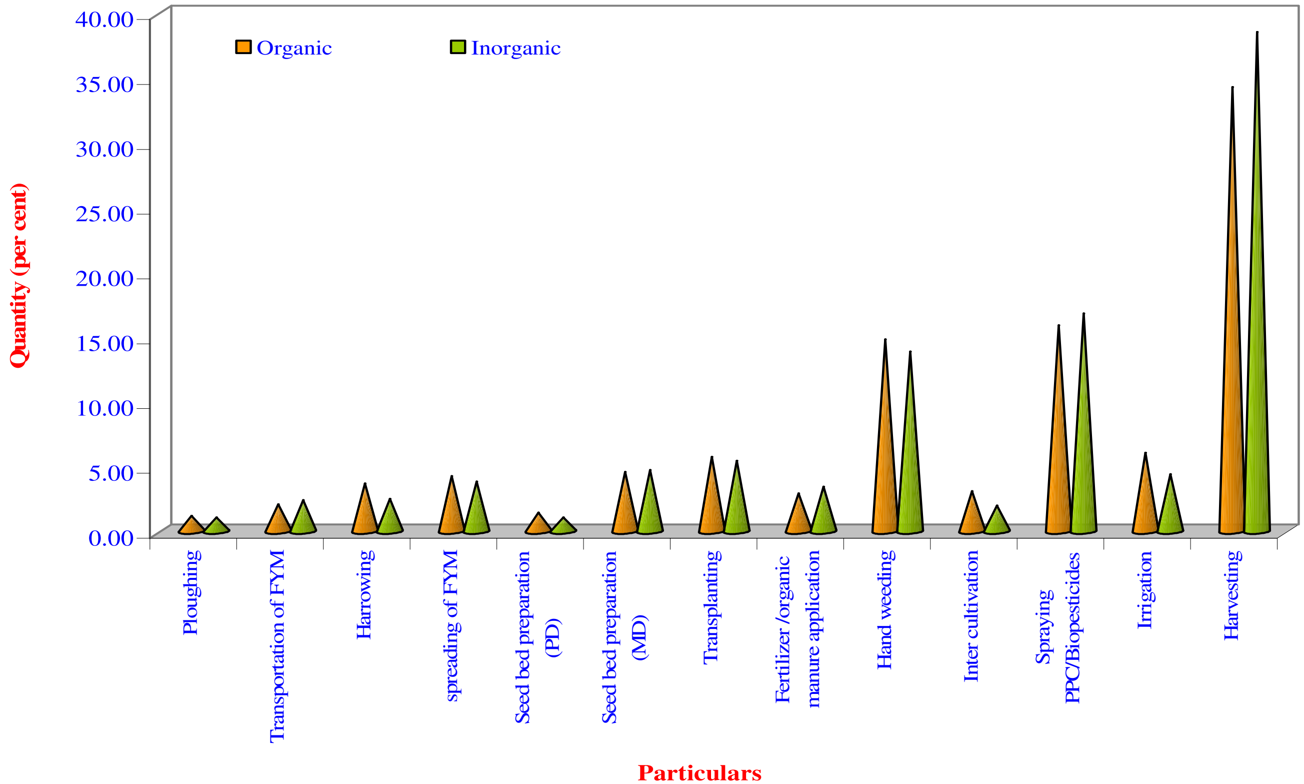

Fig. 3: Labour use pattern in the production of organic and inorganic chilli production

Fig. 3: Labour use pattern in the production of organic and inorganic chilli production

Table 4.10: Cost involved in tomato cultivation on organic and inorganic farms

(Rs/acre)

Sl. No.	Particulars	Organic farms		Inorganic farms		Difference	
A	**Variable costs**	**Cost**	**Per cent to total cost**	**Cost**	**Per cent to total cost**	**Cost**	**Per cent**
1	Seeds	541.95	3.16	626.33	3.54	-84.38	15.50
2	Farm yard manure	1829.03	10.66	1928.47	10.89	-99.44	18.26
3	Green manuring seeds	396.62	2.31	-	-	396.62	-72.83
4	Vermicompost	898.61	5.24	-	-	898.61	-165.02
5	Biofertilizers	302.19	1.76	-	-	302.19	-55.49
6	Biopesticides	293.66	1.71	-	-	293.66	-53.93
7	Chemical fertilizers	-	-	1607.12	9.08	-1607.12	295.12
8	Plant protection chemicals	-	-	845.69	4.78	-845.69	155.30
9	Human labour	4789.26	27.91	5377.98	30.38	-588.72	108.11
10	Bullock labour	2751.49	16.04	1937.17	10.94	814.32	-149.54
11	Machine labour	933.20	5.44	931.46	5.26	1.74	-0.32
12	Interest on working capital	891.52	5.20	927.79	5.24	-36.27	6.66
	Sub total (A)	**13267.53**	**79.42**	**14182.01**	**80.11**	**-914.48**	**167.93**
B	**Fixed costs**						**0.00**
1	Land revenue	25.00	0.15	25.00	0.14	0	0.00
2	Rental value of the land	2500.00	14.57	2500.00	14.12	0	0.00
3	Depreciation	452.62	2.64	472.28	2.67	-19.66	3.61
4	Interest on fixed capital	552.82	3.22	523.24	2.96	29.58	-5.43
	Sub total (B)	**3530.44**	**20.58**	**3520.52**	**19.89**	**9.92**	**-1.82**
	Total cost of cultivation (A+B)	**17157.97**	**100.00**	**17702.53**	**100.00**	**-544.56**	**100.00**

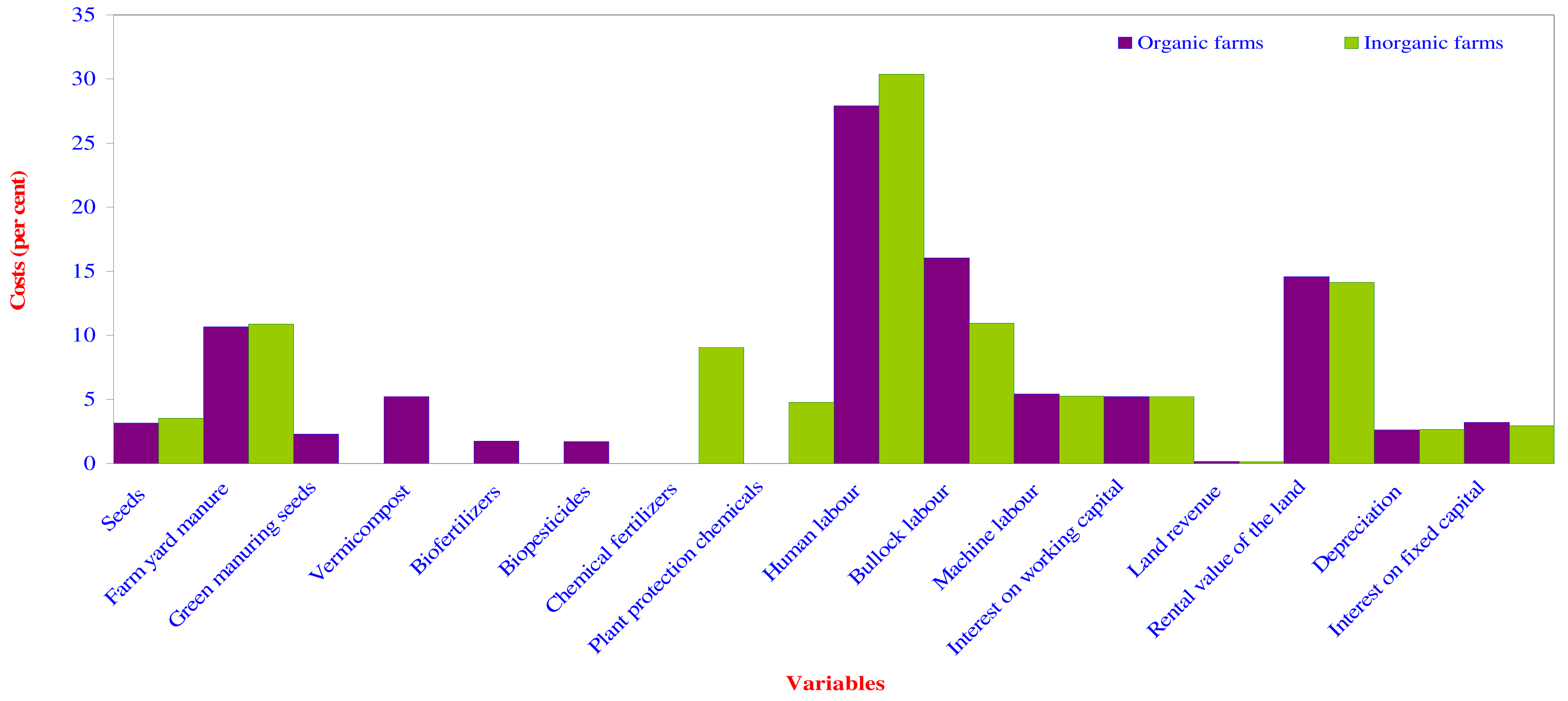

Fig. 4: Cost involved in tomato cultivation on organic and inorganic farms (per cent)

Fig. 4: Cost involved in tomato cultivation on organic and inorganic farms (per cent)

In the case of organic farms, the variable costs mainly comprised of cost of human labour, cost of organic manure (FYM, green manuring, vermicompost, biofertlizers and biopesticides) and cost of bullock labour which were Rs 4789.26, Rs 3720.11 and Rs 2751.49 accounting for 27.91 per cent, 21.68 per cent and 16.04 per cent of the total cost of cultivation respectively. The expenditure on organic manure found to be an important item in total cost of cultivation on organic farms. The other variable cost items such as cost of seeds, cost of machine labour and interest on the working capital accounted for 3.16 per cent (Rs 541.95), 5.44 per cent (Rs 933.20) and 5.20 per cent (Rs 891.52) of the total cost of cultivation of tomatoes on organic farms respectively.

In the cost of cultivation of tomato on inorganic farms, the variable cost mainly comprised of cost of human labour, cost of bullock labour, cost of FYM, cost of chemical fertilizers and cost of plant protection chemicals which were Rs 5377.98, Rs 1937.17, Rs 1928.47, Rs 1607.12 and Rs 845.69 accounting for 30.38 per cent, 10.94 per cent, 10.89 per cent, 9.08 per cent and 4.78 per cent of the total cost of cultivation respectively. The expenditure on chemical fertilizers found to be an important item in the total cost of cultivation on inorganic farms. The other variable cost items such as cost of seeds, cost of machine labour and interest on working capital accounted for 3.54 per cent (Rs 626.33), 5.26 per cent (Rs 931.46) and 5.24 per cent (Rs 927.79) of the total cost of cultivation of tomatoes on inorganic farms respectively.

The share of fixed cost in total cost of cultivation of tomato on organic farms and inorganic farms was 20.58 per cent (Rs 3530.44) and 19.89 per cent (Rs 3520.52) respectively. Among the items of fixed cost, the rental value of the land had a maximum share in the total cost of cultivation on both organic and inorganic farms.

4.5.2 Cost involved in the cultivation of chilli on organic and inorganic farms

Per acre cost of cultivation of chilli crop on organic and inorganic farms is presented in the Table 4.11.

Perusal of the table indicated that the total cost of chilli cultivation on organic farms was less than that of inorganic farms. The average cost of cultivation per acre of chilli on organic farm was Rs 18336.62 as against Rs 19114.91 on inorganic farms. The cost of chemical fertilizers and cost of plant protection chemicals on inorganic farms were the differing factors in the cost. In the total cost, variable costs accounted for a major share. The proportion of variable cost was Rs 14819.26 and Rs 15574.27 accounting for 80.82 per cent and 81.48 per cent of the total cost of cultivation of chilli on organic and inorganic farms respectively.

In the case of organic farms, the variable costs mainly comprised of cost of human labour, cost of organic manure (FYM, green manuring, vermicompost, biofertlizers and biopesticides) and cost of bullock labour which were Rs 5113.87, Rs 4610.15 and Rs 2848.86 accounting for 27.89 per cent, 25.15 per cent and 15.54 per cent of the total cost of cultivation respectively. The expenditure on organic manure found to be an important item in total cost of cultivation on organic farms. The other variable cost items such as cost of seeds, cost of machine labour and interest on the working capital accounted for 2.03 per cent (Rs 372.34), 4.93 per cent (Rs 904.55) and 5.29 per cent (Rs 969.48) of the total cost of cultivation of chilli on organic farms respectively.

In the cost of cultivation of chilli on inorganic farms, the variable cost mainly comprised of cost of human labour, cost of FYM, cost of bullock labour, cost of chemical fertilizers and cost of plant protection chemicals which were Rs 5689.86, Rs 2260.87, Rs 2081.16, Rs 1887.00 and Rs 1110.27 accounting for 29.77 per cent, 11.83 per cent, 10.89 per cent, 9.87 per cent and 5.81 per cent of the total cost of cultivation respectively. The expenditure on chemical fertilizers found to be an important item in the total cost of cultivation on inorganic farms. The other variable cost items such as cost of seeds, cost of machine labour and interest on working capital accounted for 2.57 per cent (Rs 491.45), 5.41 per cent (Rs 1034.78) and 5.33 per cent (Rs 1018.88) of the total cost of cultivation of chilli on inorganic farms respectively.

Table 4.11: Cost involved in chilli cultivation on organic and inorganic farms

(Rs/acre)

Sl. No.	Particulars	Organic farms		Inorganic farms		Difference	
A	**Variable costs**	**Cost**	**Per cent to total cost**	**Cost**	**Per cent to total cost**	**Cost**	**Per cent**
1	Seeds	372.34	2.03	491.45	2.57	-119.11	15.30
2	Farm yard manure	1821.95	9.94	2260.87	11.83	-438.92	56.40
3	Green manuring seeds	444.10	2.42	-	-	444.1	-57.06
4	Vermicompost	1436.85	7.84	-	-	1436.85	-184.62
5	Biofertilizers	162.32	0.89	-	-	162.32	-20.86
6	Biopesticide	744.93	4.06	-	-	744.93	-95.71
7	Chemical fertilizers	-	-	1887.00	9.87	-1887	242.45
8	Plant protection chemicals	-	-	1110.27	5.81	-1110.27	142.66
9	Human labour	5113.87	27.89	5689.86	29.77	-575.99	74.01
10	Bullock labour	2848.86	15.54	2081.16	10.89	767.7	-98.64
11	Machine labour	904.55	4.93	1034.78	5.41	-130.23	16.73
12	Interest on working capital	969.48	5.29	1018.88	5.33	-49.4	6.35
	Sub total (A)	**14819.26**	**80.82**	**15574.27**	**81.48**	**-755.01**	**97.01**
B	**Fixed costs**						**0.00**
1	Land revenue	25.00	0.14	25.00	0.13	0	0.00
2	Rental value of the land	2500.00	13.63	2500.00	13.08	0	0.00
3	Depreciation	465.84	2.54	469.28	2.46	-3.44	0.44
4	Interest on fixed capital	526.52	2.87	546.36	2.86	-19.84	2.55
	Sub total (B)	**3517.36**	**19.18**	**3540.64**	**18.52**	**-23.28**	**2.99**
	Total cost of cultivation (A+B)	**18336.62**	**100.00**	**19114.91**	**100.00**	**-778.29**	**100.00**

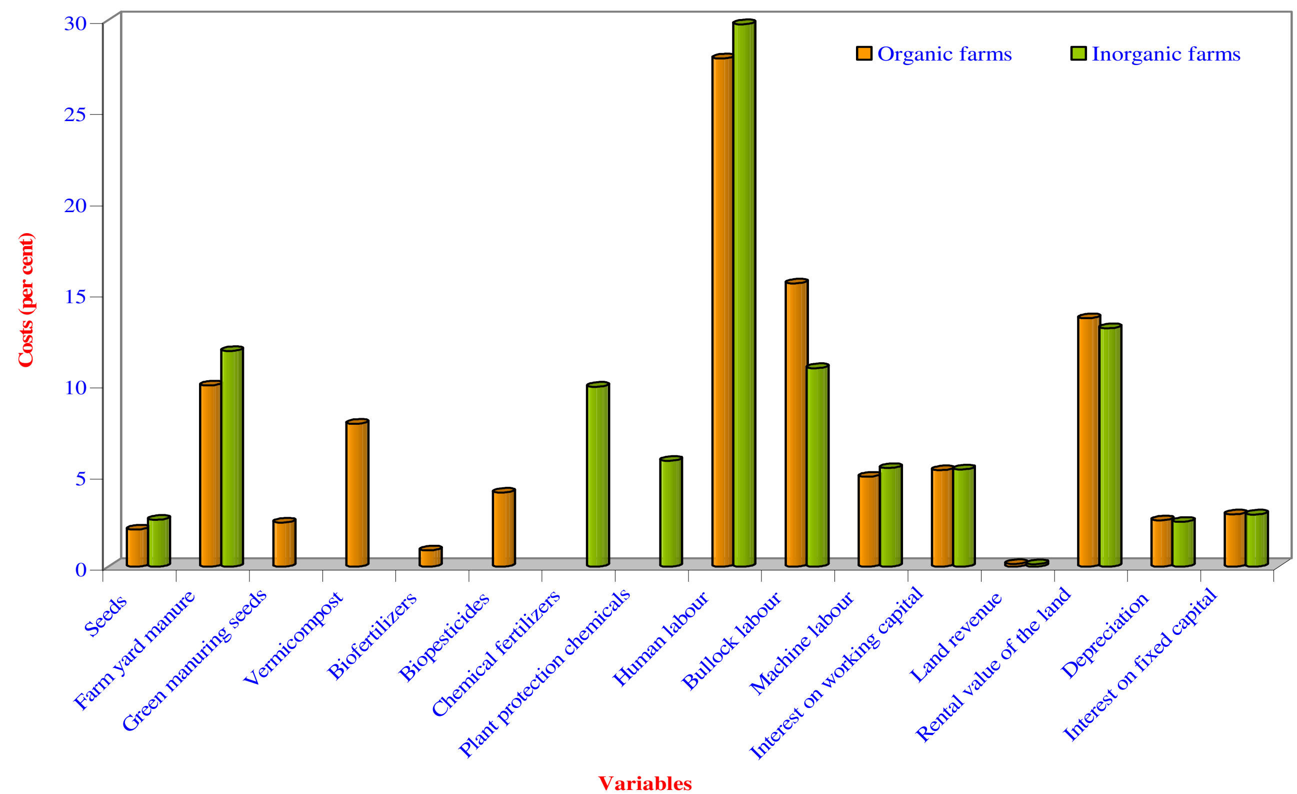

Fig. 5: Cost involved in chilli cultivation on organic and inorganic farms (per cent)

Fig. 5: Cost involved in chilli cultivation on organic and inorganic farms (per cent)

The share of fixed cost in total cost of cultivation of chilli on organic farms and inorganic farms was 19.18 per cent (Rs 3517.36) and 18.52 per cent (Rs 3540.64) respectively. Among the items of fixed cost, the rental value of the land had a maximum share in the total cost of cultivation on both organic and inorganic farms.

4.6 Yield, market price and returns in cultivation of tomato and chilli on both organic and inorganic farms

4.6.1 Yield, market price and return of organic and inorganic tomato

The average yield level, market price, marketing cost and net returns are presented in the Table 4.12.

The per acre average yield of tomatoes on organic farm (5.81 tonnes) was comparatively lower than that of inorganic farm (6.95 tonnes).The average per tonne market price of organic tomatoes (Rs 9550.00) was found to be higher than that of inorganic tomatoes (Rs 6850.00). The average transportation cost of organic tomatoes was Rs 440.96 as against Rs 396.63 per tonne of inorganic tomatoes. The commission charges paid during marketing of organically produced tomatoes was Rs 623.17 per tonne, as against Rs 500.56 per tonne for inorganically produced tomatoes. The organically produced tomatoes could fetch premium price in the market. The total marketing cost was Rs 6182.64 and Rs 6235.57 for organic and inorganic tomatoes respectively.

The return structure in tomato clearly revealed that the gross returns per acre was higher (Rs 55989.07) on organic farms compared to that of inorganic farms (Rs 47012.62) with a positive net return on both the categories of the farms. The net return on organic farm was Rs 32649.12 and was Rs 23074.52 on inorganic farms. Though the yield levels on organic farms were lower compared to inorganic farms, the net returns were higher because of the premium price received and lower cost of cultivation. The B:C ratio was also higher on organic farms (2.40) compared to inorganic farms (1.96).

4.6.2 Yield, market price and return of organic and inorganic chilli

The average yield level, market price, transportation cost, commission charges and net returns are presented in the Table 4.13.

The per acre average yield of chilli on organic farm (4.10 tonnes) was comparatively lower than that of inorganic farm (4.86 tonnes).The average per tonne market price of organic chilli (Rs 9830.00) was found to be higher than that of inorganic chilli (Rs 6300.00). The average transportation cost of organic chilli was Rs 265.19 per tonne as against Rs 284.89 per tonne of inorganic chilli. The commission charges paid during marketing of organically produced chilli was Rs 643.65 per tonne, as against Rs 432.11 per tonne for inorganically produced chilli. The organically produced chilli could fetch premium price in the market. The total marketing cost was Rs 3726.30 for organic chilli and Rs 3484.66 for inorganic chilli.

The return structure in chilli clearly revealed that the gross returns per acre was higher (Rs 40289.86) on organic farms compared to that of inorganic farms (Rs 30583.33) with a positive net return on both the categories of the farms. The net return on organic farm was Rs 18226.94 and was Rs 7983.77 on inorganic farms. Though the yield levels on organic farms were lower compared to inorganic farms, the net returns were higher because of the premium price received and lower cost of cultivation. The B:C ratio was also higher on organic farms (1.83) compared to inorganic farms (1.35).

4.7 Decomposition analysis

4.7.1 Structural break in the production relation of organic and inorganic tomato

To identify the structural break in tomato production relation with the introduction of organic farming practice as new technology, direct estimates of Cobb-Douglas type of production function presented in the Table 4.14 are used.

Table 4.12: Yield, market price and returns in tomato cultivation on organic and inorganic farms

Sl. No.	Particulars	Organic farms	Inorganic farms
1	Yield (tonne per acre)	5.81	6.95
2	Market price (Rs per tonne)	9550.00	6850.00
3	Transportation cost including loading and unloading charges (Rs per tonne)	440.96	396.63
4	Commission charges (Rs per tonnne)	623.17	500.56
5	Total marketing cost (Rs per acre)	6182.64	6235.57
6	Gross returns (Rs per acre)	55989.07	47012.62
7	Cost of cultivation (Rs per acre)	17157.97	17702.53
8	Net returns (Rs per acre)	32649.12	23074.52
9	B:C ratio	2.40	1.96

Table 4.13: Yield, market price and returns in chilli cultivation on organic and inorganic farms

Sl. No.	Particulars	Organic farms	Inorganic farms
1	Yield (tonne per acre)	4.10	4.86
2	Market price (Rs per tonne)	9830.00	6300.00
3	Transportation cost including loading and unloading (Rs per tonne)	265.19	284.89
4	Commission charges (Rs per tonne)	643.65	432.11
5	Total marketing cost (Rs per acre)	3726.30	3484.66
6	Gross returns (Rs per acre)	40289.86	30583.33
7	Cost of cultivation (Rs per acre)	18336.62	19114.91
8	Net returns (Rs per acre)	18226.94	7983.77
9	B:C ratio	1.83	1.35

In case of new technology (organic farming) farms, the calculated ‘F’ value 62.322 was greater than the ‘F’ critical value (3.71) at one per cent for 6 and 23 degrees of freedom, the R^2 value 0.942 was statistically significant. The intercept value was 7.867. The regression co-efficient for seed (0.285) was significant at one per cent level of significance, while the regression co-efficients for organic manures (0.046) and human labour (0.082) were significant at five per cent level of significance where as the regression co-efficients for remaining variables namely FYM (0.003), bullock and machine labour (0.011) and organic plant protection measures (0.020) were found to be non significant.

In case of old technology (inorganic farming) farms, the calculated ‘F’ value 96.094 was greater than the ‘F’ critical value (3.71) at one per cent for 6 and 23 degrees of freedom, the R^2 value 0.962 was statistically significant. The intercept value was 7.277.The regression co-efficients for seed (0.213) and bullock and machine labour (0.183) were found to be significant at one per cent, while the regression co-efficients for FYM (0.022) and chemical fertilizers (0.035) were significant at ten per cent and five per cent respectively. Where as the regression co-efficients for human labour (0.017) and plant protection chemicals (0.009) were found to be non significant.

In case of pooled tomato production function with organic farming as dummy variable was used for identifying structural break if any in production relation with the introduction of organic farming practices as a new technology. The regression co-efficient for dummy variable (0.226) was significant at one per cent level of significance and also calculated ‘F’ value (156.189) was greater than ‘F’ critical value (3.004) at one per cent for 7 and 52 degrees of freedom, so R^2 value 0.955 was statistically significant. The regression co-efficients for seed, organic manures/ chemical fertilizers and for dummy variable were significant at one per cent level of significance, while the regression co-efficients for human labour and bullock and machine labour were significant at five per cent level of significance where as the regression co-efficients for FYM and organic plant protection measures/ PPC were found to be non-significant.

4.7.2 Geometric mean levels of returns and cost involved in tomato production

The per acre geometric mean levels of gross returns and input costs in the tomato production are presented in the Table 4.15.

It is clear from the table that the gross returns in organic farms (Rs 55403.48) were more than inorganic farms (Rs 47744.33). With regard to input costs the organic farming practice involves about 13 per cent less seed cost, 25 per cent less FYM cost, 18 per cent less manure cost, 19 per cent less human labour cost, 0.5 per cent less bullock and machine labour cost and 65 per cent less plant protection measures cost.

4.7.3 Estimated difference in income between organic and inorganic farms of tomato

The total change in income received from tomato production due to adoption of organic farming technology was decomposed using decomposition equation (4) developed by Bisaliah provided in Chapter III, using the production function parameters (estimates) from Table 4.14 and geometric mean levels of returns and cost of inputs from Table 4.15. The results of output decomposition analysis are presented in Table 4.16

A perusal of Table 4.16 revealed that the adopters of organic farming technology produced 14.88 per cent higher income from tomato production than inorganic farming adopters The increase in the income was further decomposed into different sources of change such as adoption of organic farming technology and all other inputs. The organic farming technology alone could contribute 23.82 per cent increase in income, while the contribution of change in input levels was found to be negative (-8.94 per cent). Amongst the various inputs, seed (-4.08 per cent), plant protection measures (-2.07 per cent), human labour (-1.76 per cent), organic manures/chemical fertilizers (-0.94 per cent), FYM (-0.092 per cent) and bullock and machine labour (-0.01 per cent) contributed negatively to the income.

Table 4.14: Production function estimates in tomato production on organic and inorganic farms

Sl. No.	Particulars	Parameter	Organic	Inorganic	Pooled
1	No. of observations	N	30	30	60
2	Intercept	a	7.867 (0.657)	7.277 (0.348)	7.226 (0.336)
3	Seed (Rs)	X_1	0.285*** (0.071)	0.213*** (0.032)	0.231*** (0.033)
4	FYM (Rs)	X_2	0.003 (0.005)	0.022* (0.011)	0.004 (0.004)
5	Organic manure/Chemical fertilizers (Rs)	X_3	0.046** (0.020)	0.035** (0.016)	0.048*** (0.012)
6	Human labour (Rs)	X_4	0.082** (0.032)	0.017 (0.016)	0.030** (0.015)
7	Bullock and machine labour (Rs)	X_5	0.011 (0.122)	0.183*** (0.062)	0.153** (0.061)
8	Organic plant protection measures/PPC (Rs)	X_6	0.020 (0.031)	0.009 (0.019)	0.024 (0.016)
9	Dummy for organic farming	-	-	-	0.226*** (0.021)
10	Coefficient of multiple determination	R^2	0.942	0.962	0.955
11	Adjusted R	$\overline{R}^2$	0.927	0.952	0.948
12	F Value	F	62.322	96.094	156.189

Note: *** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
Figures in parentheses indicate standard errors of coefficients

Table 4.15: Geometric mean levels of returns and cost involved in the production of tomato on organic and inorganic farms

Sl. No.	Particulars	Organic	Inorganic	Difference (%)
1	No. of observations	30	30	
2	Seed (Rs)	541.61	625.08	-13.35
3	FYM (Rs)	1493.72	1986.94	-24.82
4	Organic manure/Chemical fertilizers (Rs)	1439.52	1762.54	-18.33
5	Human labour (Rs)	5164.33	6394.58	-19.24
6	Bullock and machine labour (Rs)	3246.57	3261.68	-0.46
7	Organic plant protection measures/ PPC (Rs)	288.71	831.19	-65.27
8	Gross returns (Rs)	55403.48	47744.33	16.04

4.7.4 Structural break in the production relation of organic and inorganic chilli

To identify the structural break in chilli production relation with the introduction of organic farming practice as new technology, direct estimates of Cobb-Douglas type of production function presented in the Table 4.17 are used.

In case of new technology (organic farming) farms, the calculated 'F' value 48.541 was greater than the 'F' critical value (3.71) at one per cent for 6 and 23 degrees of freedom, the R^2 value 0.927 was statistically significant. The intercept value was 3.983. The regression co-efficient for seed (0.175) was significant at one per cent; while the regression co-efficients for organic manures (0.132) and bullock and machine labour (0.458) were significant at five per cent and ten per cent respectively. Where as the regression co-efficients for FYM (0.022), human labour (0.043) and organic plant protection measures (0.049) were found to be non-significant.

In case of old technology (inorganic farming) farms, the calculated 'F' value 104.875 was greater than the 'F' critical value (3.71) at one per cent for 6 and 23 degrees of freedom, the R^2 value 0.965 was statistically significant. The intercept value was 6.618. The regression co-efficients for seed (0.202) and human labour (0.240) were significant at one per cent where as FYM (0.010), chemical fertilizers (0.019), bullock and machine labour (0.0004) and plant protection chemicals (0.019) were found to be non significant.

Table 4.16: Estimated difference in income between organic and inorganic farms in cultivation of tomato and chilli

(In per cent)

Sl. No.	Particulars	Tomato	Chilli
I	**Total difference in the gross income**	**14.88**	**27.07**
II	**Sources of income growth**		
1	**Technology component**	**23.82**	**33.91**
a	Neutral component	59.06	-263.44
b	Non-neutral component	-35.24	297.35
2	**Input use difference**	**-8.94**	**-6.84**
a	Seeds (Rs per acre)	-4.08	-4.29
b	FYM (Rs per acre)	-0.092	0.17
c	Organic manure/chemical fertilizers (Rs per acre)	-0.94	0.83
d	Human labour (Rs per acre)	-1.76	-0.39
e	Bullock and machine labour (Rs per acre)	-0.01	-1.52
f	Organic plant protection measures/PPC (Rs per acre)	-2.07	-1.63

Table 4.17: Production function estimates in chilli production on organic and inorganic farms

Sl. No.	Particulars	Parameter	Organic	Inorganic	Pooled
1	No. of observations	N	30	30	60
2	Intercept	a	3.983 (1.737)	6.618 (0.684)	6.688 (0.547)
3	Seed (Rs)	X_1	0.175*** (0.050)	0.202*** (0.035)	0.204*** (0.029)
4	FYM (Rs)	X_2	0.022 (0.044)	0.010 (0.007)	0.010 (0.007)
5	Organic manure/ Chemical fertilizers (Rs)	X_3	0.132** (0.057)	0.019 (0.054)	0.114*** (0.037)
6	Human labour (Rs)	X_4	0.043 (0.054)	0.240*** (0.057)	0.135*** (0.034)
7	Bullock and machine labour (Rs)	X_5	0.458* (0.243)	0.0004 (0.096)	-0.009 (0.087)
8	Organic plant protection measures/ PPC (Rs)	X_6	0.049 (0.036)	0.019 (0.032)	0.047** (0.023)
9	Dummy for organic farming		-	-	0.341*** (0.015)
10	Coefficient of Multiple determination	R^2	0.927	0.965	0.964
11	Adjusted R	$\overline{R}^2$	0.908	0.956	0.959
12	F Value	F	48.541	104.875	198.327

Note: *** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

Figures in parentheses indicate standard errors of coefficients

In case of pooled chilli production function with organic farming as dummy variable was used for identifying structural break if any in production relation with the introduction of organic farming practices as a new technology. The regression co-efficient for dummy variable (0.341) was significant at one per cent level of significance and also calculated 'F' value (198.327) was greater than 'F' critical value (3.004) at one per cent for 7 and 52 degrees of freedom, so R^2 value 0.964 was statistically significant. The regression co-efficients for seed, organic manures/ chemical fertilizers, human labour and for dummy variable were significant at one per cent level of significance, while the regression co-efficients for organic plant protection measures/ PPC was significant at five per cent level of significance where as the regression co-efficients for FYM and bullock and machine labour were found to be non significant.

4.7.5 Geometric mean levels of returns and cost involved in chilli production

The per acre geometric mean levels of gross returns and input costs in the chilli production are presented in the Table 4.18.

It is clear from the table that the gross returns in organic farms (Rs 38977.36) were more than inorganic farms (Rs 29733.26). With regard to input costs the organic farming practice involves about 22 per cent less seed cost, 9 per cent less human labour cost and 28 per cent less plant protection measures cost where as 8 per cent more FYM cost and 6 per cent more manure cost.

4.7.6 Estimated difference in income between organic and inorganic farms of chilli

The total change in income received from chilli production due to adoption of organic farming technology decomposed in to different sources of change using decomposition equation (4) provided in Chapter III, using the production function parameters (estimates) from Table 4.17 and geometric mean levels of returns and cost of inputs from Table 4.18. The results of decomposition analysis are presented in Table 4.16.

A perusal of Table 4.16 revealed that adopters of organic farming technology produced 27.07 per cent higher income from chilli production than inorganic farming adopters. The increase in the income was further decomposed into different sources of change such as adoption of organic farming technology and all other inputs. The organic farming technology alone could contribute 33.91 per cent increase in income, while the contribution of change in input levels was found to be negative (-6.84 per cent). Amongst the various inputs, organic manure/chemical fertilizers (0.83 per cent) and FYM (0.17 per cent) were found to contribute positively while rest of the inputs such as seed (-4.29 per cent), plant protection measures (-1.63 per cent), bullock and machine labour (-1.52 per cent) and human labour (-0.39 per cent) contributed negatively to the income.

4.8 Problems of organic vegetable growers

An informal discussion with the organic farmers revealed that organic production of vegetables has a lot of problems. Opinion survey was conducted to know the problems faced by the farmers in organic vegetable production and marketing and results of opinion survey are presented in the Table 4.19.

4.8.1 Production related problems

It was observed that majority of the sample farmers (78.33 per cent) expressed the problem of non-availability of labour, followed by problem of non-availability of information on organic farming (65.00 per cent), incidence of pest and diseases (51.67 per cent), limited and irregular power supply (48.33 per cent), non-availability of biopesticides (43.33 per cent), non-availability of seed material (26.67 per cent), non-availability of organic manures (18.33 per cent) and non-availability of water for irrigation (13.33 per cent) as the major problems in production of vegetables organically.

Table 4.18: Geometric mean levels of returns and cost involved in the production of chilli on organic and inorganic farms

Sl. No.	Particulars	Organic	Inorganic	Difference (%)
1	No. of observations	30	30	
2	Seed (Rs)	348.98	445.76	-21.71
3	FYM (Rs)	1890.97	1748.87	8.13
4	Organic manure/ Chemical fertilizers (Rs)	2024.91	1902.35	6.44
5	Human labour (Rs)	5619.53	6162.24	-8.81
6	Bullock and machine labour (Rs)	3232.57	3341.48	-3.26
7	Organic plant protection measures/ PPC (Rs)	736.08	1027.15	-28.34
8	Gross returns (Rs)	38977.36	29733.26	31.09

Table 4.19: Problems of organic farmers (opinion survey)

(n=60)

Sl. No.	Problems	Frequency	Percent
A	**Production related problems**		
1	Non- availability of seed materials	16	26.67
2	Non- availability of organic manures	11	18.33
3	Non-availability of biopesticide	26	43.33
4	Incidence of pests and diseases	31	51.67
5	Non- availability of water for irrigation	8	13.33
6	Limited and irregular power supply	29	48.33
7	Non- availability of labour	47	78.33
8	Non- availability of information on organic farming	39	65.00
B	**Marketing problems**		
1	Poor transport facilities	25	41.67
2	Non- availability of market related information	42	70.00
3	Fluctuation in the prices of commodities	26	43.33
4	High commission charges	46	76.67
5	Faulty weighment	17	28.33
6	Non- availability of exclusive market for organic produce	34	56.67
7	Absence of premium price in the local market	33	55.00

4.8.2 Marketing problems

It was observed that majority of the sample farmers (76.67 per cent) expressed the problem of high commission charges followed by non-availability of market related information (70.00 per cent), non-availability of exclusive market for organic produce (56.67 per cent), absence of premium price in the local market (55.00 per cent), fluctuation in the prices of commodities (43.33 per cent), poor transport facilities (41.67 per cent) and faulty weighment (28.33 per cent) as the major problems in marketing of organically produced vegetables.

5. DISCUSSION

The results of the investigation presented in the preceding chapter are discussed in detail in this chapter. The discussion throw light on the possible causes for the results obtained and are presented under the following heads.

5.1 General characteristics of the sample farmers in the study area

5.2 Reasons for shifting from inorganic to organic cultivation of vegetables

5.3 Type, level, pattern of input use and cost involved in both organic and inorganic farms

5.4 Labour use pattern in both organic and inorganic farms

5.5 Cost involved in both organic and inorganic farms

5.6 Yield, market price and returns in both organic and inorganic farms

5.7 Decomposition analysis

5.8 Problems of organic vegetable growers

5.1 General characteristics of the sample farmers in the study area

The general characters of the respondents are presented in Table 4.1. In case of tomato growers, the organic tomato growers were younger compared to inorganic tomato growers and in both the cases the main occupation of them was agriculture. It could be further observed that organic tomato growers had less number of years of schooling than inorganic tomato growers. The average size of the family was about six of both organic and inorganic farmers and average land holding of organic tomato growers was 8.45 acres and it was 8.40 acres in the case of inorganic tomato growers. The average size of irrigated farm was high in both organic and inorganic farms compared to an average size of dry land area. This was due to the fact that in the study area water for irrigation was sufficiently available from Krishna and Ghataprabha reservoirs. It is evident from the results that as the size of irrigated farm increased, the area under tomato cultivation also increased. The tomato varieties grown by the organic farmers in the study area were Namadhari, Sankranti and Champakali and the average numbers of pickings were about seven where as the varieties grown by the inorganic farmers were Namadhar, Ustav and Anand and the average numbers of pickings were about nine.

In case of chilli growers also, the organic chilli growers were younger compared to inorganic chilli growers and in both the cases the main occupation of them was agriculture. It could be further revealed that organic chilli growers had more number of years of schooling than that of inorganic chilli growers. The average size of the family was about five of both organic and inorganic farmers and average land holding was 8.23 acres in case of organic chilli growers and that in case of inorganic chilli growers it was 7.4 acres. The average size of irrigated farm was high in both organic and inorganic farms compared to an average size of dry land area. This was due to the fact that in the study area water for irrigation was sufficiently available from Krishna and Ghataprabha reservoirs. It is evident from the results that as the size of irrigated farm increased, the area under chilli cultivation also increased. The chilli varieties grown by the organic farmers in the study area were Disha, Local, and Sankeshwar and the average numbers of pickings were about six where as the varieties grown by the inorganic farmers were Disha, Trishul, and Sitara and the average numbers of pickings were about seven.

5.1.1 Cropping pattern and major crops grown

The absolute area devoted to different crops by the organic and inorganic farmers was ascertained for the agriculture year 2009-10.Table 4.2 indicated that in case of organic farms the major crops grown during kharif by sample farmers were soybean dominated the cropping pattern followed by other vegetables, groundnut, tomato and chilli. In all the three seasons sugarcane occupied the more area compared to any other crops mainly because of prevalence of organic jaggery production units, sugar factories and farmers in the study area got good returns from cultivation of sugarcane. During *rabi* season other vegetables, wheat and cotton were the major crops grown. During summer irrigation facility was available for vegetables. The horticulture crops like mango, fig and guava were cultivated in the small area.

In case of inorganic farms the major crops grown during Kharif by the sample farmers were other vegetables dominated the cropping pattern followed by tomato, chilli, soybean, maize and groundnut. In all the three seasons sugarcane occupied the more area compared to any other crop mainly because of prevalence of sugar factories and farmers in the study area got good returns from cultivation of sugarcane. During *rabi* season other vegetables, wheat, sorghum and cotton were the major crops grown. During summer season other vegetables and maize were grown because during summer season irrigation was available for the crops. The horticulture crops like mango, guava and fig were grown in small area as in case of organic farms.

5.2 Reasons for shifting from inorganic to organic cultivation of vegetables

The reasons for shifting from inorganic cultivation of vegetables to organic cultivation of vegetables are presented in the Table 4.3. It was observed that high per cent of the sample farmers were expressed the reason of increasing return from organic vegetables (73.3 per cent), followed by reason of quality of organic vegetables (71.6 per cent), soil health oriented motives (63.3 per cent), increasing cost of inorganic chemicals (61.6 per cent), environmental concern (56.6 per cent), motivation by neighbouring organic farmers (46.6 per cent) and motivation by media (33.33 per cent).

Anand Kumar (1998) found that increasing cost of chemical inputs (63%), increase on the net return in organic farming (11%), as the reasons behind shifting to organic farming.

Loganandan and Singh (2003) observed that more number of respondents (54%) had the motive of environment safety to shift to organic farming followed by financial motives(40%), soil health oriented motives(34%), motivation by significant others viz neighbouring organic farmers, environmental activists etc (30%), quality of output related motives(24%), motivation by media(24%) and philosophical motives (18%).

5.3 Type, level, pattern of input use and cost involved in both organic and inorganic farms

5.3.1 Tomato

In the study area farmers use the different types of inputs in the cultivation of tomato both organically and inorganically. About six types of inputs were used in the cultivation of organic tomato (Table 4.4). They were seeds, farm yard manure, green manuring, vermicompost, VAM and biopesticides which included neem seed cake, neem seed kernel extract, panchagavya and trichoderma. But in case of inorganic cultivation of tomato about seven types of inputs were used (Table 4.5) namely seeds, farm yard manure, urea, DAP, single super phosphate, complex fertilizers and plant protection chemicals which include monocrotophos, mancozeb, chloropyriphos and dimethoate.

In the organic farms though the more quantity of seeds were used than inorganic farms but cost involved in usage of seeds on organic farms (Rs 541.95) was less than that of inorganic farms (Rs 626.33) this is mainly due to the reason that majority of farmers use the local varieties in the cultivation of organic tomato where as in case of inorganic tomato cultivation the farmers use hybrids. The organic farmers use less quantity (1.83 tractor loads) of FYM than that of inorganic farmers (1.93 tractor loads) since the organic farmers used more of other biofertilizers mainly vermicompost (0.45 tonne), green manuring (15.86 kg of seeds), VAM (7.55 kg). Hence the cost involved in the usage of FYM is less in case of organic farms than inorganic farms. Along with FYM in inorganic farms the farmers also used urea (94.00 kg), DAP (83.5 kg), single super phosphate (38.5 kg) and complex fertilizers (13.5 kg) since these fertilizers given twice and also they are costlier than the organic manures. Hence the total cost involved in the usage of chemical fertilizers is more (Rs 1607.12) than those of organic manures (Rs 1597.42).

In the case of usage of plant protection measures, the organic farmers used neem seed cake (12.49 kg), NSKE (0.875 lit), panchagavya (14.00 lit) and trichoderma (0.83 kg) where as inorganic farmers used monocrotophos (0.51 lit), mancozeb (0.82 kg), chloropyriphos (0.27 lit) and dimethoate (0.68 lit) mainly to control pests like mites, fruit borer, leaf eating caterpillar and the diseases like, blight, leaf spot, wilt *etc.* Though in organic farms farmers used more quantity of biopestcides than plant protection chemicals in inorganic farms but cost involved was more in inorganic farms (Rs 845.69) than organic farms (Rs 293.66). The results are in agreement with Sujatha *et al.* (2006) and Sushil Kumar *et al.* (2006).

5.3.2 Chilli

In the study area farmers use the different types of inputs in the cultivation of chilli both organically and inorganically. About six types of inputs were used in the cultivation of organic chili (Table 4.6). They were Seeds, Farm yard manure, Green manuring, Vermicompost, VAM and Biopesticides which included neem seed cake, neem seed kernel extract, panchagavya and trichoderma. But in case of inorganic cultivation of chilli about seven types of inputs were used (Table 4.7) namely seeds, farm yard manure, urea, DAP, single super phosphate, complex fertilizers and plant protection chemicals which include monocrotophos, mancozeb, carbandizam and dimethoate.

In the organic farms though the more quantity of seeds were used than inorganic farms but cost involved in usage of seeds on organic farms (Rs 372.34) was less than that of inorganic farms (Rs 491.45) this is mainly due to the reason that majority of farmers use the local varieties in the cultivation of organic tomato where as in case of inorganic tomato cultivation the farmers use hybrids. The organic farmers use less quantity (1.82 tractor loads) of FYM than that of inorganic farmers (2.26 tractor loads) since the organic farmers used more of other biofertilizers mainly vermicompost (0.72 tonne), green manuring (17.76 kg of seeds), VAM (4.06 kg). Hence the cost involved in the usage of FYM is less in case of organic farms than inorganic farms. Along with FYM in inorganic farms the farmers also used urea (120.29 kg), DAP (81.16 kg), single super phosphate (38.41 kg) and complex fertilizers (33.33 kg). In organic farms farmers use more quantity of organic manures other than FYM hence even though they are less costly than chemical fertilizers but due to usage of more quantity, the total cost involved in the usage of chemical fertilizers is less (Rs 1887.00) than those of organic manures (Rs 2043.27).

In the case of plant protection measures, the organic farmers used neem seed cake (90.68 kg), NSKE (0.727 lit), panchagavya (14.70 lit) and trichoderma (0.93 kg) where as inorganic farmers used monocrotophos (0.61 lit), mancozeb (1.03 kg), carbandizam (0.47 kg) and dimethoate (0.75 lit) mainly to control pests like mites, fruit borer, leaf eating caterpillar and the diseases like, powdery mildew, seedling rot *etc.* Though in organic farms farmers used more quantity of biopestcides than plant protection chemicals in inorganic farms but cost involved was more in inorganic farms (Rs 1110.27) than organic farms (Rs 744.93).The results are in agreement with Sujatha *et al.* (2006) and Sushil Kumar *et al.* (2006).

5.4 Labour use pattern in both organic and inorganic farms

5.4.1 Tomato

The quantity of labour used, costs involved in the different operations of organic and inorganic cultivation of tomato for an acre area are presented in the Table 4.8.

It can be observed from the table that the organic farmers use less quantity of human labour, more quantity of bullock and machine labour than that of inorganic farmers in various operations. In case of organic tomato production, for ploughing about 1.3 machine hours were used for an acre, for transportation of FYM about 1.83 trips of tractor were used. In case of harrowing operation about 2.78 pair days of bullock labour were used. About 3.38 man days of human labour were used for spreading of FYM. In case of seed bed preparation, about 1.19 pair days of bullock labour and also 3.3 man days of human labour were used. In case of transplanting operation about 4.41 man days, for organic manures and biofertilizers application 2.82 man days and for hand weeding about 10.42 man days of human labour were used. In case of intercultivation operation about 2.9 pair days of bullock labour were used. About 12.52 man days for spraying of biopesticides, for irrigation 5.09 man days and for harvesting 29.78 man days of human labour were used.

In case of inorganic tomato production, for ploughing operation about 1.03 hours of machine labour were used and for transportation of FYM 1.93 trips of tractor were used. In case of harrowing operation 1.8 pair days of bullock labour were used. About 3.09 man days of human labour in spreading of FYM, 3.48 man days of human labour and also 1 pair day of bullock labour was used in seed bed preparation. About 4.8 man days for transplanting, 2.66 man days for fertilizer application and 12.31 man days of human labour for hand weeding were used. For intercultivation about 2.05 pair days of bullock labour were used. About 12.79 man days for spraying of plant protection chemicals, 4.1 man days for irrigation operation and 38.54 man days of human labour for harvesting were used. Thus human labour use was more in inorganic cultivation of tomato.

This was mainly due to the fact that the inorganic cultivation of tomato involves more number of times of spraying of plant protection chemicals as there was a pest outbreak of fruit borer and also incidence of mites was large, intensive usage of human labour in hand weeding than organic farmers as they usually follow less number of times of intercultivation than organic farmers and also the inorganic cultivation involves more number of pickings than organic cultivation. On the other hand organic cultivation of tomato involves slightly more amount of machine and bullock labour use and hence the cost involved in the usage of human labour on organic farms was less than that of inorganic farms but it was more in case of machine and bullock labour. But Sujatha *et al.* (2006) reported that organic cultivation of rice and cotton was labour intensive than inorganic cultivation.

5.4.2 Chilli

The quantity of labour used, costs involved in the different operations of organic and inorganic cultivation of chilli for an acre area are presented in the Table 4.9.

In case of organic chilli cultivation, for ploughing 1.03 machine hours were used for an acre, for transportation of FYM about 1.82 trips of tractor were used. In case of harrowing operation about 3.19 pair days of bullock labour were used. About 3.69 man days human labour were used for spreading of FYM. In case of seed bed preparation, about 1.24 pair days of bullock labour and also 3.98 man days of human labour were used. In case of transplanting operation about 4.97 man days, for organic manures and biofertilizers application 2.53 man days and for hand weeding about 12.84 man days of human labour were used. In case of intercultivation operation about 2.69 pair days of bullock labour were used. About 13.79 man days for spraying of biopesticides, for irrigation 5.26 man days and for harvesting 29.73 man days of human labour were used.

In case of inorganic chilli cultivation, for ploughing operation about 1.00 hour of machine labour was used and for transportation of FYM 2.26 trips of tractor were used. In case of harrowing operation 2.35 pair days of bullock labour were used. About 3.59 man days of human labour in spreading of FYM, 4.43 man days of human labour and also 1 pair day of bullock labour were used in seed bed preparation. About 5.10 man days for transplanting, 3.22 man days for fertilizer application and 13.01 man days of human labour for hand weeding were used. For intercultivation about 1.86 pair days of bullock labour were used. About 15.77 man days for spraying of plant protection chemicals, 4.12 man days for irrigation operation and 36.14 man days of human labour for harvesting were used. The human labour use was more in inorganic farming of chilli than organic farming.

This was mainly due to the fact that the inorganic cultivation of chilli involves more number of times of spraying of plant protection chemicals as there was a pest outbreak of fruit borer, and also incidence of thrips and mites was large, intensive usage of human labour in hand weeding than organic farmers as they usually follow less number of times of intercultivation than organic farmers and also the inorganic cultivation involves more number of pickings than organic cultivation. On the other hand organic cultivation of chilli involves more amount of machine and bullock labour and hence the cost involved in the usage of human labour on organic farms was less than that of inorganic farms but it was more in case of machine and bullock labour. But Sujatha *et al.* (2006) reported that organic cultivation of rice and cotton was labour intensive than inorganic cultivation.

5.5 Cost involved in both organic and inorganic farms

5.5.1 Cost involved in the cultivation of tomato on organic and inorganic farms

It is evident from the results presented in the Table 4.10 that, the cost of tomato cultivation on organic farms (Rs 17157.97 per acre) was less when compared to that on inorganic farms (Rs 17702.53 per acre). This marginal difference was due to the higher cost incurred on chemical fertilizers as well as on plant protection chemicals by inorganic farmers.

The per acre variable cost in cultivation of tomato on organic farms (Rs 13267.53) was lower as compared to that on inorganic farms (Rs 14182.01). The cost incurred on organic compounds was low in organic farms as compared to cost incurred on chemical fertilizers in inorganic farms because most of the organic compounds were available at village level and organic compounds were cheaper as compared to chemical fertilizers.

The cost on total human labour was lower on organic farms compared to inorganic farms this was mainly because of more number of times of spraying of plant protection chemicals in inorganic tomato cultivation and also inorganic cultivation of tomato involves more number of times of pickings than organic cultivation of tomato. The reverse trend was observed in the usage of bullock and machine labour due to practicing of more number of times of intercultivation and harrowing operations in organic farming.

There was more seed cost involved in inorganic farms than organic farms, this was mainly due to the reason that majority of the farmers use the local varieties in the cultivation of organic tomato where as in case of inorganic tomato cultivation the farmers use hybrids. The cost incurred on plant protection measures was low in organic farms compared to inorganic farms because the organic farmers used biopesticides, most of which were home preparations and some purchased microbial extracts.

The cost incurred on land revenue and land rent was similar in both organic and inorganic farms. The depreciation charge was relatively high on inorganic farms and low on organic farms because inorganic farmer's asset position was high. Similar results were observed by Jitendra Singh *et al.* (2006), Sujatha *et al.* (2006) and Waykar *et al.* (2006).

5.5.2 Cost involved in the cultivation of chilli on organic and inorganic farms

It is evident from the results presented in the Table 4.11 that, the cost of chilli cultivation on organic farms (Rs 18336.62 per acre) was less when compared to that on inorganic farms (Rs 19114.91 per acre). This marginal difference was due to the higher cost incurred on chemical fertilizers, cost incurred on plant protection chemicals and on human labour by inorganic farmers.

The per acre variable cost in cultivation of chilli on organic farms (Rs 14819.26) was lower as compared to that on inorganic farms (Rs 15574.27). The cost incurred on organic compounds was low in organic farms as compared to cost incurred on chemical fertilizers in inorganic farms because most of the organic compounds were available at village level and organic compounds were cheaper as compared to chemical fertilizers.

The cost on total human labour was lower on organic farms compared to inorganic farms this was mainly because of more number of times of spraying of plant protection chemicals in inorganic chilli cultivation and also inorganic cultivation of chilli involves more number of times of pickings than organic cultivation of chilli. The reverse trend was observed in the usage of bullock and machine labour due to practicing of more number of times of intercultivation and harrowing operations in organic farming.

There was more seed cost involved in inorganic farms than organic farms, this was mainly due to the reason that majority of the farmers use the local varieties in the cultivation of organic chilli where as in case of inorganic chilli cultivation the farmers use hybrids. The cost incurred on plant protection measures was low in organic farms compared to inorganic farms because the organic farmers used biopesticides, most of which were home preparations and some purchased microbial extracts.

The cost incurred on land revenue and land rent was similar in both organic and inorganic farms. The depreciation charge was slightly high on inorganic farms and low on organic farms because inorganic farmer's asset position was high. Similar results were observed by Jitendra Singh *et al.* (2006), Sujatha *et al.* (2006) and Waykar *et al.* (2006).

5.6 Yield, market price and returns in cultivation of tomato and chilli on both organic and inorganic farms

5.6.1 Yield, market price and return of tomato under organic and inorganic farming

It is evident from the results presented in the Table 4.12 that, the average yield of tomato was low on organic farms as compared to inorganic farms. This was mainly due to the fact that organic farmers practiced the organic farming from last three years only, since to build up soil fertility it needs more than five years and hence initial three to four years there is yield loss in the organic farms compared to inorganic farms.

The average per tonne market price of organic tomatoes (Rs 9550.00) was found to be higher than that of inorganic tomatoes (Rs 6850.00) since the organically produced tomatoes could fetch premium price in the market. The transportation cost and commission charges during the marketing of organic tomatoes are more than that of inorganic tomatoes since the organic farmers send their produce to the distant markets like Pune, Solhapur and Bangalore as they unable to get the premium price in the local market. Though yields were less but because of the premium price it fetched the net return on organic farms (Rs 32649.12) was more than inorganic farms (Rs 23074.52). The B:C ratio was also higher on organic farms (2.40) compared to inorganic farms (1.96). The findings are in conformity with the study conducted by Bharadwaj *et al.* (2000) and Jadhav *et al*. (2006).

5.6.2 Yield, market price and return of chilli under organic and inorganic farming

It is evident from the results presented in the Table 4.13 that, the average yield of chilli was low on organic farms as compared to inorganic farms. This was mainly due the fact that organic farmers practiced the organic farming from last three years only, since to build up soil fertility it needs more than five years and hence initial three to four years there is yield loss in the organic farms compared to inorganic farms.

The average per tonne market price of organic chilli (Rs 9830.00) was found to be higher than that of inorganic chilli (Rs 6300.00) since the organically produced chilli could fetch premium price in the market. The average transportation cost of organic chilli was found to be less than inorganic chilli but the organic farmers incurred more commission charges while marketing their produce than inorganic farmers because of more cost charged by the middlemen since there was high premium price for organic chilli since the organic farmers send their produce to the distant markets like Belgaum, Pune, Solhapur and Bangalore as they unable to get the premium price in the local market. Because of the premium price it fetched the net return on organic farms (Rs 18226.94) was more than inorganic farms (Rs 7983.77). The B:C ratio was also higher on organic farms (1.83) compared to inorganic farms (1.35). The findings are in conformity with the study conducted by Bharadwaj *et al.* (2000) and Jadhav *et al*. (2006).

5.7 Decomposition analysis

5.7.1 Structural break in the production relation of tomato organically and inorganically

The production function estimates for organic and inorganic farmers in tomato production presented in Table 4.14 revealed that the value of co-efficient of determination (R^2) was found to be 0.942 and 0.962 in case of organic and inorganic farmers respectively. This revealed that the independent variables included in the model have explained 94.2 and 96.2 per cent of variation in the dependent variable of organic and inorganic farmers, respectively. The elasticities of seed, organic manure and human labour were positive and significant suggesting that, an increase in the use of these factors over and above their present level resulted in substantial increase in gross returns of organic farmers where as in case of inorganic farmers, the elasticities of variables such as seed, chemical fertilizers and bullock and machine labour were found to be significant.

For identifying the structural break in production with the introduction of organic farming (new technology) in tomato production, the Cob-Douglas type of production function was used. Production function with technology dummy variable was fitted for identifying structural break in production relations between the organic and inorganic farmers. Production function with one for organic farmers and zero for inorganic farmers was estimated.

The regression co-efficient for dummy variable (0.226) was significant at one per cent level of significance. This implied that the parameter governing the input-output relations in case of organic farmers was different from those of inorganic farmers. Thus, the results provided the necessary proof for decomposing the total change in per acre income with the adoption of organic farming. This result is in conformity with those of Bisaliah (1977) for Punjab wheat economy, Kunnal (2004) for cotton economy in Karnataka.

5.7.2 Geometric mean levels of returns and cost involved in tomato production

The per acre geometric mean levels of gross returns and input costs in the tomato production presented in the Table 4.15 revealed that the gross returns in organic farms (Rs 55403.48) was more than inorganic farms (Rs 47744.33) this was mainly due to the fact that the organic tomatoes could fetch the high premium price in the market. With regard to input costs the organic farming practice involves less cost than inorganic farming this is because the chemical fertilizers and plant protection chemicals were costlier than that of organic manures and organic plant protection measures.

5.7.3 Estimated difference in income between organic and inorganic farms of tomato

With the identification of structural break, the growth in income was decomposed into constituent forces *i.e.,* efficiency of organic farming and change in level of input use. The total change in income due to adoption of organic farming was computed by using decomposition analysis. The results of output decomposition analysis are presented in Table 4.16.

A perusal of Table 4.16 revealed that the adopters of organic farming technology produced 14.88 per cent higher income from tomato production than inorganic farming adopters. The increase in the income was further decomposed into different sources of change such as adoption of organic farming technology and all other inputs. The organic farming technology alone could contribute 23.82 per cent increase in income, while the contribution of changed level of inputs was found to be negative (-8.94 per cent) to the income. Amongst the various inputs used their contribution were, seed (-4.08 per cent), plant protection measures (-2.07 per cent), human labour (-1.76 per cent), organic manures/chemical fertilizers (-0.94 per cent), FYM (-0.092 per cent) and bullock and machine labour (-0.01 per cent). This implied that the adoption of organic farming has to be encouraged by extension activities to harvest its full benefits. The result highlights the judicious utilization of resources to increase the income from tomato cultivation.

5.7.4 Structural break in the production relation of chilli organically and inorganically

The production function estimates for organic and inorganic farmers in chilli production presented in Table 4.17 revealed that the value of co-efficient of determination (R^2) was found to be 0.927 and 0.965 in case of organic and inorganic farmers respectively. This revealed that the independent variables included in the model have explained 92.7 and 96.5 per cent of variation in the dependent variable of organic and inorganic farmers, respectively. The elasticities of seed, organic manure and bullock and machine labour were positive and significant suggesting that, an increase in the use of these factors over and above their present level resulted in substantial increase in gross returns of organic farmers where as in case of inorganic farmers, the elasticities of variables such as seed, and human labour were found to be significant.

For identifying the structural break in production with the introduction of organic farming (new technology) in chilli production, the Cob-Douglas type of production function was used. Production function with technology dummy variable was fitted for identifying structural break in production relations between the organic and inorganic farmers. Production function with one for organic farmers and zero for inorganic farmers was estimated.

The regression co-efficient for dummy variable (0.341) was significant at one per cent level of significance. This implied that the parameter governing the input-output relations in case of organic farmers was different from those of inorganic farmers. Thus, the results provided the necessary proof for decomposing the total change in per acre income with the adoption of organic farming. This result is in conformity with those of Bisaliah (1977) for Punjab wheat economy, Kunnal (2004) for cotton economy in Karnataka.

5.7.5 Geometric mean levels of returns and cost involved in chilli production

The per acre geometric mean levels of gross returns and input costs in the chilli production presented in the Table 4.18 revealed that the gross returns in organic farms (Rs 38977.36) were more than inorganic farms (Rs 29733.26) this was mainly due to the fact that the organic chilli could fetch the high premium price in the market. With regard to input costs the organic farming practice involves less cost than inorganic farming this is because chemical fertilizers and plant protection chemicals were costlier than organic manures and plant protection measures.

5.7.6 Estimated difference in income between organic and inorganic farms of chilli

With the identification of structural break, the growth in income was decomposed into constituent forces *i.e.,* efficiency of organic farming and change in level of input use. The total change in income due to adoption of organic farming was computed by using decomposition analysis. The results of output decomposition analysis are presented in Table 4.16.

A perusal of Table 4.16 revealed that the adopters of organic farming technology produced 27.07 per cent higher income from chilli production than inorganic farming adopters. The increase in the income was further decomposed into different sources of change such as adoption of organic farming technology and all other inputs. The organic farming technology alone could contribute 33.91 per cent increase in income, while the contribution of changed level of inputs use was found to be negative (-6.84 per cent) to the income. Amongst the various inputs, organic manure/chemical fertilizers (0.83 per cent) and FYM (0.17 per cent) were found to contribute positively while rest of the inputs such as seed (-4.29 per cent), plant protection measures (-1.63 per cent), bullock and machine labour (-1.52 per cent) and human labour (-0.39 per cent) contributed negatively. This implied that the adoption of organic farming has to be encouraged by extension activities to harvest its full benefits. The result highlights the judicious utilization of resources to increase the income from chilli cultivation.

5.8 Problems of organic vegetable growers

An informal discussion with the organic farmers revealed that organic production of vegetables has a lot of problems. Opinion survey was conducted to know the problems faced by the farmers in organic farming of vegetable and marketing them and results of opinion survey are presented in the Table 4.19

5.8.1 Production related problems

Majority of the sample farmers expressed the problem of non-availability of labour, followed by problem of non-availability of information on organic farming, incidence of pest and diseases, limited and irregular power supply, non-availability of biopesticides, non-availability of seed material, non-availability of organic manures and non-availability of water for irrigation as the major problems in production of vegetables organically. This might be due to non-availability of recommended package of practice and laborious process involved in application of organic practices, coupled with big land holdings, and migration of agricultural labour force.

5.8.2 Marketing problems

Majority of the sample farmers expressed the problem of high commission charges followed by non-availability of market related information, non-availability of exclusive market for organic produce, absence of premium price in the local market, fluctuation in the prices of commodities, poor transport facilities and faulty weighment as the major problems in marketing of organically produced vegetables. The uncontrolled market and distress situation among the respondents while marketing, for compelling the farmers to sale the organic produce in local market might have resulted for the incidence of these problems. Similar results were observed by Thimmareddy (2001) and Mallikarjun (2008).

6. SUMMARY AND POLICY IMPLICATIONS

India is a leading vegetable producing country in the world. The country is blessed with a unique gift of nature of diverse climate and distinct seasons to make it possible to grow good number of vegetables in an area of 7.05 m.ha with the annual production of 108.20 m.t (Agriculture Today, 2008). Karnataka state is one of the leading vegetable producing state in the country with a production of 45,78,600 t, vegetables grown over an area of 3,82,200 ha (APEDA, 2005-06) of which, tomato occupies a major area of 47.2 thousand hectares with a production of 1,285.1 tonnes (National Horticulture Board, 2007-08), contributing 8.5 per cent production share of major vegetables in India and chilli occupies about 69,880 ha.

The state stands at eighth position with respect to area and production of vegetables. The major districts growing horticultural crops in the state are Kolar, Hassan, Belgaum, Kodagu, Bangalore, Shimoga, Bijapur and Dharwad. Belgaum is the major vegetable producing district in the Northern Karnataka, with an area of 49,576 ha and production of 6,77,706.56 t respectively. The total area and production of tomato and chilli in Belgaum district is 4806.70 hectares and 1,61,170.00 tonnes and 7,237.40 hectares and 96,786.10 tonnes respectively (Source: DDH Office, Belgaum 2008-009).

According to the International Fund for Agriculture Development (IFAD), organic production in India has been growing steadily. About 2.5 million hectares of land is under organic farming in India. Further there has been a remarkable growth in organic farming and 332 new organic certifications were issued during 2004.The Research Institute of Organic Agriculture reports a total 15,000 organic farms were operating in the country in 2004.

In Karnataka the area under organic farming is 4,050 ha (National Horticulture Mission Report, 2006-07). According to Ministry of Agriculture, Govt of Karnataka there are certain policies and schemes to educate farmers about organic farming and various training programes in districts and taluks in Karnataka and is providing funds to the Non Government Organisations and each organisation has a target to cover 1500 farmers and for that they are paying Rs 200 per farmer per year to the NGO's to support the farmers. The Government of Karnataka has made separate cell called 'organic cell' especially for the farmers.The Government of Karnataka is giving together of 100 hectares of area in each district and taluk, to be converted to organic farming for which state government has selected 29 Non-Governmental Organizations and given them the responsibility to work with farmers to make their farms organic and 50 per cent of the funding for organic farming has been given by Government of Karnataka and rest will be incurred by farmer himself.

Both, consumers and farmers are now slowly and gradually shifting back to organic farming in India. It is believed by many that organic farming is healthier. Though the health benefits of organic food are yet to be proved, consumers are willing to pay higher premium for the same. Many farmers in India are shifting to organic farming due to the domestic and international demand for organic food. Further stringent standards for non-organic food in European and US markets have led to rejection of many Indian food consignments in the past. Organic farming therefore provides a better alternate to chemical farming.

Specific objectives of the study

1. To ascertain the reasons for shifting from inorganic to organic cultivation of vegetables.
2. To study the type, pattern and levels of use of manures, fertilizers and plant protection measures and the cost involved under both the types of farming.
3. To compare the yields, market prices and returns of organic vegetables with that of inorganic vegetables.
4. To decompose the causes of yield/income difference between vegetables grown under organic farming and inorganic farming.
5. To enumerate the problems of organic vegetable growers.

Selection of the sample respondents

The total area and production of tomato and chilli in Belgaum district is 4,806.70 hectares and 1,61,170.00 tonnes and 7,237.40 hectares and 96,786.10 tonnes respectively. And also large number of farmers practice the organic cultivation of tomato and chilli in the district.

Organic farming is emerging trend and practiced throughout the district in cultivation of vegetables. In order to study the causes for shifting to organic cultivation of vegetables and to compare the input use pattern, costs involved, yields, market prices and the returns in organic cultivation of vegetables and problems faced by the farmers of organic vegetables, 30 farmers each practicing organic cultivation of tomato and chilli and 30 farmers each practicing inorganic cultivation of tomato and chilli spread over the district of Belgaum were selected randomly for the study.

Analytical techniques

The tabular presentation method was followed to study the general characteristics of sample farmers, reasons for shifting over to organic farming, costs and returns and problems faced by the organic farmers. The averages and percentages were worked out.

To decompose the causes of yield/income difference between the two methods of cultivation decomposition model developed by Dr. S. Bisaliah was used.

Findings of the study

Reasons for shifting from inorganic to organic cultivation of vegetables

It was observed that high per cent (73.3 per cent) of the sample farmers expressed the reason of increasing return from organic vegetables, followed by reason of quality of organic vegetables (71.6 per cent), soil health oriented motives (63.3 per cent), increasing cost of inorganic chemicals (61.6 per cent), environmental concern (56.6 per cent), motivation by neighbouring organic farmers (46.6 per cent) and motivation by media (33.33 per cent) as the reasons for shifting from inorganic to organic cultivation of vegetables.

Type, level, pattern of input use and cost involved in both organic and inorganic farms

In case of organic tomato production the maximum per acre cost of input involved (Rs 1829.03) was in the use of FYM followed by vermicompost (Rs 898.61), seeds (Rs 541.95), green manuring (Rs 396.62), VAM (Rs 302.19), neem seed kernel extract (Rs 115.77), neem seed cake (Rs74.91), panchagavya (Rs 69.98) and trichoderma (Rs 33.00) where as in case of inorganic tomato production the maximum per acre cost of input involved (Rs 1928.47) was on FYM, followed by DAP (Rs 809.47), seeds (Rs 626.33), urea (Rs 471.73), mancozeb (Rs 350.49), dimethoate (Rs 259.55), single super phosphate (Rs212.33), monocrotophos (166.37), complex fertilizer (Rs113.79) and chloropyriphos (Rs 69.28).

In case of organic chilli production the maximum per acre cost of input involved (Rs 1821.95) was in the use of FYM followed by vermicompost (Rs 1436.85), neem seed cake (Rs 544.10), green manuring (Rs 444.10), seeds (Rs 372.34),VAM (Rs 162.32), neem seed kernel extract (Rs 90.06), panchagavya (Rs 73.50) and trichoderma (Rs 37.27) where as in case of inorganic chilli production the maximum per acre cost of input involved (Rs 2260.87) was on FYM, followed by DAP (Rs 787.25), urea (Rs 603.86), seeds (Rs 491.45), mancozeb (Rs 439.78), dimethoate (Rs 284.72), complex fertilizer (Rs 284.67), single super phosphate (Rs 211.23), monocrotophos (Rs 197.36), and carbandizam (Rs 188.41).

Labour use pattern in both organic and inorganic farms

In case of organic tomato production the maximum labour cost involved (Rs 1853.88) was in case of harvesting operation followed by intercultivation (Rs 1161.03), harrowing (Rs 1113.32), spraying of biopesticides (Rs 939.36), seed bed preparation (Rs 704.77), transportation of FYM (Rs 594.43), irrigation (Rs 381.71), ploughing (Rs 338.77), transplanting (Rs 283.30), spreading of FYM (Rs 253.48), and organic manures and biofertilizers application (Rs 211.73). Where as in case of inorganic tomato production the maximum labour cost involved (Rs 2394.11) was in harvesting operation, followed by spraying of plant protection chemicals (Rs 959.33), intercultivation (Rs 819.07), hand weeding (Rs 751.75), harrowing (Rs 718.09), seed bed preparation (Rs 632.82), transportation of FYM

(Rs 627.25), transplanting (Rs 314.17), irrigation (Rs 307.15), ploughing (Rs 304 .21), spreading of FYM (Rs 218.79) and fertilizer application (Rs 199.86).

In case of organic chilli production the maximum labour cost involved (Rs 1841.61) was in case of harvesting operation followed by harrowing (Rs 1275.36), intercultivation (Rs 1076.6), spraying of biopesticides (Rs 1034.16), seed bed preparation (Rs 777.43), hand weeding (Rs 776.4), transportation of FYM (Rs 592.13), irrigation (Rs 394.41), transplanting (Rs 320.91), ploughing (Rs 312.42), spreading of FYM (Rs 276.4) and organic manures and biofertilizers application (Rs 189.44). Where as in case of inorganic chilli production the maximum labour cost involved (Rs 2276.81) was in harvesting operation, followed by spraying of plant protection chemicals (Rs 1182.61), harrowing (Rs 939.13), hand weeding (Rs 802.17), intercultivation (Rs 742.03), transportation of FYM (Rs 734.78), seed bed preparation (Rs 695.65), transplanting (Rs 328.26), irrigation (Rs 308.70), ploughing (Rs 300.00), spreading of FYM (Rs 254.35) and fertilizer application (Rs 241.30).

Cost involved in both organic and inorganic farms

The average cost of cultivation per acre of tomato on organic farm was Rs 17157.97 as against Rs 17702.53 on inorganic farms. In the total cost, variable costs accounted for a major share. The proportion of variable cost was Rs 13267.53 and Rs 14182.01 accounting for 79.42 per cent and 80.11 per cent of the total cost of cultivation of tomatoes on organic and inorganic farms respectively. In the case of organic farms, the variable costs mainly comprised of cost of human labour, cost of organic manure (FYM, green manuring, vermicompost, biofertlizers and biopesticides) and cost of bullock labour which were Rs 4789.26, Rs 3720.11 and Rs 2751.49 accounting for 27.91 per cent, 21.68 per cent and 16.04 per cent of the total cost of cultivation respectively. In the cost of cultivation of tomato on inorganic farms, the variable cost mainly comprised of cost on human labour, cost on bullock labour, cost on FYM, cost on chemical fertilizers and cost on plant protection chemicals which were Rs 5377.98, Rs 1937.17, Rs 1928.47, Rs 1607.12 and Rs 845.69 accounting for 30.38 per cent, 10.94 per cent, 10.89 per cent, 9.08 per cent and 4.78 of the total cost of cultivation respectively.

The average cost of cultivation per acre of chilli on organic farm was Rs. 18336.62 as against Rs 19114.91 on inorganic farms. In the total cost, variable costs accounted for a major share. The proportion of variable cost was Rs 14819.26 and Rs. 15574.27 accounting for 80.82 per cent and 81.48 per cent of the total cost of cultivation of chilli on organic and inorganic farms respectively. In the case of organic farms, the variable costs mainly comprised of cost of human labour, cost of organic manure (FYM, green manuring, vermicompost, biofertlizers and biopesticides) and cost of bullock labour which were Rs 5113.87, Rs 4610.15 and Rs 2848.86 accounting for 27.89 per cent, 25.15 per cent and 15.54 per cent of the total cost of cultivation respectively. In the cost of cultivation of chilli on inorganic farms, the variable cost mainly comprised of cost on human labour, cost on FYM, cost on bullock labour, cost on chemical fertilizers and cost on plant protection chemicals which were Rs 5689.86, Rs 2260.87, Rs 2081.16, Rs 1887.00 and Rs 1110.27 accounting for 29.77 per cent, 11.83 per cent, 10.89 per cent, 9.87 per cent and 5.81 per cent of the total cost of cultivation respectively.

Yield, market price and returns in both organic and inorganic farms

The per acre average yield of tomatoes on organic farm (5.81 tonnes) was comparatively lower than that of inorganic farm (6.95 tonnes).The average per tonne market price of organic tomatoes (Rs 9550.00) was found to be higher than that of inorganic tomatoes (Rs 6850.00). The total marketing cost was Rs 6182.64 and Rs. 6235.57 for organic and inorganic tomatoes respectively. The gross return in tomato per acre was higher (Rs 55989.07) on organic farms compared to that of inorganic farms (Rs 47012.62) with a positive net return on both the categories of the farms. The net return on organic farm was Rs 32649.12 and was Rs 23074.52 on inorganic farms. The B:C ratio was also higher on organic farms (2.40) compared to inorganic farms (1.96).

The per acre average yield of chilli on organic farm (4.10 tonnes) was comparatively lower than that of inorganic farm (4.86 tonnes).The average per tonne market price of organic chilli (Rs 9830.00) was found to be higher than that of inorganic chilli (Rs 6300.00). The total marketing cost was Rs 3726.30 for organic chilli and Rs 3484.66 for inorganic chilli. The gross return in chilli per acre was higher (Rs 40289.86) on organic farms compared to that of inorganic farms (Rs 30583.33) with a positive net return on both the categories of the farms. The net return on organic farm was Rs 18226.94 and was Rs 7983.77 on inorganic farms. The B:C ratio was also higher on organic farms (1.83) compared to inorganic farms (1.35).

Decomposition analysis

The results of decomposition analysis showed that the adopters of organic farming technology produced 14.88 per cent higher income from tomato production than inorganic farming adopters. The organic farming technology alone could contribute 23.82 per cent increase in income, However, contribution of inputs is negatively accounted for (-8.94 per cent).

Similarly in chilli production the adopters of organic farming technology produced 27.07 per cent higher income from chilli production than inorganic farming adopters. The organic farming technology alone could contribute 33.91 per cent increase in income, while the contribution of all other inputs was found to be negative (-6.84 per cent).

Problems of organic vegetable growers

The major problems faced by the sample farmers were categorized under two, heads viz., production and marketing problems. Among the production problems non-availability of labour, non-availability of information on organic farming, incidence of pest and diseases, limited and irregular power supply and-non availability of biopesticides were the major problems in the study area. Non-availability of seed material, non-availability of organic manures and non-availability of water for irrigation were the other problems. Among the marketing problems high commission charges non-availability of market related information, non-availability of exclusive market for organic produce and absence of premium price were the major problems. Fluctuation in the prices of commodities, poor transport facilities and faulty weighment were the other crucial problems in the study area.

Policy implications

Based on the findings of the study following policy implications are drawn,

1. The results of the study revealed that the yields on organic farms were found to be lower than inorganic farms. Though organic farming gives relatively lower yields in the initial years, its continuous practice will help to build up the soil fertility, there by to get increased yield in the later years. Hence it is advisible for the farmers to switch over to organic farming which minimizes the environmental degradation.
2. The difference in cost of cultivation between organic farming and inorganic farming is marginal as per the study. The organic inputs are mostly produced on the farms by the farmers themselves. Proper practicing of it will lead to higher net returns to the farmers because of the premium price the organic produce fetch. Hence farmers should be convinced by the extension workers about its economics to achieve its larger scale adoption.
3. Farmers are facing the problem of non-availability of organic inputs hence large scale multiplication of biofertilizers, vermicompost, biocontrol agents should be undertaken for distribution to the farmers at reasonable rates by the NGO's, Department of Agriculture, Agricultural Universities and private companies.
4. Producers of organic vegetables are not finding market for their produce locally so consumer awareness about the quality of products produced from organic farming should be increased so that producer will get good market.

REFERENCES

Anand Kumar, S., 1998, Motivating farmers to convert to organic farming and strategies for organic extension, IFOAM-Ecology and farming. May-Aug, pp. 18-21.

*Anjugam, M., Jaganmohan, K. R., Padmarani, S. and Sundaresan, R., 2006, A study on organic farming of sugarcane in Western Zone of Tamil Nadu. *Agric. Econ. Res. Rev.,* **19**(2) : 233.

*Anita Arya., 2006, Organic farming in cotton-A case study of Agrocel industries,. *Agric. Econ. Res. Rev.,* **19**(2) : 235.

Bennett,R.M, 1999, The financial performance of organic vegetables growing : case studies from Southern England. *Farm Mngt.,* **10**(6) : 306-317.

Benvenuti, G. and Nasolini, T., 1996, Organic farming of fruit and citrus fruit in Italy : an ongoing success. *Rivista-di-frutticoltura-e-di-ortofloricoltura,* **58**(10) : 33-40.

Bhardwaj,M.L, Harender Raj and Koul.B.L,2000,Yield response and economics of organic sources of nutrients as substitute to inorganic sources in tomato, okra, cabbage and cauliflower. *J. Agric. Sci.,* **70**(10) : 653-656.

Bisaliah, S., 1977, Decomposition analysis of output change under new production technology in wheat farming – some implications to returns on investment. *Indian J. Agril. Econ.,***32**(3) : 193-201.

Bruggen, A. H.C.van. and Termorshuizen, A. J.,2003, Integrated approaches to root disease management in organic farming systems. *Australasian Pl. Pathol.,* **32**(2) : 141-156.

Chothe, G.D.and Borkar, M.M., 2000, Constraints faced by farmers in adoption of biofertilizers. *Maharashtra J. Extn. Edu.,* **19** : 298-299.

Dixit, G. D. and Gupta, B. R., 2000, Effect of farm yard manure, chemical and biofertilizers on yield and quality of rice and soil properties. *Journal of the Indian Society of Soil Science.* **48**(4) : 773-780.

Engyndenyz, S., 2000, Economic feasibility of organic greenhouse cucumber production : the case of Menderes. *J. App. Hort.*, **2**(2) : 113-116.

Franco,S., Pancino, B. and Ferrucci, D., 2005, Production and marketing of organic hazelnuts : the case of 'Tonda Gentile Romana'. *Acta Horticulturae,* **686**(6) : 565-572.

Gaddi, G. M., Mundinamani, S. M. and Patil, S. A., 2002, Yield Gaps, Constraints and potential in cotton Production in North Karnataka - An Econometric Analysis. *Indian J. Agril. Econ.,* **57**(4) : 722-734.

Hile, R.B., Chauhan, M. R., Pardeshi, H. P., and Bagul, R. S.,2008. Economics of organic banana production in Sangali, *India Agric. Update*. **3**(1/2) : 20-22.

Indushekaran, B. S., 1982, An economic analysis of ICDP in Dharwad district : A Study on development programme impact. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Bangalore, Karnataka (India).

*Jadhav, M.S., Kamble, B.H. and Yadav, D.B., 2006, Profitability of organic and inorganic farming of suru sugarcane in Maharastra. *Agric. Econ. Res. Rev.,* **19**(2) : 234.

Jain, R. K. and Bhatacharyya, 2000, Farmers involvement in biofertilizer demonstration and promotion campaign. *Maharatra J. Extn. Edu.,* **19** : 264-268.

Jaswinder Kaur. and Kalra, R. K., 2006, Organic farming in Punjab-A case study. *J. Interacademicia.* **10**(3) : 411-419.

Jitendra Singh., Singh, G. P. and Rajkishor., 2006, Present status and economics of organic farming in the district of Udham Singh Nagar in Uttaranchal. *Agric. Econ. Res. Rev.,* **19**(2) : 135-144.

*Kalamkar, S.S., 2006, Organic farming in India : progress, possibilities and constraints. *Agric. Econ. Res. Rev.,* **19**(2) : 230.

Kunnal, L. B., Gaddi, M., Olekar, J. N. and Dabali, S. D., 2004, New cotton production technology in Karnataka- An econometric analysis. Paper presented in the symposium *Strategies for Sustainable Cotton Production- A Global Vision*; Univ. Agric. Sci., Dharwad.

Lalwani, N. R., and Koshta, A. K., 2000, Decomposition analysis of milk yield in members and non-members of Milk Producers Cooperative Societies. *Indian Cooperative Rev.,* **38**(2) : 104-114.

Loganandan. N. and Premalata Singh., 2003, Adoption of organic farming : Profile and motives of farmer. *Indian J. Ext. Edu.*, **39**(1) : 35-40

Mallikarjun Patil., 2008, A study on production and marketing management behavior of organic vegetable growers in Belgaum district, *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad.

Mohan, H. P., 2009. Impact of IPM technology on cotton and paddy production in Haveri district- an economic analysis. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad.

Murthy, M. K. K., Dhananjaya, B. and Naik,C. M., 2008, Organic farming practitioners and their perception *Environment and Ecology*. **26**(1) : 136-141.

Nagarajan , S. S. 2000, Chennai doctor's maiden venture with organic farming. *Kissan World*, **27**(3) : 19-20.

Olgun, A., Adanacoglu, H. and Saner, G., 2006, An economic evaluation on organic cherry production : a case of Turkey. *J. Sust. Agric.,* **28**(2) : 117-130.

Pandey, A. K., Gopinath, K.A., Chattacharya, P., Hooda, K.S., Sushil, S. N., Kundu, S., Selvakumar, G. and Gupta, H. S., 2006, Effect of source and rate of organic manures on yield attributes, pod yield and economics of organic garden pea (Pisum sativum subsp. hortense) in north west Himalaya. *Ind. J. Agric.Sci.,* **76**(4) : 230-234.

Radha, Y. and Chowdry, K. R., 2005, Comparative economics of seed production vis-a-vis commercial production of cotton in Andhra Pradesh. *Indian J. Agric. Econ.,* **60**(1) : 94-102.

*Ravichandran, S., Sundaravaradarajan, K. R. and Venkatraman, R., 2006, Bio-input usage in rice cultivation in Tamil Nadu : Decmposition analysis. *Agric. Econ. Res. Rev.,* **19**(2) : 231.

Restrepo. and Rivera. J., 1997, Can the university contribute to the development of organic farming in Latin America?. *Hoja. a. Hoja. del. Maela.*, **7**(11) : 32-36

Rios, A., Sanchez Perez, H. J. and Hellin, J., 2007,Child nutrition in Mexico under conventional and organic agriculture. *LEISA Magazine,* **23**(3) : 16-17.

Sale,Y.C., and Yadav, D. B., 2008, Sugarcane cultivation with an integrated approach in Kolhapur District of Maharashtra. *Cooperative Sugar,* **39** (8) : 29-32.

Saxena, K.K. and Singh, R.L., 2000, Adoption of organic farming practices by farmers of Malwa region. *Maharashtra J. Extn. Educ.,* **19** : 53-58.

Singh, G. P. and Jitendra Singh., 2007, Organic farming in India : An overview. *Indian Farmer's Digest,* April 2007 : 9-15.

Sisodiya. A. S., Singh. T.B.,and Nahatkar. S. B., 1999, Temporal analysis of decomposition of pigeonpea production in different agroclimatic regions of Madhya Pradesh. *Bhartiya Krishi Anusandhan Patrika.* **14**(1/2) : 15-22.

Solanki,R. M., Bhalu, V.B., and Jadav, K. V.,2006, Organic farming approach for sustaining productivity of rainfed groundnut. *Annals of Agricultural Research.* **27**(3) : 236-239.

*Sujatha, R. V., Eswara Prasad, Y. and Suhasini, K., 2006, Comparative analysis of efficiency of organic farming Vs inorganic farming- A case study in Karimnagar district of Andhra Pradesh. *Agric. Econ. Res. Rev.,* **19**(2) : 232.

Suresh, H., 2001, Performance of organic farming in Shimoga district of Karnataka – An economic analysis, *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

*Sushil Kumar., Thakur, D.S., Chauhan, S. K. and Sharma, K.D., 2006, Impact of drought on cost and returns from cereal crops under different organic and inorganic farming systems in Himachal Pradesh. *Agric. Econ. Res. Rev.,* **19**(2) : 227.

Timmareddy, K.S., 2001, Case studies on organic farming. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).

*Venkatram, R. and Mani, K., 2006, Prospects and constraints in adoption of organic farming- A micro-level study in Tamil Nadu. *Agric. Econ. Res. Rev.,* **19**(2) : 228.

Vinod Kumar., 2001, Decomposition analysis of output change under new production technology in dairy farming. *Indian J. of Animal Sci.,* **71**(10) : 966-969.

*Waykar, K. R., Yadav, D. B., Shendage, P. N. and Sale, Y. C., 2006, Economics of grape production under organic and inorganic farming in the Nasik district of Maharastra state. *Agric. Econ. Res. Rev.,* **19**(2) : 240.

Yadav, B. D., Balraj Singh. and Sharma, Y. K., 2004, Production of tomato under organic conditions. *Haryana J. Hort. Sci.*, **33**(3/4) : 306-307.

** Originals not seen*

APPENDIX I : INTERVIEW SCHEDULE

"COMPARATIVE ECONOMICS OF VEGETABLE PRODUCTION UNDER ORGANIC AND INORGANIC FARMING IN BELGAUM DISTRICT"

Department of Agricultural Economics
University of Agricultural Sciences – Dharwad

Schedule No. :

I. GENERAL INFORMATION

1. **Name of the respondent**

   Village:

   Taluk :

   District:

   b. Occupation: Primary:

   Secondary: 1.

   2.

2 .Family Particulars

Sl. No	Name	Sex	Age	Education	Whether engaged in farming
1.					
2.					
3.					
4.					
5.					
6.					

3. Land Holding (Acre)

(a)

Sl. No	Types of land	Owned	Leased in	Leased out	Total
1.	Dry				
2.	Irrigated				

(b) Source of Irrigation

Sl. No.	Source	Area irrigated(acre)
1.	Open well	
2.	Bore well	
3.	Canal	
4.	Tank	
5.	Others if any	

4. Cropping Pattern

Season	Crop	Area	Dry / Irrigation
Kharif	1.		
	2.		
	3.		
	4.		
	5.		
	6.		
Rabi	1.		
	2.		
	3.		
	4.		
	5.		
Summer	1.		
	2.		
	3.		
	4.		
	5.		

5 Asset Position

Types of assets	Nos.	Year of purchase/ Construction	Purchase/ construction Value(Rs)	Junk value	Expected life span
Building					
Bullock cart					
Livestock					
Tractor					
Implements					
1. Pumpset					
2. Irrigation equipmets					
3. Others					
(i)					
(ii)					
(iii)					

II: REASONS FOR SHIFTING TO ORGANIC CULTIVATION

Reasons	Remarks
1: Increasing cost of inorganic chemicals	Yes/No
2. Increasing return from organic vegetables	Yes/No
3. Quality of organic vegetables	Yes/No
4. Soil health oriented motives	Yes/No
5. Environmental concern	Yes/No
6. Motivation by neighboring organic farmers	Yes/No
7. Motivation by media	Yes/No

III. TYPE OF ORGANIC FARMING PRACTICED

Organic					Inorganic				
Type	**Time of appli-cation**	**Method of appli-cation**	**Qty/ acre**	**Price/unit**	**Type**	**Time of application**	**Method of application**	**Qty/ acre**	**Price/ unit**
FYM					Fertilizer				
					1.N				
					2.P				
Green manuring					3.K				
Vermicompost					Complex				
Biofertilizers					Pesticides				
					1.				
Biopesticides					2.				
					3				

IV. COST OF CULTIVATION

Crop: Area (acres):

Variety: HYV/Local Season: *Kharif /Rabi/Summer*

a) Labour charges:

Cost of hiring labour

1. Men (Rs. /day) :
2. Women (Rs. /day) :
3. Bullock pair (B pair /day):

4. Machine labour (Rs/hr)

Particulars	No of times	Family labour				Hired labour			
		M	W	BP	ML	M	W	BP	ML
Ploughing									
Transportation of FYM									
Harrowing									
spreading of FYM									
Seed bed preparation									
Sowing									
Fertilizer /organic manure application									
Hand weeding									
Inter cultivation									
Spraying PPC/Biopesticides									
Irrigation									
Harvesting									
Transportation									
Others									
1)									
2)									

Note: M=Men, W=Women, BP= Bullock pairs, ML=Machine labour

b) Input cost

Particulars	Quantity (kgs)	Price /unit	Total cost (Rs)
Seeds			
Seed treatment chemicals			
Fertilizers/Biofertilizers			
Pesticides /Biopestcides			
Irrigation charges			
Land revenue			
Rental value of land			
Others (specify)			

c) Marketing cost

1. Transportation cost :
2. Commission paid :
3. Any other charges (specify) :

Total:

V. DETAILS ON RETURNS

1. Crop Type : Organic/Inorganic
2. Area sown :
3. Yield/acre :
4. Price (Rs/t) :

Gross returns:

VI. PROBLEMS FACED BY ORGANIC VEGETABLE GROWERS

Sl no	Problems	Yes	No	Remarks
A	**Production related problems**			
1	Non-availability of seed materials			
2	Non-availability of organic manures			
3	Non-availability of biopesticide			
4	Incidence of pest and diseases			
5	Non-availability of water for irrigation			
6	Limited and irregular power supply			
7	Non-availability of labour			
8	Non-availability of information on organic farming			
B	**Marketing problems**			
1	Poor transport facilities			
2	Non-availability of market related information			
3	Fluctuation in the prices of commodities			
4	High commission charges			
5	Faulty weighment			
6	In accurate weighing instruments			
7	Non-availability of exclusive market placer exclusively for organic produce			
8	Absence of premium price in the local market			
9	Others (If any)			

COMPARATIVE ECONOMICS OF VEGETABLE PRODUCTION UNDER ORGANIC AND INORGANIC FARMING IN BELGAUM DISTRICT

VINOD R. NAIK **2010** **Dr. L. B. KUNNAL**
MAJOR ADVISOR

ABSTRACT

The present study was conducted in Belgaum District of Karnataka. A sample of 30 farmers each practicing organic and inorganic cultivation of tomato and chilli were selected randomly for the study. Data were elicited for the year 2009-10 through survey method. The data collected was analysed using tabular presentation and output decomposition model.

The estimated per acre cost of cultivation of tomato and chilli on organic farms was Rs. 17157.97 and Rs. 18336.62 respectively. On inorganic farms per acre cost of cultivation of these crops was Rs 17702.53 and Rs 19114.91. The per acre average yield of tomatoes and chilli on organic farms was 5.81 and 4.10 tonnes compared to 6.95 and 4.86 tonnes on inorganic farms. The average per tonne market price of organic tomatoes was Rs 9550.00 whereas it was Rs 6850.00 for inorganic tomatoes similarly for organic chilli it was Rs 9830.00 whereas for inorganic chilli it was Rs 6300.00. The net return of tomato on organic farms was Rs 32649.12 and was Rs 23074.52 on inorganic farms, the B:C ratio was also higher on organic farms (2.40) compared to inorganic farms (1.96). The net return of chilli on organic farms was Rs. 18226.94 and Rs. 7983.77 on inorganic farms, B:C ratio was also higher on organic farms (1.83) compared to inorganic farms (1.35).

The results of decomposition analysis showed that the adopters of organic farming technology produced 14.88 per cent higher income from tomato production than inorganic farming adopters. Similarly 27.07 per cent higher income was realised from chilli production by organic farming adopters than inorganic farming adopters. As expressed by sample farmers the major reasons for shifting to organic cultivation were higher returns and good quality of the vegetables. The major problems faced by the sample farmers were non-availability of labour and high commission charges.