

कर्नाटक में जैविक कृषि का संसाधन उपयोग क्षमता एवं
स्थिरता

**Resource Utilization Efficiency and
Sustainability of Organic Farming in Karnataka**

MAHESH MALGATTI



**DIVISION OF AGRICULTURAL EXTENSION
INDIAN AGRICULTURAL RESEARCH INSTITUTE**

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**Resource Utilization Efficiency and Sustainability of
Organic Farming in Karnataka**

by

MAHESH MALGATTI

A Thesis Submitted to the Faculty of Post-Graduate School,
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This is to certify that the thesis entitled “*Resource Utilization Efficiency and Sustainability in Organic Farming in Karnataka*” submitted to the Faculty of the Post-Graduate School, Indian Agricultural Research Institute, New Delhi, in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Agricultural Extension**, embodies the results of bona fide research work carried out by **Mr. Mahesh Malgatti** under my guidance and supervision, and that no part of this thesis has been submitted for any other degree or diploma.

It is further certified that any assistance and help availed during the course of investigation as well as source of information have been duly acknowledged by him.

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Place: New Delhi

Date: October, 2011

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*Dedicated
To
Indian farmers*

CHAPTER - I

INTRODUCTION

*If villages survive nobody can perish India and
If villages perish nobody can save India.*

- *Mahatma Gandhi*

Indeed the survival of the villages and farmers' livelihoods has been an issue for debates in the last decade. As the new millennium was ushered in, the agrarian crisis loomed large with farmer suicides all over the country. To ameliorate this pathetic condition, steps were taken by all state governments across the country to diagnose the problem, suggest remedies and bring out a policy document of strategies and action plans. Everyone agreed unanimously on one issue "if villages perish, India too would perish" and agriculture was the main focus of action for all governments to revive villages and to resurrect agrarian economy.

Experiences of Green Revolution and Consequences

Responding to the food scarcity and starvation in the mid 1960's, the then government ushered in green revolution with intensive cultivation of high yielding varieties with all assured inputs of irrigation, chemical fertilizers and pesticides, which resulted in unparalleled increase in land productivity and in a matter of a decade the country was made not only self-sufficient but also with a respectable reserve of foodgrains. But over the years, the negative impacts of green revolution were witnessed everywhere and the issue of sustainability has become increasingly prominent (Dhir, 2008).

The chemical approach to productivity augmentation followed since mid sixties has depleted the natural resource base for sustainable agricultural growth. The

earlier technology has disturbed the biological composition, which might have lasting adverse impact on equilibrium. Unless the disturbed natural base equilibrium is restored, sustainable agriculture growth with competitive edge will not be possible. This would call a search for new technologies, policies, and institutional approaches for rebuilding natural resource base.

Alternatives for Sustainable Agriculture

While searching for alternative technologies, the following key issues were debated and considered. Any new alternative agricultural technology need to be oriented towards holistic and sustainable development leading to;

- Restoration of soil health and fertility
- Enhancement of resource use efficiency
- Rebuilding natural resource base at farm level
- Internalizing the inputs and reduction or elimination of dependency on external inputs
- Reduction in the cost of cultivation
- Restoration of natural ecological equilibrium
- Integrated pest management and plant protection at minimum cost with due concern to environmental factors
- Protection and provision of sound environment support to agriculture
- Diversification in agriculture, including animal husbandry
- Food and income security at household level, and
- Sustainable rural livelihood security.

“Do we really need to embark upon another risky technological fix to solve the mistakes of a previous one? Instead, we should be looking for solutions that are based on ecological and biological principles and have significantly fewer environmental costs.” (Vasilikiotis, 2000). There is such an alternative that has been pioneered by organic farmers. In contrast to the industrial/monoculture approach advocated by the biotech industry, organic agriculture is described by the United Nations Food & Agriculture Organization (FAO) as "a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity." (Vasilikiotis, 2000).

Organic Farming

So, organic farming is a kind of farming, which suffices resource utilisation efficiency and sustainable agriculture. *Organic agriculture is a production system that sustains the health of soil, ecosystem and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.* (IFOAM, 2008). Owing small units of dairy and poultry, engage the farmers throughout the year in addition to strengthening the interrelations with agriculture and animal husbandry. Considering its pivotal role in sustainable agriculture, organic farming is experiencing rapid worldwide growth through the creative energy of thousands of grassroots organizations, farmers, activists, and traders. In some countries there is good support from the public and private sectors too. The converts to organic farming strategy are now fully convinced that organic farming stimulates plant growth without exhausting the natural resources or adversely affecting the soil health.

Karnataka's Agriculture Policy on Organic Farming

In the very right spirit, to address the emerging issues in agriculture, the Government of Karnataka has come out with a state policy on organic farming in 2004, the first to do so among all states in India, and articulated the advantage of organic farming technology vis-à-vis green revolution technology. The policy document also recognized the principal requirement for organic farming; provide policy objectives, future strategies for promotion and revival of this traditional system of farming.

The objectives of Karnataka state policy on organic farming were : to reduce debt burden, to enhance soil productivity, to reduce cost of cultivation through less dependence on external inputs and use of local natural resources, to use water judiciously, to improve farm income through quality produce and to increase food security by encouraging traditional crops and food habits. Protection, restoration and improvement of soil health and fertility is one of the five panchasutras of Agricultural policy, 2006.

In 2005, the Karnataka state agriculture department has taken up a pilot project to convert 3,000 hectares spread over 30 districts to organic farming. About 100 hectares in each district has been identified with 21 NGOs in a three year project (2004-07). The results were encouraging to move forward. According to a top official of the Karnataka agricultural department, *"If we have to meet the emerging food related challenges in the globalized era, we need to start preparing the ground to popularize organic farming"*.

KVK and agriculture department had taken steps to promote pulse production through promotion, demonstration and adoption of Integrated Pest Management (IPM) in pigeonpea among the farmers in the "Pulse Bowl of the state", comprising Bidar, Gulbarga and Yadgir districts. Encouraged by the results, the agriculture department proposed and implemented special schemes on the promotion of organic farming schemes of the state government across the state. Pigeonpea farmers have also taken advantage of the financial subsidies under these schemes (subsidies for bio-digester tanks, subsidies for setting up of vermi-compost units, subsidies on purchase of farm equipment like rotavators, inter-cultivators, chaff-cutters, etc., financial aid for rejuvenation of *Krishi* ponds, and for farmer-to-farmer seed exchange, etc.), accepted and adopted organic farming techniques.

Statement of problem

The planners, researchers, and development professionals, everywhere, have raised more concerns about the sustainability of modern production technologies in agriculture, as mounting evidences are found on declining factor productivity, stagnation of crop yields, and deteriorating natural resource base. Humankind instead of living in tune with nature, by protecting themselves and their environment through its judicious use and monitoring it, is out to destroy the very sustenance of diversified ecosystems including land, water, flora, and fauna. So, the pursuit of more sustainable forms of agriculture is of central importance in meeting the current challenges of food security and environmental protection.

Proven alternatives to conventional agriculture exist in many parts of the world. Yet many skeptics raised objections to up-scale these organic farming practices especially in cereal and pulse crops, citing apprehensions of losing food security for

the masses. Organic farming proponents argue that it is high time to revert from unsustainable chemical farming to more sustainable organic farming due to the latter's capability in mitigating climate change, enhancing resource use efficiency, and restoring agro-ecology of the cropping systems. But modern agriculture proponents are quite apprehensive about such claims.

There are enormous problems due to conventional farming system; for example, excessive use of resources, environmental degradation, global warming, stagnant food production, decreasing soil fertility, etc. it is therefore necessary to look for suitable and sustainable alternatives for conventional farming.

Although organic farming has been promoted through several government schemes, and even though farmers are ardently following organic farming practices and reaping their benefits (both ecologically and economically), many skeptics have raised concerns about the viability and sustainability of organic farming. There are adequate number of evidences and arguments for and against organic farming and it becomes really difficult to take a stand and promote one or the other way of farming. While conventional farming proponents may argue against organic farming for its lack of capability for feeding the burgeoning population due to its uncertain low yields, and warn against jeopardizing our national food security, organic farming advocates cite issues of environmental degradation and pesticide poisoning of our foods and restoration of our agro-ecosystems for preserving the Nature's ecological equilibrium.

Hence, it has been envisaged in this research study to assess and compare the economic viability of organic farming and conventional farming practices, assess and compare the elasticities of production of these two systems of farming, and evaluate whether these organic and conventional farming practices are sustainable or not. In addition, another crucial issue that demands a thorough understanding is the kind of motivating factors that persuade farmers to opt for organic farming techniques, in spite of the risks of lower yields and pest problems. Hence, the key research problem of this study is to analyse organic *vis-à-vis* conventional farming systems and practices. While assessing the quantitative data on organic and conventional farming, it was also thought imperative to analyse the process of transformation (through qualitative descriptive data) that a successful organic farmer passes through while

converting his farm to organic farming. In the context of above discussion, the present study makes an attempt to study the following research issues.

Research Questions

1. What are the factors motivating farmers to practice organic farming?
2. What is the contextual background of conversion to organic farming and the interventions and accomplishments of successful cases of '*model organic farmers*'?
3. What is the economic viability of organic *vis-à-vis* conventional farming systems?
4. How farmers perceive resource utilization efficiency in organic *vis-à-vis* conventional farming systems?
5. What is the sustainability of organic *vis-à-vis* conventional farming practices?

Keeping the above research issues in mind, the study entitled "***Resource Utilization Efficiency and Sustainability of Organic Farming in Karnataka***" has been planned with the main objective of analyzing organic farming *vis-à-vis* conventional farming especially on such key issues as resource use efficiency, economic viability and sustainability. However, the specific objectives are given below;

Specific Objectives

1. To study the factors motivating farmers to practice organic farming.
2. To document the successful cases of '*model organic farmers*'.
3. To analyse the economic viability of organic *vis-à-vis* conventional farming practices.
4. To study the resource utilization efficiency in organic *vis-à-vis* conventional farming practices.

5. To assess the sustainability of organic *vis-à-vis* conventional farming practices.

Importance and scope of the study

The study has relevance and importance to the current agrarian situation in the state as well as the country. The study aimed at finding the factors that motivate farmers to practice organic farming. This information would be quite useful for planners and promoters of organic farming in devising new schemes for motivating farmers for conversion to organic farming. The comparative assessment of economic viability of organic farming and conventional farming would help provide justification for organic farming, in terms of better net returns and better cost-benefit ratios, even when the crop yields may be initially lower. The comparative assessment of resource use efficiency of both organic and conventional farming practices would help identify the contributing factors of production and help in their optimal allocation in crop production for better net returns.

The attempt made in the study to assess whether the pigeonpea cultivation practices are sustainable or not, as perceived by the farmers for both conventional and organic farming practices would help us in promoting environment friendly, economically profitable and socio-culturally acceptable and compatible package of practices for sustainable agriculture in the country.

As the study has adopted a case study approach in documenting the success stories of '*model organic farmers*' the case stories would bring home the qualitative data, especially on the interventions, activities and achievements of the organic farmers for providing adequate proof of evidence for others who may emulate. Hence this study had taken a comprehensive outlook on organic farming and attempted to gather adequate evidence for or against organic farming alternatives.

Limitations of the study

As the study area is limited to one district of Karnataka state, generalization of the findings to the whole state and country will be a difficult task. However, the findings may be relevant to similar dryland farming areas growing pulse crops in restricted irrigation or rainfed conditions. This study is based on primary data

collected from a small sample of farmers practicing organic farming in north eastern dry zone of Karnataka state. As most of the information they have given is from their own experience, during the various stages of their farming life, there may be chances of human bias. However, the data were cross checked and vetted to minimize the error, even then, it is a fact that the results of the study may be apt only for the area where the study had been conducted and other similar areas. So, this point needs be considered while generalizing the results to a larger area.

Presentation of the thesis

The thesis is presented in six chapters as follows:

- Chapter I: Introduction:** It discusses the relevance and limitations of the study along with the specific objectives.
- Chapter II: Background:** It includes the discussion on different concepts used in the study and the review of the relevant past research.
- Chapter III: Research Methodology:** It covers the research design, sampling procedure, method of data collection, measurement of variables and statistical tools used for carrying out the data collection and analysis.
- Chapter IV: Research Papers:** This chapter includes five research papers based on the five specific objectives of the study.
- Chapter V: Discussion:** A comprehensive discussion of all key aspects of findings, linking all objectives, is presented here.
- Chapter VI: Summary:** The summary of the results of study is presented to draw specific conclusion. The references are given at the end. A set of relevant appendices are also added.

BACKGROUND

Critical literature review within the specific field of research is one of the most essential steps of research. A comprehensive and critical review of the previous research studies provides a sound base for scientific investigation. An acquaintance with earlier pertinent studies is necessary to develop a good understanding of the research problem. It also lends support for the interpretation of the findings. Keeping the objectives of the study in mind, an attempt was made to review earlier studies and is presented under the following sections:

- 1. Concept and Relevance of Organic Farming**
- 2. Contextual Background behind Conversion to Organic Farming**
- 3. Factors Motivating Farmers to Practice Organic Farming**
- 4. Comparisons of Organic and Conventional Farming Systems**
- 5. Economic Viability of Organic *vis-à-vis* Conventional farming**
- 6. Resource Utilization Efficiency in Organic *vis-à-vis* Conventional Farming**
- 7. Sustainability of Organic Farming Practices**

2.1 Concept and Relevance of Organic Farming

Agriculture is the backbone of Indian economy. The practice of agriculture in India is centuries old, dating back to Vedic times. The records of history from times immemorial have clearly stated that ancient Indian agriculture was primarily organic in nature, relying heavily on resources locally available within the agro-ecosystem and not dependent on any chemicals from outside the system.

Gunjal (1991) reiterates: '*whoever tries to write history of organic farming will have to refer to India and China*'. The farmers of these two large countries are known as farmers of forty centuries and it is organic farming that sustained Indian agriculture. Organic farming is our own product and contribution to the world.

This fact has been proudly emphasized by Prince Charles in his inaugural speech delivered (televised directly from London) at the International Conference in Ontario, Canada in 1999.

Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment. Organic production systems are based on specific standards precisely formulated for food production and aim at achieving agro-ecosystems, which are socially and ecologically sustainable. It is based on minimizing the use of external inputs through use of on-farm resources efficiently compared to industrial agriculture. Thus the use of synthetic fertilizers and pesticides is avoided. (Ramesh, *et al.*, 2005).

Organic farming is known by several names: natural farming, bio-dynamic farming, ecological agriculture, biological agriculture, permaculture, etc. However LEISA (Low External Input Sustainable Agriculture) adopts some of the principles of organic farming.

Fukuoka (1978) developed four principles of natural farming: (1) no cultivation (2) no chemical fertilizer or, prepared compost (3) no weeding by tillage or, herbicides and (4) no dependence on chemicals.

The United States Department of Agriculture (1980) defined organic farming as a production system which avoids or, largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock additives. To the

maximum extent possible, organic farming system rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral bearing rocks to maintain soil productivity and tilth, to supply plant nutrients and aspects of biological pest control, weeds and other pests.

The term 'Organic farming' was first used by Lord Northbourne and the phrase 'Sustainable Agriculture' was coined by Lady Eve Balfour (Francis and Youngberg, 1990).

Venkataramani (1991) reported that sustainable agriculture is that form of farming which produces sufficient food to meet the needs of present generation without ending the ecological assets and the productivity of the life supporting system of the future generation.

To promote organic agriculture and to ensure fair practices in international trade of organic food, the Codex Alimentarius Commission, a joint body of FAO and WHO framed certain guidelines for the production, processing, labelling and marketing of organically produced foods, with a view to facilitate trade and prevent misleading claims. The Codex Alimentarius Commission defines organic agriculture as a holistic food production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system. (FAO, 2001).

Organic agriculture is defined as "a holistic production management whose primary goal is to optimize the health and productivity of interdependent communities of soil, life, plants, animals and people". (UNCTAD, 2006). Therefore, it aims to utilise and maintain ecosystem services by improving the natural environment, increased water retention, reduced soil erosion and increased agro-biodiversity. (UN, 2008).

The concept of organic farming as revealed by the studies reviewed here has been perceived differently by different people, to most of them it implies use of

organic manures and natural methods of plant protection instead of using synthetic fertilizers and pesticides.

Organic agriculture is capable of contributing significantly to global food supply. One recent study (Badgley *et al.*, 2006), examined 293 cases from all over the world and compared yields of organic and conventional systems. The study (Badgley *et al.*, 2006) indicated that organic agriculture has the potential to contribute significantly to the global food supply. Increasing concerns about food security in least developed and developing countries will require a wide range of sustainable agricultural practices (combining some organic and conventional practices) to fulfill the food demand of a growing population. (Ericksen *et al.*, 2009).

The common claim that large-scale conversion to organic agriculture would result in drastic reduction in world food supplies or large increases in conversion of undisturbed lands to agriculture (Avery, 1995; Trewavas, 2001), has not been borne out in modelling studies. Conversion studies showed that domestic food consumption would not suffer, exports would vary depending on crop, but the structure of farming would definitely change with more diversification of agriculture. (Woodward, 1998). Widespread conversion to organic agriculture would result in crop yield increase over the current averages as a result of increased investment in research and extension. (Lampkin, 1994).

2.2 Contextual Background behind Conversion to Organic Farming

Increasing concerns about intensive agriculture and its detrimental effects have led to the development of sustainable agricultural practices such as organic farming (Lampkin and Padel, 1994; FiBL, 2000; Reganold *et al.*, 2001; FAO/WHO, 2001; IFOAM, 2002).

In India, green revolution started in sixties with the introduction of high yielding varieties and input intensive agriculture helped to achieve the goal of targeted food production which became conspicuous by 1980s. Further, the indiscriminate use of inputs (chemical pesticides and fertilizers) has caused serious environmental problems in naturally well endowed regions, like Haryana and Punjab due to the instability and fluctuations in productivity. Since then the scientists of our country are

making efforts to evolve certain technologies in agriculture which are of low cost and ecologically safe besides maximizing productivity in long-run.

According to a study conducted by Agriculture-Man-Ecology (1991) on the transitional experiences of twelve organic farmers in Tamil Nadu, Kerala and Karnataka revealed that, on an average, the farmers had seven to ten years of experience with organic farming. Soil fertility improved, yields increased during transition and even surpassed conventional levels. Changes in soil fertility management were well prepared and all at once or gradually chemical fertilizers were replaced by nitrogen-fixing crops, green manures, animal manures, tank silt, agro-industrial by products or wastes. Pest control measures were mainly derived from traditional farming.

Chopra (1993) reported that, the biochemical technology introduced in mid sixties has been the major exogenous technological change, witnessed by Indian agriculture. This irrigation-fertilizer based HYV technology has spread to roughly one third of the 140 million hectares of net sown area in this country. The problem is concerned with long-run productivity deficiency, which reduces the marginal productivity of highly productive crop lands. When we viewed from the sustainability angle, a close watch needs to be kept on their ecological costs, it is clear that new technologies with a focus on sustainability also need to be developed.

2.3 Factors motivating farmers to practice organic farming

The public concern regarding the environmental and food safety implications of agricultural chemical was paralleled by growing concern among farms regarding their effect on their own health and that of their families and livestock. This concern was an important reason for farmers to convert to organic farming. (Lockerets and Madden, 1987).

Ananda Kumar (1998) studied the reasons responsible for conversion to organic farming in Puducherry. The results are classified as follows: ***Socio-personal reasons:*** Consideration of soil fertility and physical conditions, concern over families health, success stories regarding organic farming, availability of FYM and concern over fulfillment of needs of future generation. ***Socio-economic reasons:*** Increasing cost of inputs in conventional farming, increase in net return despite reductions in

yield in organic farming, farmers own decision and intention to reduce expenditure, eventual yield drops in conventional farming. ***Socio-psychological reasons:*** Encouragements and advice from neighboring organic farmers.

John (2000) reported the reasons for adopting organic farming as organic philosophy (Concern for chemicals in food), Personal health, environmental concerns and concern for the soil.

Farming related reasons for adopting organic farming were: a) Husbandry and technical reasons such as animal health problems and soil fertility and erosion problems b) Financial reasons such as solving existing financial problems securing future of the farm, cost saving and premium marketing. Personal reasons for adopting organic farming were: a) Personal health consciousness, b) General reasons like stewardship, food quality, conservation of environment and rural development. (Padel, 2001).

International Research suggests that those attributes of organic farming most likely to influence farmers/consumers from most to least important were, a) Health; minimal artificial chemicals residues in the product and high nutritive value, b) Environment; environment friendly production and processing, c) Animal welfare, d) minimal processing, and e) Novelty and fashion. (Locke *et al.*, 2002).

Panda *et al.*, (2005) revealed the reasons for adopting organic farming as good safety, no nasty additives (good value addition to agricultural products), avoidance of pesticides, fertilizers, generally modified crops, concern for animal welfare, concern for the wild life and the environment.

The environmental costs of conventional agriculture are substantial, and the evidence for significant environmental amelioration via conversion to organic agriculture is overwhelming. (Kler *et al.*, 2001; Kler *et al.*, 2002).

2.4 Comparisons of Organic and Conventional Farming Systems

A number of studies have shown that under drought conditions, crops in organic agriculture systems produce significantly higher yields than comparable conventional agricultural crops (Dormaar *et al.*, 1988; Stanhill, 1990), often out-

yielding conventional crops by 7–90 per cent. (Lockeretz *et al.*, 1981; Wynen, 1994; Petersen *et al.*, 1999).

In rainfed systems, organic agriculture has demonstrated to out-perform conventional agricultural systems under environmental stress conditions. (Stanhill, 1990; Wynen, 1994; Peters, 1994).

Others have shown that organic systems have less long-term yield variability (Peters, 1994; Smolik *et al.*, 1995). A survey of 208 projects in developing tropical countries, in which contemporary organic practices were introduced, showed average yield increases of 5–10 per cent in irrigated crops and 50–100 per cent in rainfed crops. (Pretty and Hine, 2001).

The so called organic transition effect, in which a yield decline in the first 1–4 years of transition to organic agriculture, followed by a yield increase when soils have developed adequate biological activity (Liebhardt *et al.*, 1989; Peters, 1994; Neera *et al.*, 1999), has not been borne out in some reviews of yield comparison studies. (Stanhill, 1990; Padel and Lampkin, 1994).

Evidence from Studies conducted in India

Pretty (1995) revealed that farmers in India, Kenya, Brazil, Guatemala and Honduras have doubled/tripled yield by switching to organic or natural farming.

Ravankar *et al.* (2000) reported that field experiment on cotton-sorghum-soybean rotation was carried out from 1996 to 1998 at the Department of Agronomy at Akola. Highest yield of cotton, sorghum and soyabean were obtained with full recommended dose through fertilizer, but was at par with the treatment where 50 per cent Nitrogen is supplied through organics. The soil fertility was improved with the application of nutrient through organics. Hence, it could be that for sustainable yield and maintenance of soil fertility, the inclusion of organics appears to be essential.

Trials conducted on organic cotton at Nagpur indicated that after the third year, the organic plot, which did not receive fertilizers and insecticides, produced as much cotton as that cultivated with them. (Rajendran *et al.*, 2000).

Similarly, studies conducted in Punjab clearly indicated that organic farming gave higher or equal yields of different cropping systems compared to chemical farming after an initial period of three years. (Kler *et al.*, 2002).

Evidence from United States

A survey of recent studies comparing the productivity of organic practices to conventional agriculture provides an excellent example of the wide range of benefits we can expect from a conversion to sustainable agricultural methods. The results clearly show that organic farming accomplishes many of the FAO's sustainability aims, as well as showing promise in increasing food production ability.

- The study (Sustainable Agriculture Farming Systems (SFAS) project at University of California, Davis) examined four farming systems that differ in crop rotation design and material input use: a 2-year and a 4-year rotation conventional system, an organic and a low-input system. Results from the first 8 years of the long-term comparison study showed that the organic and low-input systems had yields comparable to the conventional systems in all crops which were tested - tomato, safflower, corn and bean, and in some instances yielding higher than conventional systems (Clark, 1999a). Tomato yields in the organic system were lower in the first three years, but reached the levels of the conventional tomatoes in the subsequent years and had a higher yield during the last year of the experiment (80 t/ha in the organic compared to 68 t/ha in the conventional in 1996).
- Initiated in 1981, the Farming Systems Trial (Rodale Institute, 1999) at Rodale Institute, compares intensive soybean and maize production under a conventional and two organic management farming systems. The first organic cropping system simulates a traditional integrated farming system. Leguminous cover crops are fed to cattle and the resulting manure is applied to the fields as the main source of nitrogen. In the second organic system, the leguminous cover crops were incorporated in to the soil as the source for nitrogen before corn or soybean planting. Corn yields were comparable in all three cropping systems (less than 1 per cent difference) (Drinkwater, 1998). However, a comparison of soil characteristics during a 15-year period found that soil fertility was enhanced in the organic systems, while it decreased

considerably in the conventional system. Nitrogen content and organic matter levels in the soil increased markedly in the manure-fertilized organic system and declined in the conventional system.

- One of the longest running agricultural trials on record (more than 150 years) is the Broadbalk experiment at the Rothamsted Experimental Station in the United Kingdom. The trials compare a manure based fertilizer farming system (but not certified organic) to a synthetic chemical fertilizer farming system. Wheat yields are shown to be on average slightly higher in the organically fertilized plots (3.45 tones/hectare) than the plots receiving chemical fertilizers (3.40 tones/hectare). More importantly though, soil fertility, measured as soil organic matter and nitrogen levels, increased by 120 per cent over 150 years in the organic plots, compared with only 20 per cent increase in chemically fertilized plots (Jenkinson, 1994).
- A comprehensive review of a large number of comparison studies of grain and soybean production conduct by six Midwestern universities since 1978 found that in all of these studies organic production was equivalent to, and in many cases better than, conventional (Welsh, 1999). Organic systems had higher yields than conventional systems which featured continuous crop production (no rotations) and equal or lower yields in conventional systems that included crop rotations. In the drier climates, organic systems had higher yields, as they tend to be better during droughts than conventional systems.
- Lastly, a study which compared ecological characteristics and productivity of 20 commercial farms in the Central Valley of California gives us a better understanding of how a conversion to organic would fare in a commercial farm setting. The farms compared had a fresh market tomato production. Tomato yields were shown to be quite similar in organic and conventional farms (Drinkwater, 1995). Insect pest damage was also comparable in both cases of organic and conventional farms. However, significant differences were found in soil health indicators such as nitrogen mineralization potential and microbial abundance and diversity which were higher in the organic farms. Nitrogen mineralization potential was three times greater in organic compared to conventional fields. The organic fields also had 28 per cent more

organic carbon. The increased soil health in the organic farms resulted in considerably lower disease incidence. Severity of the most prevalent disease in the study, tomato corky root disease, was found to be significantly lower in the organic farms (Drinkwater, 1995).

From the studies mentioned above and from an increasing body of case studies, it is becoming evident that organic farming does not result in neither catastrophic crop losses due to pests nor in dramatically reduced yields as many critics from agribusiness and in academia would have us believe. In fact, as a number of studies attest, organic farming methods can produce higher yields than conventional methods. Moreover, a worldwide conversion to organic has the potential to increase food production levels, not to mention reversing the degradation of agricultural soils and increase soil fertility and health. Furthermore, organic and agro-ecological farming methods continually increase soil fertility and prevent loss of topsoil to erosion, while conventional methods have the opposite effect. In the end, only a conversion to organic farming will allow us to maintain and even increase current crop yields.

2.5 Economic viability of organic *vis-à-vis* conventional farming

Mixed results were obtained by various researchers when they attempted to compare the yields and profits, accruing from organic farming and conventional farming systems.

Economics of organic farming

The replacement of external inputs by farm-derived resources normally leads to a reduction in variable input costs under organic management. Expenditure on fertilizers and sprays is substantially lower than in conventional systems in almost all the cases. (Padel and Lampkin, 1994; Offermann and Nieberg, 1999).

In a few cases, higher input costs due to the purchase of compost and other organic manure have been reported. (Sellen *et al.*, 1993). Studies have shown that the common organic agricultural combination of lower input costs and favourable price premiums can offset reduced yields and make organic farms equally and often more profitable than conventional farms. (Hanson *et al.*, 1997; Petersen *et al.*, 1999;

Reganold *et al.*, 2001). Studies that did not include organic price premiums have given mixed results on profitability. (Welsh, 1999).

Worf and Jayar (1992) reported that ecological farms achieve similar economic results as conventional farms, for gross margin/ha (Rs. 10620/- and Rs. 11,515/- respectively).

Padel and Lampkin (1994) reported that total variable cost to be typically 50 to 60 per cent lower for organic cereals and grain legumes, 10 to 20 per cent for potatoes and horticultural crops and 20 to 25 per cent for dairy cows, mainly due to reduced concentrates.

Venkatramani (1995) reported case studies of organic farming in rice which revealed that the net return from the ecological and chemical farming was Rs.8,179.50 and Rs. 7,500 respectively.

Rajendran *et al.*, (2000) reported that economic of organic cotton cultivation over a period of six years indicated that there was a reduction in cost cultivation and increased gross and net returns compared to conventional cotton cultivation in India.

Page (2001) reported that the profits under organic cotton farming (US \$91) was more than conventional farming (US \$ 55) through yield under organic farming (750 kg/ha) was low compared to yield under conventional farming (1000 kg/ha) in Zimbabwe.

Manjunath (2005) reported that the per acre returns from organic basmati Paddy (Rs.16183.5) was more compared to inorganic basmati paddy (Rs.15720) though the yield of inorganic basmati paddy (14.24q/acre) was more than that of organic basmati paddy(11.49q/acre).

Gill (2008) revealed that the crops raised in different cropping systems such as green manure basmati rice-wheat, turmeric-onion, summer groundnut-garlic and rice-garlic+mentha with organic management systems gave 9.2, 62.2, 14.5 and 12.4 per cent more productivity respectively than chemical farming.

From the review of all the studies presented above, it can be concluded that yields of organic farming were lesser but profits or returns were higher (Page, 2001; and Manjunath, 2005).

The organic systems were found to be more profitable in both corn and tomato among the 4-year rotations mainly due to the higher price premiums (Clark, 1999b).

When comparing the profitability of farming systems, the study (Welsh, 1999) found that organic cropping systems were always more profitable than the most common conventional cropping systems if the higher premiums that organic crops enjoy were factored in. When the higher premiums were not factored in, the organic systems were still more productive and profitable in three of the six studies. This was attributed to lower production costs and the ability of organic systems to outperform conventional in drier areas, or during drier periods. (Welsh, 1999).

2.6 Resource Use Efficiency under Different Cropping Systems

One of the crucial points of organic farming is optimising, and that is when both the producer and the consumer tend to achieve the highest available quality through the least minimal costs (Sarudi *et al.*, 2003). Hence it is quite pertinent to analyse the resource use efficiency of organic farming in order that optimal allocation of resources is done for maximizing returns. So a review of available literature on economic analysis of resource use efficiency is presented here.

Sankhayan and Sirohi (1971) studied productivity and allocation efficiency on seed potato farm in Himachal Pradesh. They observed that, at the present level of technology, the farm resources were optimally or near optimally allocated in the case of potato and maize.

Muralidharan (1987) studied the resource use efficiency in rice production in Kerala, employing the Cobb-Douglas production function. The adjusted R^2 was 0.84 indicating that 84 per cent of the variation in yield of paddy is explained by the estimated production function. The coefficient of land and human labour were positive and significant at one per cent probability level.

Vishweshwar (1994) employed Cobb-Douglas type of production function to measure the efficiency of inputs used in the production of cotton by IPM and non-

IPM adopted farmers in Malaprabha command area in Karnataka. The study indicated that the ratio of MVP to MFC for land was greater than one, while it was less than one for labour. It was negative for seeds, fertilizers and pesticides in conventional farmers. In case of IPM adopted farmers, the MVP to MFC ratio for land, labour, seeds and fertilizers were greater than one and it was negative for fertilizers.

Nagraj *et al.*, (1996) in their study to evaluate the economics of maize-sunflower cropping system at different size group of farmers of Tungabhadra command area, concluded that the variation in the gross returns explained by the variables included in the production function analysis was to the extent of 89.49 per cent and 99.03 per cent in maize and sunflower, respectively. The resource use efficiency indicated that land, manures and fertilizers together had maximum influence on gross returns of maize and in the case of sunflower after maize, land was the single most factors that greatly influenced the gross returns.

Naik *et al.*, (1998) while analyzing the resource use efficiency and productivity at various factors involved in onion production using Cobb-Douglas production function observed that land and farmyard manure were positive and highly significant.

Ganesh (2000) analysed resource use efficiency for mixed farming systems in Gazani lands of Karnataka. Results of the study indicated that about 98 per cent of the total variation in gross income was explained by the variables included in the production function. The resources like fish, fingerlings, manure and labour had significant effect on the gross returns.

Verma (2002) employed Cobb-Douglas production function for evaluating resource use efficiency in onion. The marginal value product of seed, manures and fertilizers, human labour and machine power were (Rs. 0.15, Rs. 1.51, Rs. 0.69 and Rs. 0.28 respectively) found to be positive on small farms while it had negative value on bullock labour, plant protection and irrigation (Rs. -0.13, Rs. -0.49 and Rs. -0.47 respectively). This implied that the small farms were underutilizing seed, manures and fertilizers, human labour and machine power and bullock labour, plant protection and irrigation were used excessively on the farms. In case of large farms, marginal value product of seed, manures and fertilizers, human labour, bullock labour and plant

protection were (Rs. 0.80, Rs. 0.34, Rs. 0.18, Rs. 0.01 and Rs. 0.15) respectively found to be positive while it had negative value of machine power and irrigation (Rs.–0.16 and Rs.-0.01) respectively implying that large farms were underutilizing seed, manures and fertilizers, human labour, bullock labour and plant protection while machine power and irrigation were over-utilized by the large farms. Thus indicating there is scope for increasing their use up to the optimum level where the efficiency of the input use is maximum.

Wadear (2003), while analyzing the resource use efficiency and productivity at various factors involved in different animal based farming systems in the three dry zones of Northern Karnataka, concluded that, the milk production increased with the farm size and ranged from 4.5 to 5.0 litres per day per animal. In milk production, green fodder, concentrates and labour were significantly contributing factors in all the three zones.

Sunanda and Narender (2003), while studying resource productivity of mesta farms in Srikakulam district of Andhra Pradesh, observed that mesta fibre accounts for 70 per cent of raw jute. The cultivation involves intensive human labour in addition to manures and fertilizers, seed and cattle labour. The Cobb-Douglas production function analysis for these variables indicated constant returns to scale on all farm size groups. The marginal value product to opportunity cost ratios for all farm size groups indicated resource use efficiency and revealed the scope of adjustments and reorganisation of resources, so as to obtain higher returns in mesta cultivation.

Rajeshwari (2004) analysed resource use efficiency for coconut based farming systems in Tumkur district of Karnataka, using Cobb-Douglas production function. She observed that the capital and feed in Farming System-I, (*coconut+greengram followed by ragi+dairy*) number of cows in Farming System-II, (*coconut+greengram+groundnut followed by ragi+dairy*) labour in Farming System-III, (*coconut+paddy+greengram followed by ragi+dairy*) land, labour, feed and number of sheep in Farming System-IV (*coconut+greengram followed by ragi+dairy+sheep*) and land and number of cows in Farming System-V (*coconut+arecanut+ragi+dairy*) had positive and significant influence on gross returns.

Saikumar (2005) studied the resource use efficiency in different farming systems of three districts of north-eastern Karnataka employing the Cobb-Douglas production function. The adjusted R^2 was 0.76, 0.58 and 0.54 for Bidar, Bellary and Raichur districts, respectively, indicating that 76, 58 and 54 per cent of variation in yield could be explained by the estimated production function. The coefficient of cost of seeds and cost of feeds+concentrates in Bidar, fertilizer+FYM cost in Bellary and fertilizer+FYM cost and labour cost in Raichur district were positive and significant at 5 per cent probability level.

Suresh and Reddy (2006) while studying the resource use efficiency of paddy cultivation in Peechi command area of Thrissur district of Kerala, has examined the resource productivity and allocative as well as the technical efficiency of paddy production. The cost of cultivation of paddy in the command area has been found as Rs 21603 per ha, resulting in a BC ratio of 1.34. The elasticity co-efficient for chemical fertilizers, farm-yard manure and human labour, have been observed significant and positive. The allocative efficiency has indicated that marginal return per rupee increase under these heads would be Rs 2.83, Rs 1.57, Rs 1.17, respectively. The average technical efficiency of the paddy farmer in the command area was been found as 66.8 per cent. The study has called for an equitable distribution of canal water and enhanced extension services for resource management in the area.

Biradar (2007) in their study of economics of redgram based cropping systems in Bidar district all cropping system (Redgram with Jowar, black gram, green gram, Soyabean and redgram sole) resources were had positive and significant influence on gross return, were bullock labour, machine labour, plant protection chemicals, bullock labour over utilized and seed, farm yard manure and fertilizer under-utilized, the adjusted coefficient of multiple determination was 0.66 and production function fitted showed increasing return to scale.

2.7 Sustainability in Agriculture

Francis and Young Berg (1990) were of the view that sustainable agriculture systems are indicated by reduced ecological degradation, stable agriculture productivity, economic viability, stable rural communities and quality of life.

Venkataramanaika and Siddaramaiah (1996), sustainability refers to overall balance between the use of renewable and nonrenewable resources of energy. The concept of sustainability as applied to agriculture refers to the long-term productivity of food production system. However, studies have shown a system will prove sustainable only if it can: (1) maintain or enhance environment quality and remain robust against external stress or major disturbances (2) satisfy society's future demand for food and fibers, and (3) assure the economic and social well being of producers.

Wynen and Edwards (1990) reported that private net returns were similar for both conventional and chemical-free farming. The study indicated that favorable change in net externality could be expected from a movement towards chemical free farming. Major positive externalities of chemical free farming were improved soil quality, improved water quality, improved human health, reduced susceptibility, reduced risk of pest, adoption to farm management techniques, increased personal satisfaction and so on.

Lewis *et al.* (1997) argue that we must move away from quests for short-term, therapeutic interventions (silver bullets), such as pesticides that merely treat the symptoms of an unbalanced ecosystem. They advocated that researchers concentrate on developing long-lasting solutions that build in an array of preventative, natural regulators.

Swaminathan (2006) in the report "Jai Kisan: Revised Draft National Policy for Farmers" opined that the areas like the States of Maharashtra, Andhra, Karnataka and Kerala have been affected by a serious agrarian crisis, leading occasionally to farmers' suicides. The time has therefore come when we should focus more on the economic well-being of the women and men feeding the nation than just on production. It is clear that the human dimension must be the principal determinant of agricultural policies and not just production in physical terms.

Gandhi and Patel (1997) examined farmers' perception, awareness and behavior on the use of pest control technology in agriculture in relation to environmental concern. The study indicated that farmer's awareness regarding the effects of pesticides on water and air was very limited. The share of highly hazardous chemical is very high in different locations.

Carlson (1989) reported that wind, water and movements of agriculture carry pesticide across property lines leading to negative and positive effects on neighboring producers and other individuals. Changes in human health, due to pesticides through food and water were also discussed.

Mahantesh (2002) studied the Economic & environmental issues related to use of agro chemicals in cotton production in Belgaum district. This study revealed that farmers experienced an increased cost on plant protection chemicals. This externality also reflected partly the additional cost incurred on over use of plant protection chemicals due to resistance developed by pests against particular plant protection chemical. The co-efficient of multiple determination (R^2) was found to be 0.85 indicating the variables included in the model explains about 85 per cent of variation in independent variable

Singh *et al.* (2000) said that the concept of sustainability lies in maintaining harmony between buoyancy and dynamism in agricultural growth for meeting basic human needs along with emphasis on protection and conservation of natural resources.

Organic agriculture is considered to be one of the production systems that aim to achieve sustainability (Reganold *et al.*, 1990; Lampkin and Measures, 2001) by utilising and maintaining ecosystem services.

Sustainable agriculture involves the use of nature's goods and services while maintaining them for future generations. (Altieri, 1995; Thrupp, 1996; Pretty *et al.*, 2003; Pretty, 2005; Pretty and Hine, 2001; Tilman *et al.*, 2002).

Organic agriculture both utilises and maintains ecosystem services. It is therefore more sustainable than is conventional agriculture which degrades some ecosystem services. (Sandhu *et al.*, 2010). Ecosystem services associated with agriculture can be classified into four groups: provisioning, supporting, regulating and cultural services as explained by Reid *et al.*, (2005).

Organic agriculture offers great potential to develop low cost, low input, locally available eco-technologies to provide food and fibre (Badgley *et al.*, 2006), without causing damage to human health and the environment (UN, 2008).

The current and future challenge is to develop cost-effective, low input eco-technologies, for their rapid implementation and uptake by end users (Porter *et al.*, 2009). This has potential to ensure sustainable food production for the growing human population (Sandhu *et al.*, 2010).

Environmental benefits of organic agriculture

The impact of organic agriculture on natural resources favours interactions within the agro-ecosystem that are vital for both agricultural production and nature conservation. Ecological services derived include soil forming and conditioning, soil stabilization, waste recycling, carbon sequestration, nutrient cycling, predation, pollination and habitats (IFOAM, 1998).

Pest and disease management in organic farming

Pest control in organic farming begins by making sensible choices, such as growing crops that are naturally resistant to diseases and pests, or choosing sowing times that prevent pest and disease outbreaks. Careful management in both time and space of planting not only prevents pests, but also increases population of natural predators that can contribute to the control of insects, diseases and weeds. (FAO, 2003).

Other methods generally employed for the management of pests and diseases are: improving soil health to resist soil pathogens and promote plant growth; rotating crops; encouraging natural biological agents for control of diseases, insects and weeds; using physical barriers for protection from insects, birds and animals; modifying habitat to encourage pollinators and natural enemies of pests; and using semi-chemicals such as pheromone attractants and trap pests. Organic farmers have long maintained that synthetic fertilizers and pesticides increase crop susceptibility to pests. (Yepsen, 1976).

Thus the research studies reviewed here have provided adequate background of the research problem and helped the researcher in developing a sound conceptual understanding of the study and data collection and case study analysis.

CHAPTER -III

RESEARCH METHODOLOGY

The purpose of this chapter is to describe the research methods and techniques followed in conducting this research. The various aspects included in this chapter have been organized under the following sub-heads:

- 3.1. Locale of the study**
- 3.2. Sampling procedure**
- 3.3. Variables and their measurement**
- 3.4. Data collection tools and procedures**
- 3.5. Research design**
- 3.6. Statistical analysis**

3.1. Locale of the Study

The study aimed at delineating the factors that motivated farmers to convert to organic farming. The study also envisaged to analyse and compare the economic viability, resource utilization efficiency, and sustainability of organic farming and conventional farming systems. Hence, through careful analysis, pigeonpea based cropping systems of Gulbarga district were chosen because of the following reasons.

Choosing Pigeonpea based cropping systems

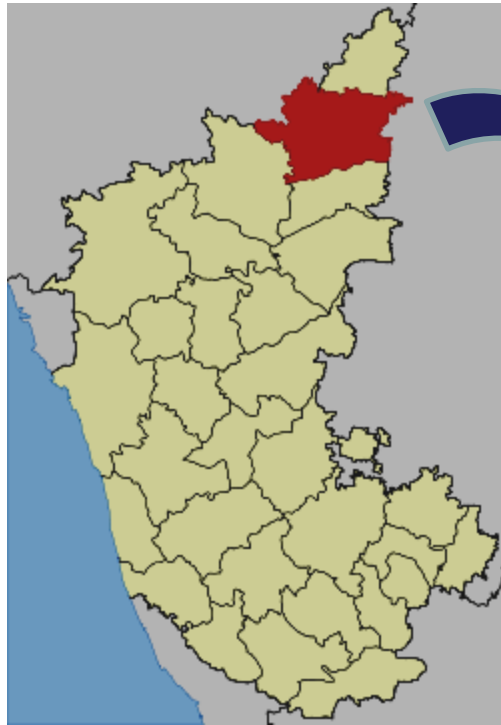
Pulses occupy an important place in the daily diet of Indians. Although the total pulse production in 2009-10 was 14.57 million tonnes. But the total pulse requirement is 17.71 million tonnes. This huge deficit is met through importing pulses from other countries. Hence it is of utmost importance that we should increase our pulse production. Among the pulses, pigeonpea forms the most important pulse crop. Pigeonpea supplies a major share of protein requirement of vegetarian population of our country. The total annual domestic consumption of pigeonpea is more than 28 lakh tonnes. We import 3-4 lakh tonnes annually from neighbouring country, Myanmar.

Karnataka possesses maximum area under pulses, especially pigeonpea. The area under pigeonpea in Karnataka is around 6.00 lakh hectares producing around 60 lakh quintals. The average productivity in the state is around 10 quintals per hectare, but ranges very widely between 600 to 1200 kilograms per hectare. The yields vary so widely due to heavy pest attack, especially *Helicoverpa* pod borer, due to which farmers spend major part of their cost of cultivation on pesticides. Organic farming was also attempted by farmers as an alternative to remove hazardous pesticides from this important food crop. So, pigeonpea crop offered a good sample of farmers growing this crop under organic as well as conventional farming systems. Hence pigeonpea crop was purposively selected for the study.

Choosing Gulbarga District

Four districts of Hyderabad Karnataka region: Gulbarga, Yadgir, Bidar and Raichur, is considered the '*Pulse Bowl*' of the state. The region is blessed with deep to very deep black soils, medium black, and light textured soils, ideal for pulse production. This region accounts for 5.57 lakh hectares (85 per cent area of the state under pigeonpea) under pigeonpea producing 56.63 lakh quintals. Since pigeonpea is mainly cultivated under rain-fed conditions, this region is ideal for pulse cultivation. Being a drought resistant crop, it is suitable for dry farming.

Gulbarga district is the largest producer of pigeonpea in the state of Karnataka accounting for 65 per cent of area under pigeonpea producing 70 per cent of total pigeonpea production in the state. The total area under pigeonpea is 3.73 lakh hectares



Map of Karnataka



Aland and Gulbarga taluks of Gulbarga district

Maps showing the study area of the research investigation

producing 3.77 lakh tonnes. Gulbarga is famous for its arhar dal or tur dal, which has good cooking quality as well as good taste. The district is a major pulse trading centre. Gulbarga also has a major APMC consisting main market yard with sub-market yards at Afzalpur, Aland, Jewargi and Yadrami. Hence, Gulbarga district was purposively selected for this study (see plate I).

Choosing Gulbarga and Aland Taluks

Among the seven taluks in the reorganized Gulbarga district (recently a new district called Yadgir was carved out with three taluks), two taluks: Gulbarga and Aland were found with more number of farmers, growing pigeonpea under organic farming conditions. The state government was also promoting organic farming of pigeonpea in these taluks. Hence, these two taluks were purposively selected.

Geographic Details of the district

Gulbarga district is situated in northern Karnataka between 76°.04' and 77°.42' east longitude, and 17°.12' and 17°.46' north latitude, covering an area of 10,951 km². This district is bounded on the west by Bijapur district and Solapur district of Maharashtra state, on the north by Bidar district and Osmanabad district of Maharashtra state, on the south by Yadgir district, and on the east by Rangareddy district of Andhra Pradesh state. The district constitutes 7 revenue blocks and 8 educational blocks: Afzalpur, Aland, Chincholi, Chittapur, Gulbarga (North), Gulbarga (South), Jewargi and Sedam. The district has got 872 revenue villages, 32 Hobalis, 04 Town Municipals, 4 Municipals, 7 Taluk Panchayats, 220 Grama Panchayats and 9 Assembly Constituencies.

As of 2001 Karnataka census, Gulbarga district had a population of 2,174,742 (Twenty one lakh seventy four thousand seven hundred and forty two), of which male population was 1,110,442 (Eleven lakh ten thousand four hundred and forty two) and female population was 1,064,300 (Ten lakh sixty four thousand and three hundred). The sex ratio is 963 and population density is 196. About 33.85 percent of the families (i.e., 1,26,586) in the district are below poverty line (BPL) families. The literacy rate of Gulbarga district was recorded at 51.04 percent in 2001. The male and female literacy rates were 63.36 and 38.36 respectively.

It is predominantly an agricultural district divided into two agro-climatic zones namely eastern transition and north eastern dry zone. The zones indicate the predominance of rain dependent dry land agricultural area. The normal rainfall of the district is 777 mm. The climate of Gulbarga district is generally dry and healthy. The net sown area in the district is 85.1 percent of the total cultivable land area, which is 13821.94 square kilometers. The net area irrigated to net area sown is 14 percent, which is below the state average of 24 percent. The major crops grown in the district are jowar, red gram, sunflower and groundnut. Bhima, Kagina, Mullamari, Benne Tora and Bori rivers flow in the district. There are 36 lift irrigation schemes and 445 minor irrigation tanks in the district.

3.2. Sampling Procedure

3.2.1. Selection of Taluks

Two taluks from the seven taluks of Gulbarga district were selected purposively. As pigeonpea crop is predominantly grown in these taluks with organic farming practices in different cropping systems. Pigeonpea is intercropped with jowar, soybean, black gram, green gram, sesamum, groundnut, sunflower etc. The criterion adopted was the large scale adoption of organic farming practices in pigeonpea based cropping systems by the farmers. Most of the farmers are members of organic farmers' association: *Savayava Krishi Parivars* in these two taluks.

3.2.2. Selection of Villages for Case Studies and Survey

Four villages from the selected taluks were randomly selected. Majority of farmers in these villages were growing pigeonpea along with intercrops of black gram and green gram. The villages selected for the research study are listed in Table 3.1.

Table 3.1: Taluks and Villages selected for the study

District	Taluk	Village
Gulbarga	Aland	Tadkal
		Pattan
	Gulbarga	Bhemalli
		Melkunda

3.2.3. Selection of the Respondents

Since the study aims at analyzing organic farming, a survey approach was adopted for assessing the economic viability, resource utilization efficiency and sustainability comparisons of organic and conventional farming, fifteen organic farmer respondents and fifteen farmers practicing conventional farming were selected randomly from each village as respondents for personal interviews. The farmers, who have been practicing organic farming of pigeonpea in their fields for the last three or more number of years, were considered for the study. A sample of 60 organic and 60 farmers practicing conventional farming were taken through simple random sampling for data collection. The details of the sampling are given in Table 3.2.

Table 3.2: The Sample of Farmers from three Pigeonpea based cropping systems

Taluks	Villages	Organic Farmers				Conventional Farmers				Total
		P*	P+BG	P+GG	Total	P*	P+BG	P+GG	Total	
Aland	Tadkal	5	5	5	15	5	5	5	15	30
	Pattan	5	5	5	15	5	5	5	15	30
Gulbarga	Bhemalli	5	5	5	15	5	5	5	15	30
	Melkunda	5	5	5	15	5	5	5	15	30
Total		20	20	20	60	20	20	20	60	120

P*=Pigeonpea (sole crop); P+BG=Pigeonpea + Black gram; P+GG=Pigeonpea +Green gram

Since comparisons are attempted, it was befitting to formulate hypotheses for the study so that empirical testing can be done.

3.2.4. Selection of Respondents for Case Studies

Case study technique was adopted and a sample of four cases (one case of model organic farmer from each village) was taken for case writing and analysis. Since a case study approach was adopted for the study to bring home the qualitative aspects like the motivating factors involved, and interventions in adoption of organic farming practices, four '*model organic farmers*' from four villages were treated as four units for case study and analysis.

3.3. Variables and their Measurement

The appropriate variables for the study were selected on the basis of extensive review of literature and consultation with experts. Keeping in view the objectives of the study, the specific variables to be measured were selected. Different approaches were adopted for studying different objectives, which are detailed below;

3.3.1 Factors motivating farmers to practice organic farming

Sixty organic farmers formed the sample for studying this objective. A semi-structured schedule was prepared to include all motivational factors: environmental motives, financial motives, soil and health oriented motives, motivation by media, etc., and organic farmers' rating was obtained on a five point rating scale of degree of motivation i.e., very highly motivating to very low motivating.

3.3.2 Case Study Technique

Four '*model organic farmers*' formed the sample for the case studies. The data were collected through long in-depth interviews and documentation of their organic farming activities and accomplishments. A set of open-ended questions were prepared in the form of case study interview guides (See Appendix I) and were used in collecting detailed data on contextual background, the chronological events, motivating factors, and interventions made on their organic farms, infrastructure developed, achievements etc.

3.3.3 Economic viability of organic *vis-à-vis* conventional farming

Forty farmers (20 organic and 20 farmers practicing conventional farming) formed the sample for studying this objective. They represented each group of farmers growing pigeonpea under three cropping systems: (i) sole crop of pigeonpea, (ii) intercropping of pigeonpea with black gram and (iii) intercropping of pigeonpea with green gram. A schedule was developed to collect data related to yield, cost of inputs and returns. Cost benefit analysis was done for assessing the economic viability of organic farming *vis-à-vis* conventional farming in pigeonpea based cropping systems.

3.3.4 Resource utilization efficiency of organic *vis-à-vis* conventional farming

Forty farmers (20 organic and 20 farmers practicing conventional farming) formed the sample for studying this objective. They represented each group of farmers growing pigeonpea under three cropping systems: (i) sole crop of pigeonpea, (ii) intercropping of pigeonpea with black gram and (iii) intercropping of pigeonpea with green gram. *Resource utilization efficiency* means using the farm resources like soil, nutrients, vegetative and animal wastes judiciously thereby enhancing the soil productivity and net income by choosing better sub-systems of agriculture.

Cobb-Douglas production function was used to estimate resource use efficiency and returns to scale in pigeonpea based cropping systems. The resource factors like land, human labour, manures and fertilizers, seeds and plant protection measures were used in both organic and conventional farming and hence they are considered in the present study.

3.3.5 Sustainability of organic *vis-à-vis* conventional farming

Sixty organic farmers and sixty farmers practicing conventional farming formed the sample for studying this objective. Here an attempt was made to assess the sustainability of pigeonpea cultivation practices (organic and conventional farming).

The data were collected through personal interviews from both organic and farmers practicing conventional farming with a semi-structured schedule, adopting the GTZ Sustainet parameters of sustainability. Each of these parameters has six indicators. So, eighteen indicators were included to assess sustainability of these organic and conventional farming practices. These Sustainet parameters are given in Appendix II.

The Sustainet parameters includes: ecological, economic, social and cultural parameters. Pigeonpea cultivation practices with clear-cut difference in organic and conventional farming were put into five sets: land preparation and seed treatment, weed management, nutrient management, plant protection and seed storage. These practices are given in Table 3.3 below.

Table 3.3: Pigeonpea cultivation practices in organic and conventional farming

No.	Sets of Practices	Organic Farming Practices	Conventional Farming Practices
1	Land preparation and seed treatment	Incorporation of crop residues in soil, Deep summer ploughing, In-situ Green manuring, Seed treatment with resources like cow urine, Panchagavya and microbial inoculants.	Burning of crop residues, Seed treatment with chemicals.
2.	Weed management	Mulching, Manual weeding, Harrowing, Soil solarization, Use of Biological agents like <i>Zygothrips</i> sp.	Manual weeding and Application of Herbicides.
3.	Nutrient management	FYM, Vermi-compost, Incorporation of crop residues, Ex-situ green manuring, Crop rotation, Panchagavya, Oilcakes, Tank silt application.	Application of Chemical Fertilizers and Micronutrients.
4.	Plant protection	NSKE, Use of Botanicals like Neem oil, Leaf extracts etc., Use of Bio-control agents, Bio-digest extract, Vermi-wash, Pheromone traps, Bird perches, Light traps, Sticky plates, Trap crops, Shaking of plants, Manual collection and destruction of eggs and larvae.	Insecticides, Fungicides, Acaricides and other chemical based plant protection chemicals.
5.	Seed storage	Sun drying and Storage at dry places, Incorporation of Neem leaves into the produce.	Chemical treatment with Fungicides, Dormancy-inhibitors and Germination inhibitors.

3.3.6. Derivation of Hypothesis

Based on the review of past work done and the objectives of the study the following general hypotheses and empirical hypotheses were derived.

General Hypothesis (GH-I): There is difference in the economic viability of organic and conventional farming in the three pigeonpea based cropping systems.

Empirical Hypothesis (EH-I-1): There is no significant difference in the net returns of organic farming and conventional farming in pigeonpea (sole crop) cropping system.

Empirical Hypothesis (EH-I-2): There is no significant difference in the net returns of organic farming and conventional farming in pigeonpea + black gram cropping system.

Empirical Hypothesis (EH-I-3): There is no significant difference in the net returns of organic farming and conventional farming in pigeonpea + green gram cropping system.

General Hypothesis (GH-II)

There is association between the various factors of production and the resource utilization efficiency of organic and conventional farming in the three pigeonpea based cropping systems.

Empirical Hypothesis (EH-II-1): There is no relationship between the various factors of production and the resource utilization efficiency of organic farming and conventional farming in pigeonpea (sole crop) cropping system.

Empirical Hypothesis (EH-II-2): There is no relationship between the various factors of production and the resource utilization efficiency of organic farming and conventional farming in pigeonpea + black gram cropping system.

Empirical Hypothesis (EH-II-3): There is no relationship between the various factors of production and the resource utilization efficiency of organic farming and conventional farming in pigeonpea + green gram cropping system.

General Hypothesis (GH-III)

There is difference in the sustainability of pigeonpea cultivation practices between organic and conventional farmers.

These hypotheses will be put to test and the results will be discussed in the appropriate research papers.

3.3.7. Measurement of Socio-personal Attributes of Famers

Age: Age was measured as the number of full years completed by the respondents at the time of enquiry.

Education status: Education status was operationalised by using the criteria of the number of years of formal education of the respondents. The numerical coding procedure followed by Murali (1997) was used in this study with slight modification.

Level of Education	Code
Illiterate	1
Primary school	2
Middle school	3
High school	4
Junior College	5
Degree College	6

Occupational status: It is defined as a type of occupation the respondent has been engaged in. The numerical coding procedure adopted by Sreedaya (2000) was used with slight modification. The scoring pattern is given below.

Occupation Type	Code
Farming alone	1
Farming and allied occupation	2
Farming and other occupation	3
Any other	4

Family size: it is measured as number of members in Respondent's family at the time of enquiry. Supply of family labour depends on family size.

Type of house: It is defined as a type of house the respondent is possessing. For that numerical coding procedure adopted by Sriram (1997) was used with slight modification and the scoring pattern is given below.

House type	Code
Thatched	1
Tiled	2
Concrete single storey	3
Concrete double storey	4

Domestic Material Possession: This is referred to the type of domestic materials, possessed by respondent. The possessions are measured by numerical coding procedure adopted by Sriram (1997) was used and the scoring pattern is given below.

Components	Code
Cow /Buffalo/ Goat / Cooker / Grinder/ Radio / Bicycle / Electricity connection	1
Telephone / T.V	2
Automobile / Pump sets / Farm machinery and other equipments	3

Land Holding: The extent of land individual farmer possessed and cultivated is termed as farm size. The land size is recorded in acres.

Irrigation Facilities: Irrigation facilities available with the respondent were given a numerical code of one for yes and zero is given for No.

Farming Experience: It refers to the number of years a farmer has the experience in cultivation of crops. The scoring procedure adopted by Sreedaya (2000) was used. The numerical coding pattern is given below.

Farming Experience	Code
1 year	1
2 years	2
2-3 years	3
3-5 years	4
>5 years	5

Experience in organic farming: It refers to the number of years a farmer has the experience in cultivation of crops with organic farming practice. The numerical coding procedure adopted by Sreedaya (2000) was used. The scoring pattern is given below.

Experience in organic farming	Code
1 year	1
2 years	2
2-3 years	3
3-5 years	4
>5 years	5

Social participation: It refers to the participation of an individual farmer in different formal organizations. The social participation was measured on a Scale containing ‘Yes’ or ‘No’ responses and the scores assigned were one and zero respectively.

Institutions	Participation	
	Yes	No
Organic Farmers Association	1	0
Village Clubs	1	0
Women’s Self Help Group (SHG)	1	0
Farmers’ Field School	1	0
Plant Protection Committee	1	0

3.4. Data collection tools and procedures

The data were collected from the respondents through personal interviews with the help of structured interview schedule specially constructed for the purpose of this study, keeping in view the objective and variables. The interview schedule was prepared in English and Kannada, which acted as guide during data collection. Necessary precautions were taken to ensure that the questions in the schedule were unambiguous, clear, concise, complete, and comprehensive. The respondents were contacted in person mostly at the residence or fields. The assistance of the agriculture department and KVK personnel was availed to establish rapport with the respondents and for getting the information gathered from respondents. Village level information was collected from group interactions, taking inputs from Panchayat officials and from government official in taluka and district departments. Website search engines were also used to seek additional information to support the data collected in the field. Group interviews were done to collect data on organic farming (*Savayava Krishi*) practices in the village.

The situation prior to organic farming practice, specific interventions made, management of various activities including meetings, *krishi melas*, farm visits, felicitating farmers with awards, review meetings, etc., were recorded and cases were written. Then cases were analysed through discussions, rewritten and finalised. Reflections arising out of case story analysis and discussions were recorded and presented. Finally, a list of lessons drawn was also noted down as they form part of the major findings of case study analysis.

3.5. Research Design

Research design is the entire process of planning and carrying out research. Kerlinger (1978) defined “Research design as the plan, structure and strategy of investigation so as to obtain answers to research questions and to control variance”. The plan is the overall scheme or programme of research.

For this study, ex-post facto design was used. This is systematic empirical enquiry in which the scientist does not have direct control over the variables because their manifestations have already occurred or because they are inherently not manipulatable. A case study approach and survey approach were adopted to collect both qualitative and quantitative data.

3.6. Statistical Analysis

The data collected for the study was tabulated, processed and analyzed using SPSS (Statistical Package for Social Sciences). The Statistical methods used in this study were frequencies (f), percentages(%), arithmetic mean(AM), standard deviation (SD), ‘t’ test, and correlation and multiple regression analysis, etc.

Research Paper-I

Factors Motivating Farmers to Practice Organic Farming among Pigeonpea Growers of Gulbarga District of Karnataka

Abstract

In a study conducted among the farmers of Aland and Gulbarga taluks in Gulbarga district of Karnataka, who were growing Pigeonpea in Pigeonpea based organic farming systems, it was revealed that reduction in cost of cultivation, enhancement of net income and profit, internal dependency on inputs, sustainable use of resources and the philosophy of farmers for a sustainable development, living in harmony with nature, and live and let live philosophy were the major motivating factors that pushed farmers towards practicing organic farming. In addition to these push factors, the pull factors of incentives in terms of Krishi Pundit awards, promotional schemes of government, awareness campaigns of NGOs, success stories of other organic farmers, better price for organic produce, and safe and nutritious food were also acting as motivating factors.

Key words: *organic farming, motivating factors*

Introduction

Organic farming is a production system of crops, which avoids the use of synthetic and chemical inputs, like fertilizers, pesticides, growth regulators and livestock feed additives. Organic farming systems depend mainly on crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic residues, mineral bearing rocks and biological pest control to maintain soil productivity and supply of nutrients. (Anonymous, 2002).

The emphasis now given to organic farming by all the stakeholders has its origin in the rethinking done by them on the adverse consequences and negative impacts of green revolution. It has made possible by dint of hard work of the farming community and agricultural researches through the irrigation- fertilizer interaction that resulted in an unparalleled increase in land productivity and in just a decade the country achieved food self sufficiency. But excessive use of chemical fertilizers and pesticides, in the eighties and nineties has adversely affected our agro-ecosystem resulting in plateau in crop and land productivity.

Indiscriminate use of chemical pesticides over the years has destroyed many naturally occurring effective biological control agents. In addition to this, various health hazards associated with intensive modern agriculture and unsafe food laden with pesticide residues gave birth to new concepts in agriculture, like organic farming. The agrarian crisis with thousands of farmers' suicides all over the country had forced the agricultural professionals and policy makers to review the whole agricultural scene that emerged in the new millennium and regenerate fundamentally new perspectives for agricultural sector in India.

In the state of Karnataka, the new agricultural policy of 2006 (www.kar.gov.in, 2006) clearly stated the current agrarian crisis and the clarion call was made for sustainable agriculture: “The chemical approach to productivity augmentation since mid-sixties has depleted the natural resources base for sustainable agricultural growth. The earlier technology has disturbed the biological composition, which might have adverse and lasting impact on the equilibrium. Unless the disturbed natural resource base equilibrium is restored, sustainable agricultural growth with competitive edge will not be possible. Holistic development of natural resources aiming at sustainable livelihood and security of all life forms in the region will be the focal point for future strategy. This would call for a search for new technologies, policies and institutional approaches for rebuilding the natural resource base”.

In the very right spirit, the government of Karnataka has come out with a state policy on organic farming in 2004, and articulated the advantages of organic farming technology *vis-a-vis* green revolution technology. The policy document has also recognized the principal requirements for organic farming, provided policy objectives and future strategies for promotion and revival of these traditional systems of farming.

While the state government was addressing the concerns of soil health degradation and depleting natural resources base and propagated organic farming through newly formulated special schemes with incentives, the farming community did a rethinking on the sustainability of the farming systems and raised concerns on increasing cost of cultivation, stagnation of crop yields, inefficient use of limited resources, food safety, harmful effects of poisonous chemical pesticides, degradation in the quality of natural resources, especially soil and water.

On the other hand, with growing awareness of food safety among people, the demand for organic products is growing fast, and most of the countries are trying to convert a remarkable portion of their cultivated areas into organic farming (Kumar, 2008). With enhanced restriction on food safety and permissible pesticide residue levels in foods imposed by Codex Alimentarius, export of organic produce is gaining prominence in agricultural trade and commerce worldwide.

Against this background, the farmers everywhere were finding new alternatives to sustainable agriculture with a clear and strong emphasis on restoration of agro-ecosystem with minimal use of external inputs and regenerating natural resource base in the community. Thus the organic farmers have started practicing sustainable agriculture without use of any chemicals and reverted from chemical farming for various reasons.

There are research reports that outline the reasons behind the increased adoption of organic farming. The promise of a better and improved health conditions ingrained in the concept and operation of organic farming could also act as an added incentive for practicing farmers (Das, 2004). Palaniappan and Annadurai (2007) viewed the encouraging factors of organic farming as it solely depends on the use of on-farm and off-farm crop residues and organic wastes, animal manures, green manures, crop rotations, incorporating legumes and biological pest control to maintain soil productivity.

The most important reason behind the increased adoption of organic farming in Kerala was the high literacy level of farmers that made them to appreciate the ecological and economic values of organic farming for export crops (Pratap and Vaidya, 2009). In addition they have delineated the following reasons: i) reduced external dependence under organic farming, ii) high prices of chemical inputs, iii) serious health hazards to human beings, farm animals and wildlife from chemical inputs and iv) improved soil quality and productivity due to organic farming. Hence an attempt has been made in this study to delineate the factors that had motivated farmers for practicing organic farming in Karnataka.

Methodology

In order to delineate the motivating factors behind adoption of organic farming of pigeonpea, a sample of sixty organic farmers were selected using random sampling from four villages: Tadkal and Pattan of Aland taluk, Melkunda and Bhemalli of Gulbarga taluk

of Gulbarga district. The district and taluks were purposively selected; as they have more organic farmers practicing pigeonpea based cropping systems.

Several motivating factors behind organic farming were collected from reviews of literature, interaction with organic farming experts and organic farmers. A semi-structured schedule was used for collecting data through personal interview method. The respondents were asked to rate the motivating factors behind organic farming on a five point rating scale of degree of motivation i.e., highly motivating to very low motivating. The total scores obtained by each respondent for each factor was pooled and the mean score values of each factor were computed. The overall mean score and standard deviation of all the factors were also computed.

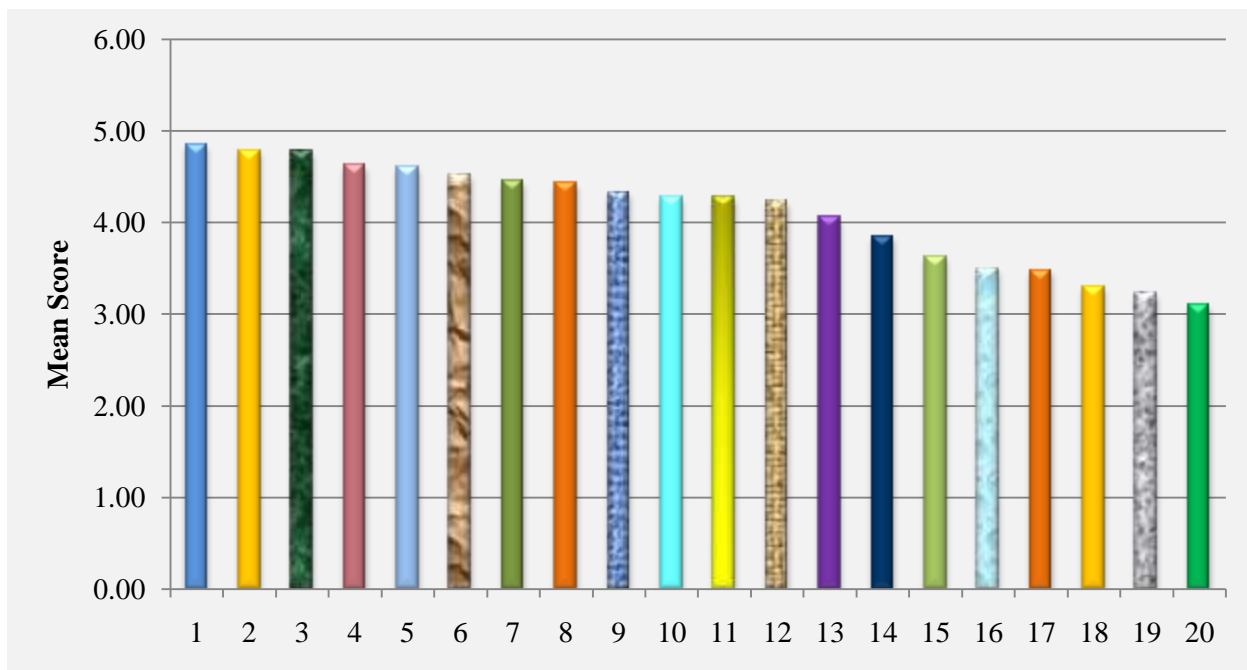
To select the final list of motivating factors, all the factors were arranged in their ascending order of mean score values and the factors whose mean score values were greater than mean-1SD were selected. Thus twenty factors were finalized for interpretation and discussion.

Result and Discussion

The factors motivating organic farmers to convert from conventional farming to organic farming were presented in Table.4.1.1 and Fig.4.1.1. In the table, the factors were listed according to their ranks of importance as perceived by the respondents. The ranking was done on the basis of the mean score obtained by each factor by the sixty organic farmers. The frequencies of the five ratings of importance can also be seen in the Table. Although the motivating factors were arranged in their rank order, they were discussed in groups of three or four, which are closely related to each other.

Economic Factors

The first group of motivating factors relate to economics of organic farming. Economic reasons such as 'reduction in cost of cultivation', 'enhancement of net income and profit', 'internal dependency of farm-produced inputs', 'sustain livelihood security and better price for organic produce' were ranked 1st, 3rd, 10th, 11th and 16th respectively by the respondents.



Motivating Factors

- 1 Reduction in cost of cultivation
- 2 *Krishi Pundit* Awards
- 3 Net income & profit enhancement
- 4 Promotional schemes & Advertisements of government
- 5 Awareness campaigns by NGOs & other agencies
- 6 Reduction in pesticide poisoning (nausea) cases
- 7 Success stories of organic farming
- 8 Diversification of agriculture
- 9 Sustainable development
- 10 Internal dependency of inputs
- 11 Sustain livelihood security.
- 12 Self-dependence and freedom in farming
- 13 'Live and Let Live' philosophy of life
- 14 Increase in productivity of soil and improvement in soil health
- 15 Sustainable use of resources
- 16 Better price for organic produce
- 17 Better quality of food & nutrition
- 18 Increase in earthworms population
- 19 Living in harmony with nature
- 20 Ability to cope with and survive a crisis (loss due to drought/heavy rain/calamity/pest attack, etc.)

Fig.4.1.1 Motivating Factors for practicing Organic Farming

Table 4.1.1.: Factors motivating farmers to practice organic farming in pigeonpea cultivation

S.No.	Motivating Factors	Very High		High		Medium		Low		Very Low		Mean Score	Rank
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%		
1.	Reduction in cost of cultivation	51	85	9	15	0	0	0	0	0	0	4.85	I
2.	' <i>Krishi Pundit</i> ' Awards	56	93.3	1	1.7	0	0	0	0	3	5	4.78	II
3.	Net income & profit enhancement	46	76.7	14	23.3	0	0	0	0	0	0	4.77	III
4.	Promotional schemes and Advertisements of government	45	75	8	13.3	7	11.7	0	0	0	0	4.63	IV
5.	Awareness campaigns by NGOs & other agencies	36	60	24	40	0	0	0	0	0	0	4.60	V
6.	Reduction in pesticide poisoning (nausea) cases	34	56.7	25	41.7	0	0	0	0	1	1.7	4.52	VI
7.	Success stories of organic farming	33	55	19	31.7	4	6.7	0	0	4	6.7	4.45	VII
8.	Diversification of agriculture	36	60	17	28.3	4	6.7	3	5	0	0	4.43	VIII
9.	Sustainable development	21	35	38	63.3	1	1.7	0	0	0	0	4.33	IX
10.	Internal dependency of inputs	33	55	22	36.7	4	6.7	1	1.7	0	0	4.28	X
11.	Sustain livelihood security	20	33.3	37	61.7	3	5	0	0	0	0	4.28	XI
12.	Self-dependence and freedom in farming	34	56.7	15	25	5	8.3	3	5	3	5	4.23	XII
13.	' <i>Live and Let Live</i> ' philosophy of life	28	46.7	20	33.3	3	5	5	8.3	4	6.7	4.05	XIII
14.	Increase in productivity of soil and improvement in soil health	13	21.7	26	43.3	20	33.3	1	1.7	0	0	3.85	XIV
15.	Sustainable use of resources	18	30	22	36.7	8	13.3	4	6.7	8	13.3	3.63	XV
16.	Better price for organic produce	0	0	30	50	30	50	0	0	0	0	3.5	XVI
17.	Better quality of food & nutrition	35	58.3	2	3.3	0	0	3	5	20	33.3	3.48	XVII
18.	Increase in earthworms population	26	43.3	5	8.3	4	6.7	11	18.3	14	23.3	3.30	XVIII
19.	Living in harmony with nature	8	13.3	21	35	15	25	9	15	7	11.7	3.23	XIX
20.	Ability to cope with and survive a crisis (loss due to drought/heavy rain/calamity/pest attack etc.)	4	6.7	12	20	30	50	14	23.3	0	0	3.10	XX

Indeed cost of cultivation was the most crucial motivating factor that has pushed farmers to the brink. With dwindling yields (due to crop losses caused by pests attack, droughts or floods) and unsustainable production, farmers were laden with increasing debt burden. With dwindling market prices, farmers could not settle their dues to money lenders even after selling their crop produce. Thus farmers were trapped into vicious cycle of poverty, with continued crop failures. Thus most of the farmers thought it wise, to reduce the investment in agriculture, and reduced their cost of cultivation by buying fewer amounts of expensive external inputs, like chemical fertilizers and chemical pesticides. They thought that the best way was to reduce costs when returns were not assured or not stable. So, most of the respondents resorted to organic farming as the cost of cultivation in organic farming was much less and the reduction in cost of cultivation was thus the most pivotal and prime motivating factor for the conversion.

Obviously, with reduced cost of cultivation in organic cultivation of Pigeonpea, the respondents had experienced remarkable enhancement in net incomes and profits. The 'net income and profit enhancement' was ranked third most important motivating factor. The increase in net incomes was due to less dependence on external inputs and increased use of on-farm local resources for plant nutrition as well as plant protection. Thus organic farming ensured increase in net income by minimizing dependence on the external inputs.

The motivating factor 'Internal dependency on inputs' was ranked 10th by the respondents practicing organic farming. In organic farming, most of the inputs were available within the farm, so farmers hardly purchased any external inputs for farming. With greater emphasis on regenerating on-farm resources to cut costs as well as to improve the efficiency of internal resources of agro-ecosystem, the organic farming accomplished sustainability on both economic as well as ecological dimensions. Thus most of the farmers switched over to organic farming and achieved sustainability on their farms.

Consequently, with accomplishment of better economic returns, farmers were able to pay off their debts and achieved freedom from indebtness. Earlier their livelihood security was at stake due to the problem of indebtness which was because of high cost of inputs-chemical fertilizers and chemical pesticides. Gradually they came to understand that if they switch over to organic farming they would be free from indebtness since organic farming

basically relies on locally available inputs. Thus the motivating factor 'sustain livelihood security' was ranked 11th by the respondents as a reason for practicing organic farming. Another economic reason for practicing organic farming was 'Better price for organic produce', which ranked 16th among the motivating factors of organic farming. Though this was an important factor, it ranked lower because of lack of assured markets and premium price for organic produce. As the market demand increases, the prices are bound to increase, leading more farmers in to organic farming.

All the motivating factors related to economic aspects of organic farming. Any farming activity will survive only when it is economically sustainable and profitable. Here too, organic farming was taken up by farmers only for the economic motivation and profitability.

Propaganda Factors

Another set of motivating factors that were closely related are: *Krishi Pundit* awards, promotional schemes and advertisements of the government, awareness campaign by government organizations and other agencies, and success stories of organic farming. These parameters were respectively ranked at 2nd, 4th, 5th and 7th positions among the motivating factors of organic farming.

Governments of all states of India had started huge programmes for promoting organic farming with a view to encash the ever increasing demand for organic produce in international markets and also to provide viable and sustainable alternatives for grief stricken farming community. So the propaganda factors had motivated farmers to practice organic farming.

The lure of *Krishi Pundit* awards was the second most important motivating factor for organic farming. Every year *Krishi Pundit* awards are given to farmers for enhanced crop productivity with the same level of inputs available at the farm. So, farmers get motivated for working hard to get *Krishi Pundit* awards and the attention and media glare attached with award ceremonies, field-days, *Krishi melas*, etc. A sense of prestige that may get accrued through awards was a great motivating force.

Promotional schemes and extension activities of government agencies were another major motivating factor for wide adoption of organic farming among farmers. Karnataka state government allocated Rs. 100 crores for large scale promotion of organic farming in 2008-09. Under this scheme subsidies were given to farmers for compost pits, vermi-composting units, training programmes and visit to model organic farms, etc. Adequate steps were taken for establishment of necessary infrastructure and institutional framework.

In addition to the efforts of government agencies, several Non- Governmental organizations (NGOs) had taken up mass awareness campaigns to remove any misconceptions about organic farming. Special training programmes were conducted by these promoting agencies to clear the doubts of farmers on lower yields and less return, and to persuade them to take up organic farming with adequate organic manures, production units and use of biological methods of plant protection. Promotion of organic farming through farmers groups called '*Savayava Krishi Parivar*' by encouraging collective responsibility and group actions of participating farmers.

Finally, another important motivating factor was the wide publicity given to the success stories of organic farms and visits of farmers made by the various promoting agencies to these successful organic farms. Advocating the principle of "Seeing is Believing" farmers' groups visited the successful organic farms of neighboring villages which has enthused them to adopt the organic farming practices on their own farms. Thus they got living experiences and demonstrations which boosted their morale and confidence to understand and practice organic farming. These four motivating factors dealt with propaganda, media and promotion acted as 'pull factors' which acted as external incentives and extrinsic motivating factors for enthusiastic farmers to adopt and practice organic farming.

Ecological Factors

Another set of factors that are closely related to ecological reasons for organic farming were: reduction in pesticide poisoning (nausea) cases, diversification of agriculture, increase in productivity of soil and improvement in soil health, sustainable use of resources, better quality of food and nutrition, increase in earthworms population, and ability to survive a crisis (loss due to drought/ heavy rain/calamity/pest attack etc). All these seven ecological

reasons were ranked respectively at 6th, 8th, 14th, 15th, 17th, 18th and 20th among all the motivating factors for organic farming.

A farm is usually seen as an agro-ecosystem with a specific micro-climate where in the flora and fauna live in equilibrium. The sustainability of the ecosystem needs to be maintained well in order to get benefits from it. When harmful poisonous chemical pesticides were introduced in an ecosystem, its natural ecological equilibrium was lost. The ill effects of chemical farming on the health of human beings in addition to polluting natural resources of soil and water had disturbed the ecosystem of the farm. But with organic farming, these ill effects were reduced and thus resulting in sharp drop of pesticide poisoning (nausea) cases. Hence, this factor was rated at 6th by the organic farmer respondents.

Another important ecological reason for adoption of organic farming was that it encourages more diversification in agriculture, quite contrary to highly intensified monocropping system of conventional farming. On the other hand, organic farming encourages and encompasses crops, livestock, trees, poultry, fish, and allied agricultural activities. Diversification of cropping systems and farming systems not only helped in maximizing farm incomes but also helped in recycling resources among different farming systems and in balancing the ecosystem.

"Increased soil productivity and improved soil health" as witnessed in organic farming practices was another most important ecological motivating factor for practicing organic farming by the respondents. This was ranked at 14th position among the final list of twenty factors of motivation. Farmers believed that soil was the source of life, so for healthy plants and healthy soil is important. Indiscriminate use of chemicals in conventional farming had resulted in poor physical, chemical, biological properties of the soil, thereby adversely affecting the soil health. But farmers practicing organic farming had observed the restoration of soil health and increased accumulation of humus, resulting in enriched soil biological activities. Hence this was one of the most important motivating factors for adopting organic farming.

With restoration of soil health and soil biological activity, earthworms proliferate profusely, thereby enhancing the soil physical and chemical properties. This was another reason stated by organic farming respondents who ranked this factor at 18th position. Indeed

increase in earthworm population could be an easily observed indicator in improved soil health due to organic farming practices.

'Sustainable use of resources' was another important ecological reason for organic farming. Excessive use of chemical fertilizers and chemical pesticides had not only disturbed the natural ecological balance but also jeopardized the sustainability in agriculture. In organic farming all the farm production resources are used judiciously and quite efficiently. All production factors, land, water, labour, capital, organic manures, bio-pesticides, bio-control agents, soil microbial flora and fauna, and other natural resources should be used at optimum levels in order to ensure that all resources are used sustainably.

Better quality of food and nutrition, which is accrued from organic farming, was another motivating factor for the organic farmers. With destruction of agro-ecosystem and deterioration of natural resources, the increased pesticide residues in food had raised serious concerns among all for bio-safety and safe food free of chemical residues. Hence the farmers resorted to organic farming to raise safe food and better quality food for not only themselves and their families, but also for general public.

Another important ecological reason for practicing organic farming was its ability to cope with stress and ability to survive crisis, since the organic farmers generally used locally adopted desi varieties, which are sturdy and robust, can withstand vagaries of monsoon. In addition the agronomic practices of mulching, inter-cropping, mixed cropping, biological control of pests and organic manuring, green manuring, etc. would help the organic farmers to face and survive any crisis.

In addition, with the use of locally available internal resources the costs incurred were quite less and any crop loss may not be jeopardizing the economic condition of the organic farmer. Thus organic farming has the ability to mitigate and survive any crisis and this was another reason found for practicing organic farming by the respondents.

Thus, a cursory look at the seven motivating factors of organic farming discussed here revealed that restoration and regeneration of the agro-ecosystem through adoption of organic farming practices was essential for sustainable agriculture and these seven reasons were adequate to justify the adoption of organic farming by the farmers.

Philosophical Factors

The last set of factors from among the twenty listed factors in the table, relate closely to one another in a much broader outlook and way of life or philosophy. They were: sustainable development, self dependence and freedom in farming, 'Live and Let Live' philosophy of life and living in harmony with nature, and these were ranked respectively at 9th, 12th, 13th and 19th positions among the twenty motivating factors.

Sustainable development was adopted as a major philosophy by the organic farmers. The experiences of modern chemical farming were disturbing, as it is resulting in yield stagnation, fluctuations in yields and diminishing returns to fertilizers and highly vulnerable production system, unable to cope with pest and disease attacks. Farmers have realized the ill effects of chemicals on environment. Natural resource base got deteriorated and new problems of minor pests and diseases becoming major ones have emerged. Development itself became unsustainable. But with organic farming, the philosophy of sustainable development got new lease of life. Hence this philosophical factor was ranked at 9th position by the organic farmer respondents.

Over the years, with heavy dependence on external inputs, farming has become completely dependent on market supplies of farm inputs, like seeds, fertilizers, pesticides, etc. Moreover, this dependency has resulted in other problems like, long waiting for the supply of inputs, being not able to complete field operations on time leading to yield losses and losing the sovereignty and independence in farming. But by practicing organic farming farmers were self-dependent and self-driven and enjoyed the freedom in completing field operations on time and with satisfaction since most of the inputs were available within the farm itself.

The philosophy of life of '*Live and Let Live*' was another important philosophical reason for farmers for practicing organic farming. In chemical farming, the indiscriminate use of poisonous pesticides killed all the insects, both harmful as well as beneficial insects. Complete removal of pests had adversely affected the predators too. But in organic farming, use of several plant protection measures would not remove the pests completely, but check its population to below damaging levels, leaving enough insect pests for predators. '*Live and Let*

Live' allows for maintaining ecological balance and this philosophy of life would lead to sustainable development. Hence, organic farmers believed strongly in this philosophy of life.

'Living in harmony with Nature' was another important philosophical reason for practicing organic farming. Farmers believed that Mother Nature has its own ways of creation, destruction and regeneration to maintain the natural equilibrium of the ecosystem, and man's intervention need to be minimal, otherwise his very own survival would be at stake. Hence, the organic farmers had evolved several farming techniques that emphasize this philosophy of living with nature, rather than going against the Mother Nature. Thus, all the four philosophical reasons had emphasized the philosophy of life evolved by the organic farmers through practicing organic farming over the years.

Conclusion

Although differential perception of various motivating factors was observed by the practicing organic farmers, each and every factor has its own role in producing a synergistic effect in the whole organic farming movement. While the economic, ecological and philosophical factors were motivating farmers for organic farming were internal and push factors of propaganda and persuasive communication by agriculture officials would play a greater role in promoting organic farming in Karnataka. More number of awareness campaigns and intensive training courses may be taken up to educate farmers for persuading them to continue practicing organic farming and spread organic farming among small and marginal farmers of Karnataka.

Research Paper-II

Case Studies of Successful Organic Farmers of Gulbarga District

Abstract

In a study conducted among the organic pigeonpea farmers of Aland and Gulbarga taluks in Gulbarga district of Karnataka, four case studies were written on four successful organic farmers to highlight the qualitative aspects of organic farming practices. It has brought out few key lessons for organic farming promoters in evolving appropriate strategies: On a first priority, improve soil health through enhancing biomass, by application of compost and FYM; build infrastructure like vermi-compost pits and bio-digesters for nutrient and pest management; enriching natural resource base through soil and water conservation; diversifying the organic farms with mixed cropping and mixed farming; and finding better marketing avenues for selling organic produce. The case studies also brought out the details of the struggles of farmers in converting to organic farming and the way they have coped up with them successfully.

Key words: *organic farming, successful farmers, model farmers, awarded farmers*

Introduction

Organic farming is a production system of crops, which avoids the use of synthetic and chemical inputs like fertilizers, pesticides, growth regulators and livestock feed additives. Organic farming systems depend mainly on crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic residues, mineral bearing rocks and biological pests control to maintain soil productivity and supply of nutrients. (Anonymous, 2002).

Organic farming basically adopts a systems approach to farming where in on-farm resource use is emphasised to help build self-reliance on the organic farm with low dependence on external inputs. It also highlights the synergistic effect of various components of the agro-ecosystem and their harmonious balance as well as interdependence through recycling of resources from one sub system to another. To

bring home these attributes of organic farming it was envisaged to adopt a case study approach which emphasises in-depth thorough analysis of all pertinent aspects of an organic farm as well as the initiatives and efforts of the organic farmers. Case study attempts to delve deeper into the phenomenon – *the successful case of an organic farmer who has been awarded and considered a model farmer* – and bring out qualitative aspects that may be beyond the reach of quantitative data analysis.

Hence, an attempt was made here to collect qualitative data from a few selected model organic farmers and write case stories and critically analyse them for drawing lessons for formulating action plans for further spread of organic farming.

Methodology

First a list of organic farmers who have been felicitated with *Krishi Pundit* awards and other such awards was procured from department of agriculture and Krishi Vigyan Kendra (KVK). Through discussions with the officials, the '*model organic farmers*' were selected to represent all the villages of the study area. Then these organic farmers were approached for long in-depth interviews and documentation of their organic farming activities and accomplishments. Case study interview guides (See Appendix I) prepared especially for the study were used in conducting the interviews and necessary documentation was done through extensive notes, voice recorder and photography. All the qualitative aspects like contextual background, the chronological events, motivating factors, and interventions made on their organic farms, infrastructure developed and the achievements were noted in detail. Later case stories were written keeping the farm as unit comprising all crops, trees, dairy, and other allied activities. Then each case study was subjected to critical analysis for writing the reflections and for drawing lessons.

Results and Discussion

Here four case studies are presented along with the reflections on each case study. Each case study brought out the highlights of all the qualitative aspects of the successful organic farmer and his accomplishments. Four such case studies were written and analysed here. These are:

1. Shivalingappa's Pearls of Wisdom

2. Shivananda Belli, the Marketing Wizard
3. Mallinath Kollur, the Water Conservator, and
4. Basawaraj Jewangi, the Bold Innovator

The plates containing the photographs of organic farms of the model organic farmers are given for each case. Towards the end, the lessons drawn from all the four case studies are discussed.

Case Study 1: Shivalingappa's pearls of Wisdom

“Saving is earning for me. That's why I always look for ways and means of reducing cost of cultivation by internalizing dependency of inputs on my farm.”

Thus beamed Shivalingappa with a smile of contentment. Indeed that is a pearl of wisdom gained over long years of farming. He had observed that the single most important problem in farming is the ever increasing cost of cultivation that is playing havoc on the farming community. The only way is to look for alternative ways and means to reduce costs in cultivating crops. A bucket with holes would never get filled until and unless the holes are plugged. So he strongly believed in the simple dictum: 'a rupee saved is a rupee earned'

Shivalingappa Chorgasthi, 50 is an acclaimed organic farmer from Bheemalli village in Gulbarga taluk of Gulbarga district in Karnataka. He studied upto P.U.C. (Pre-University Course, equivalent to XII standard) and is engaged in farming for over 30 years. He owned 20 acres of land and used to grow rainfed dryland crops such as jowar, pigeonpea, green gram, black gram and sesamum.

Background Situation

Like many farmers, Shivalingappa too had relied on chemical fertilizers for nutrition management and pesticides for plant protection. Initially, he did not mind the costs as he was getting better yields and better income. Imitating the fellow farmers, he took loans and dug up an open well, only to grow sugarcane. He has replaced his draught cattle with a tractor. The farm-yard manure was replaced with chemical fertilizers. Thus over the years, more and more chemical inputs were used to maintain the same yield level. Gradually, over a period of time, the yields started declining and

the debts started mounting. His life became quite vulnerable. He started wondering: *“What’s happening? There was nothing other than mounting debts in my life. My world was always preoccupied with worries of ‘from whom to borrow and whom to pay’? I was under tremendous stress and confused state of mind as to what to do”*. Shivalingappa lost interest in agriculture and thought of quitting agriculture as a livelihood option, and go out and work as a daily wage labourer to feed at least two meals to his family.

Realization and Enlightenment

Then one day, while searching for something, he had chanced upon an old notebook, in which he used to record his accounts of his farm. While browsing through it carefully, he found that the costs of all inputs (seeds, chemical fertilizers, pesticides, diesel and lubricants for tractor, etc.) had increased over time. He realised that it was this dependency on external inputs, which was the source of all his worries. Thus, he recalled his precarious situation: *“Once I looked back for the cause of my situation, and thought of internalizing inputs. I was also mobilized by Basawaraj’s experiences of organic farming in the neighbouring village.”*

Shivalingappa Chorgasthi had diagnosed the problem and prioritised the critical issues of concern and action. *‘A healthy soil will lead to a healthy crop’*. *So soil productivity is an integral part of organic farming. This is the first issue.*

He observed that soil had become unproductive and had less biomass, biological activity and humus. A healthy soil with good amount of humus will have teeming million of soil micro-flora and fauna and smells differently. So Shivalingappa started applying cart loads of farm yard manure bought from the villages on his return journey from sugarcane factories, after dumping sugarcane. He continued with this practice of purchasing cow dung manure for 2-3 years till he could raise his own dairy animals. He realized: *‘Dairying is an integral part of agriculture; it will take care of soil and human health’*.

So, Shivalingappa purchased buffaloes and bullocks, constructed sheds for them and made pits to collect urine and waste water, which is a good source of organic manure. His farm yard manure stock piled up. Cow and buffalo urine is a good on-farm resource for seed treatment, for making *Panchagavya* and *Jeevamrutha*.

Initial Experiences

In the initial season of converting into organic farming Shivalingappa faced many teething troubles. On the one hand, the soil recovery took longer time and changes were not easily visible. On the other hand, he had to face a lot of criticism not only from neighbouring farmers, but also from members from his own family. But he did not let himself down. He started observing and learning from other organic farmers and got motivated by the farmers' achievements in organic farming through media, like newspapers and TV programmes, like Annadata telecast by etv Kannada.

His confidence got boosted up, when his field was visited by Mr. Ahmed Patel, Assistant Director of Agriculture who had also guided him on technical aspects of organic farming. After seeing improvement in yield and net income in his first organic yield of banana (See Plate II), his conviction and enthusiasm in organic farming got doubled up and he started attending various training programmes and visiting melas and model organic fields in the neighbouring villages and acquired adequate expertise in organic farming techniques. He began to build up necessary infrastructure to move on to second level of organic farming by evolving adequate on-farm natural resource base at his own farm.

Technological Interventions through Government Schemes

Shivalingappa got subsidy from government for purchasing a rotavator (See Plate II) which can be used to chop and mix the crop residues in the soil to improve biomass in the soil. He had also constructed vermi-compost pits (See Plate II), with government subsidy, and a bio-digester plant for making botanical pesticides (for plant protection against specific pests and diseases) through bio-digestion process of non-edible poisonous plants like *Calotropis*, *Datura*, etc.

He has dug up trenches alongside the tree plantations (through financial aid from government), in order to enhance water percolation and reduce water and soil run off. The tree leaves fall into these trenches and get decomposed (See Plate II). The decomposed soil in the pits was collected taken up and applied in crop a field which is a good source of well decomposed organic manure. Thus he had increased organic carbon levels in his farm.

Plate II

Shivalingappa Chorgasthi of Bhemalli village



Vermi-compost pit



Incorporating crop residue with rotavator



Trench for water recharging



Organic Banana plantation



Researcher interviewing the farmer



Farmer receiving *Krishi Pundit* award from CM of Karnataka

Impact of Organic Farming

Impact of organic farming could be seen, albeit slowly and gradually, on restoration of agro-ecosystem and natural ecological equilibrium. Shivalingappa observed that his fields become safer by improving soil health and by improving safety and quality of water and other natural resources. He saw that with increase in biomass in the soil, organic carbon and humus has increased resulting in large number of earthworm population. All these were good indicators of better soil biological activity, better soil quality, and better quality of water and air. So he could confidently feel that the agro-ecosystem of his field has improved considerably.

Shivalingappa's family members felt more satisfied, contented and usefully employed and engaged in organic farming activities and felt healthier and secured. Organic farming had also impacted farmers' lives in helping them to lead healthy and contented and committed lives through organizing themselves into *Savayava Krishi Parivar* (Organic Farmer Families), a formal association promoted by Department of Agriculture.

Although fellow villagers never visited his organic farm, many people from different talukas: Shahapur, Chittapur, Sedam, Chincholi, Afzalpur, Jewargi visited his farm and exchanged their own and others experiences in organic farming. Now Shivalingappa has become a known person and a recognizable face among the extension personnel and other fellow farmers of the district. Thus Shivalingappa became model organic farmer in the region and the state government felicitated him with *Krishi Pundit* award (See Plate II) in 2008-2009. He was also very happy and felt proud to have received award from Honourable Chief Minister of Karnataka.

The impact of organic farming could also be seen on the quality of agricultural produce too. Tuberose flowers were more fragrant and remained fresh for longer hours when grown under organic farming. Banana was sweeter and tastier with better keeping quality, as compared to produce in conventional farming.

Shivalingappa started building up adequate infrastructure for making required organic inputs for practicing organic farming. He has also developed a machine tool room wherein he moulds his equipment through welding machines.

Personal Insights of Shivalingappa Chorgasthi

By practicing organic farming, Shivalingappa felt that his fields have become safer for all animals with improved soil health and improved quality of air and water. So Shivalingappa felt that organic farming methods were gaining wider importance in the present context of commercialisation of agriculture. He strongly felt that giving subsidies or providing organic inputs at subsidised rates was not good for farmers, as it was likely that misuse and pilferage of funds may occur. Instead, he feels, building up infrastructure or constructing composts pits, bio-digesters or such units for generating on-farm resource base that would enable farmers to become self reliant and practice sustainable agriculture.

Shivalingappa Chorgasthi also felt that organic farming was better not only for an individual farmer, but also for the whole country. So it should be adopted on a large scale. Government and non-governmental agencies must monitor and assess the quality of organic produce and give better price for the farmers' produce grown through organic farming. 'Better price is a better incentive than subsidies', thus concludes Shivalingappa.

Reflections

1. Shivalingappa Chorgasthi was an able organic farmer with special attribute of being perseverant, risk taking enthusiastic, hard working, and intelligent. He has the ability to understand and comprehend the key principles of organic farming and internalise them through active practicing. He has great conceptual clarity in organic farming practices.
2. Shivalingappa had clearly diagnosed his problem situation, delineated clearly the critical issues of concern, prioritised them and immediately addressed them. His success secret was in addressing the soil health at the first instance, which had laid a strong foundation for his concept and action. He has improved soil fertility by improving soil health and soil biological activity.
3. Shivalingappa's greatest strength lied in evolving suitable infrastructure on his organic farm through the construction of compost pits, bio-digesters

and efficient use of internally available on-farm resources. He has developed strong natural resource base on his organic farm. His internalising the inputs on the farm has helped him to be self-sufficient, self-reliant and self-confident, through which he has reduced the cost and became debt-free.

4. Another key feature of this case was the diversification and integration of enterprises achieved by Shivalingappa. He had silvi-cultural systems of teak plantations, dairy farm of animals, cropping systems including jowar, pigeonpea, green gram, black gram, sugarcane and vegetables. All these sub systems provided free-cycling and recycling of resources among them making his organic farm much more sustainable.

Case study 2: Shivanand Belli “The Marketing Wizard”

Shivanand Belli, 50 is a farmer of Tadkal village in Aland taluk of Gulbarga district. He is the most popular organic farmer of the region. He gained popularity in that locality as a farmer, who sells his produce at his farm itself, at higher prices than others. Since past several years, he has advertised his farm as an organic farm and interested people flock to his farm after harvesting season and purchase his produce-pesticide free and better quality produce, even at higher prices.

Background Situation

Shivanand Belli studied up to 10th Standard. He owns 45 acres of land, out of which 15 acres is irrigated. He grows pigeonpea, jowar, green gram, black gram and soybean in 30 acres under rainfed conditions. In the irrigated land he grows wheat and grapes (2.5 acres) along with a lemon orchard (4.0 acres) and black jamun orchard (2.0 acres). He has a diary farm with cows, buffaloes and bullocks for draught purpose.

The Beginning and the two initial years

Shivanand Belli had a habit of visiting *Krishi Melas*, farmer’s meetings and usually attracts the attention of the officials of the university or, department of agriculture through his questions with his natural inquisitiveness and child-like

curiosity. He is a natural information seeker and never hesitates to ask questions, even for the 'simplest of the simple ones'. He will keep asking questions, till he is completely convinced with their answers.

Once he visited *Krishi Mela* at Dharwad, in 2004. He was quite impressed with the new varieties and farm equipment there. While he was interacting with officials of the university, he came across Dr. Benege, a scientist of UAS, Dharwad. Amused with his enthusiasm for learning new things, Dr. Benege took him under his personal counseling and invited him to attend the seminars and training courses held there at regular intervals.

Thus Shivanand attended a training programme on 'Enhancing Soil Productivity in the field' in which he came to know about compost preparation, importance of biological activity and biomass in the soil. Equipped with this new knowledge, he immediately went into action, and constructed compost pits with a subsidy of Rs.30,000/- under the new scheme on promoting organic farming. He started making compost with inputs from his dairy farm.

But in the first two years he could not see any visible changes. Although yields were not encouraging, he did not lose his faith in scientists he met at *Krishi Mela*. His family members stood by him throughout these initial years of struggle. Somehow his family members reposed confidence in him and believed strongly in his business acumen, hard work, immense patience and perseverance. The long wait has ultimately bore fruit and in the third year of practicing organic farming, his crop yields had increased which boosted his morale. Then he started putting in more interest and effort in organic farming.

Building up a viable organic farm

Shivanand Belli had started building up necessary infrastructure for his farm. He had constructed bio-digester (see plate III) for making bio-pesticides using the poisonous plants that cows and buffaloes refrain from eating such as *Calotropis*, Neem, *Datura*, and other herbs. He used these bio-pesticide preparations for controlling leaf eating caterpillars and other sucking pests.

Shivananda Belli of Tadkal village



Organic Lemon plot



Organic pigeonpea field



Black Jamun orchard



Bio-digester tank



Grape vine yard



Vermi-compost pit

For nutrient management, he had constructed vermi-compost units (see plate III) and tanks for preparing *Panchagavya*, *Jeevamrutha* and other organic nutrient supplements. For application of farm yard manure (FYM) and vermi-compost to lemon trees, he devised a new way of digging trenches around lemon plants and added farm yard manure and compost at the root zone below the surface and covered it up. He believes that it would be less useful if compost is put at the base of the plant.

In 2009-10, he grew pigeonpea (see plate III) in 22 acres and fodder maize in 8 acres for his cattle. In pigeonpea he had applied ten tractor loads of FYM and compost, and sprayed Neem Seed Kernel Extract (NSKE) during flowering stage and got a yield of 60 quintals, but sold at Rs.7000-8000 per quintal at his own farm, which was much higher than market price. He has planted a lemon orchard (see plate III) in four acres and grows lemons organically and earns Rs.4 lakh per year, by selling lemons directly to all bars and restaurants in Gulbarga city. He had grape vine-yard (see plate III) in 2.5 acres and earns Rs. 6 lakhs per year. He had also taken up wheat (especially for porridge) which is in great demand among customers for its better quality.

In addition, he had planted teak trees along the bunds in his farm, as a long term investment, which can provide money whenever urgently needed. He had planted black jamun trees (see plate III), knowing that there is great demand for these fruits in cities.

Beliefs and Convictions

*“We are the researchers of our own farm.
If we keenly observe, we get solutions
for major pests and diseases in our own field”*

Thus believes, Shivanand. He believes that the farmer should visit his fields daily, constantly supervise, keenly observe and analyse the changes occurring in his agro-ecosystem and try to find the remedial measures within the field itself. The farmer need to act as a researcher and question himself and seek possible reasons for changes in his farm setting. Indeed constant vigil, observation and analysis is required to run an organic farm successfully.

Shivanand takes up deep ploughing in summer so that there will be adequate soil solarization, which will kill harmful micro-organisms and allow for better percolation of rain water. He strongly believes that optimum soil moisture and biomass content will improve soil biological activity which will enhance humus content in soil, and consequently result in better crop yields.

Shivanand also believes that organic manure, vermi-compost, etc. are complete in all essential nutrients and micro-nutrients for plant growth. So, he raises adequate number of cattle for preparation of compost, *Panchagavya*, *Jeevamrutha*, etc. for providing balanced plant nutrition to his crops and trees and for getting better quality crop produce. Although he gets orders for supply of vermi-compost and farm yard manure, he strongly contends that given a chance, he will purchase organic manures, but he would never sell any.

*“It's not great to grow 30 bags of produce
by incurring costs to the tune of 20 bags.
Instead it is great to grow only 20 bags
by spending the costs of one bag”*

That is the business acumen of Shivanand Belli. He always believes in internalizing the inputs, thereby reducing costs of cultivation. He declares that he had always tried to take back at least six rupees for every single rupee invested.

Shivanand is a hard worker and is usually found intensively engaged in field operations in his farm. Agricultural officials would never miss to visit his farm, whenever they pass-by his farm. He is a member of the *Savayava Krishi Parivar* and improved his organic farming practices by visiting the fellow member's farms.

Shivanand also believes in the following simple truth

*“Seeing is believing and
Learning by doing”*

He believes that one will have more understanding of the concept and practice of organic farming, when seen once by the learner. So he surveyed model organic farms across the length and breadth of Karnataka and Maharashtra. He is also inspired by and has adopted some of the practices of Sadananda Gowda, an organic farmer from Doddaballapur taluk near Bangalore, earning an income of Rs.16 lakh from 2.5

acres of diversified organic farm. Thus Sadananda Gowda became a role model for Shivanand.

As he believes in learning by doing, before taking up grape cultivation, he sent his son to stay and learn from successful grape farmer in Pune, so that his son could get well acquainted with grape cultivation practices from his direct experience of working along with the labourers there. By this, he could get a bumper crop of grapes, and earned more.

Marketing Techniques

Shivanand is quite adept at creating markets for his organic produce. He had developed unique ways of making his produce gain demand among the consumers, by tactfully avoiding any middlemen.

Once in 2008-09, he visited *Pusa Krishi Vigyan Mela* at New Delhi where he purchased 5 kg of baby corn seeds, which he had grown in half an acre plot. When the baby corn was ready, he took them in small packets and distributed free to all the higher officials of district administration, police, agriculture department, etc. in the city. After that, they started coming back searching his farm to purchase baby corn. He got Rs 80,000 profit from a half acre plot. So he feels that once the consumers get a taste of the organic produce they keep coming back. Thus the customers come to his organic farm. That is the secret of marketing, according to Shivanand Belli, who works on creating a demand for his better quality produce, rather than running after markets and customers.

From the beginning, Shivanand Belli had created his organic farm as a sales point for his better quality organic produce. Whenever, new products are grown, he goes around and distributes free to the higher officials for publicity, sampling and trial. Once the customer is hooked, he or she would run to his farm and would buy at higher prices, which they do not mind to pay for the assured best quality of produce.

He had also avoided any middle-men/agents who may eat away his share of consumer rupee. With respect to lemons, he is the sole distributor to all the 130 bars and restaurants in Gulbarga city. Now his black jamun fruits will reach the tables of higher officials very soon to create demand for his organic jamuns.

After every harvesting season, his organic farm gets busy in selling organic produce to the consumers visiting his farm. Shivanand is a generous and kind person and he feeds the consumers his fruits for tasting purposes and believes that the taste on their tongues lingers long enough to draw them back to his farm one day, for business transactions.

Strategies Suggested by Shivanand Belli

- Farmers in general are still not aware of the benefits of organic farming. Even if they are aware also, they do not know the details of the organic farming practices. So government and other agencies like KVKs should actively involve in the demonstration of organic farming practices of *kharif* and *rabi* crops.
- Forest and horticulture departments should develop nurseries and supply saplings and other planting materials so that farmers can diversify their fields.
- Shivanand Belli's lemons are known for their size and better juicy content. He is confident that his lemons can fetch better price, if exported to other countries. Now, he wants to take the lead in forming a lemon grower's group, train them with organic practices to enhance the quality of their lemons and export them collectively by pooling all the produce of all lemon growers. So, there should be better infrastructural set-up and export promoting agencies, which can really boost up the farmer's socio-economic status, for which farmers will be happy and continue to feed the nation.

Reflections

1. Shivanand Belli is good at both hard working and smart selling. Basically, he appears to be a shrewd businessman who deliberately creates a demand for his new product and enjoys the monopoly in trade and business. Since the people are not aware of the good taste of organic produce he supplies free samples to make people get addicted to the better taste and quality of his agricultural produce of his organic farm.

2. He mastered the organic farming practices, developed necessary infrastructure for making organic manures and bio-pesticides on his farm and made his farm self-sufficient for local internal resources. His greatest wealth lied in the organic manures that he made at his farm which he does not want to part with. His internalisation of inputs is the key to his ability to earn adequate returns on investment.
3. Although Shivanand is less educated, he had developed strong convictions and beliefs on the principles involved in the concept and practice of organic farming. He is able to convert a part of his farm into organic initially, and he would soon convert whole of his farm into completely organic. He may need further technical guidance and training to enhance his conceptual clarity, zeal, coverage and leadership qualities among the *Savayava Krishi Parivar*.

Case Study 3: Mallinath kollur "The Water Conservator"

*“The bore wells which were once considered dead and
Dried up are now over recharged, Sometimes Water
Comes out automatically without being lifted”*

That’s the miracle that captured the attention of one and all. Mallinath was in news headlines for his remarkable achievement of water conservation efforts made on his farm. All the agriculture magazines published his success stories of recharging of wells in his fields in the dry land tracts of northern Karnataka.

Mallinath Kollur, 47 is an organic farmer residing in Melkunda village in Gulbarga taluk of Gulbarga district. He left his school after 7th standard and started farming since 1975. He has 35 acres of land, of which two acres are covered by deciduous shrubs; 5 acres are open pasture lands with a green cover during monsoons and remaining 28 acres under cultivation. He started organic farming in 2006 and presently covering an area of 10 acres. He grows dry land crops like pigeonpea, jowar, bajra, groundnut etc.

Background Situation:

Earlier, when Mallinath was practicing inorganic farming he used to grow dryland crops by bringing inputs like chemical fertilizers, pesticides, weedicides, etc on credit from the dealers and the commission agents. He used to get even cash on credit from them to pay for the cultural operations. After harvesting the crop, he was forced to sell the produce to the same commission agent at very throwaway prices.

“Every season, when I used to go through the accounts, the principal and interest amount used to be more than the price of produce and every time I used to come back with empty hands. I used to feel that my hardwork is not rewarding me!”

Thus, Mallinath was trapped under debt all the time and since he had lost the liberty to sell his produce elsewhere for higher returns, he had continued to be debt ridden. Again for the next crop, he was forced to get inputs from the same commission agents/dealers and sell back the produce only to them. This vicious cycle continued for years and his debts increased.

As Mallinath was ending up in zero net profit in crops, his family needs were taken care of by the dairy farming. His parents used to advise him not to sell land, cattle and buffaloes, as they are the only source of their livelihood security. So their advice paid him in the lean period.

Reasons for Conversion to Organic Farming

Mallinath Kollur got motivated to convert to organic farming, specifically for two reasons: *One reason* was the shortage of inputs like fertilizers. For instance, Diammonium phosphate (DAP) fertilizer was supposed to be sold at Rs.485 per bag, but due to shortage, he was forced to purchase it at Rs.600-700 per bag after struggling through a long queue and in less quantity than required. Moreover, the total costs on fertilizers for all of his fields would be around Rs.20,000. So he felt that regular application of Farm Yard Manure (FYM) could be a cheaper alternative. Initially, he was unaware of the benefits of organic farming practices but he was left with no option but to learn more about them and practice them due to irregular supply of external inputs.

The second reason that motivated him was Dr. Benege in-charge of KVK of Gulbarga who stood by him and meticulously taught him the technical details of organic farming practices and encouraged him. Dr. Benege had not only evinced his knowledge and merits of organic farming, but also provided details of various promotional schemes, which Mallinath could avail of to practice organic farming.

Thus, both '*push*' and '*pull*' factors operated in motivating Mallinath to convert a part of his farm into organic farming. While the bleak situation of inorganic farming with expensive external inputs '*pushed*' him, the encouragement of KVK staff '*pulled*' him into organic farming.

Initial Experiences

With adequate training in organic farming at KVK of Gulbarga, Mallinath started organic farming in his fields. Since he has dairy animals (See Plate IV), farm yard manure was available in good quantity and he started applying in his fields.

He received a subsidy of Rs.30,000/- for construction of vermi-compost pits (see plate IV), and made use of available farm yard manure. He bought neem plants from the forest department and planted all along the border and prepared Neem Seed Kernel Extract (NSKE) for spraying on crops to control leaf eating caterpillars. He took up the azolla cultivation (see plate IV), which he is using it as cattle feed as well as a source of nutrition for crops (with the ability of biological nitrogen fixation).

He started visiting *Krishi Melas*, seminars, *charcha goshtis* and training courses, and learnt many new things about organic farming. Wherever melas are organized; he exhibits his produce and get prizes for them. This motivated him a lot to travel distant places, like to attend the *Krishi Mela* at University of Agricultural Sciences (UAS), Bengaluru. He believes in vertical exchange of knowledge between scientists and farmers, as well as in '*horizontal exchange*' of knowledge between farmers, which enriches the knowledge base of the recipients.

Mallinath received first prize for having highest number (27-29) of internodes in sugarcane (see plate IV) at *Krishi Mela* organized at KVK Gulbarga in 2010. He got more interest by awards and recognition and involved himself more earnestly than ever in field operations on his organic farm.

Mallanna Kolli of Melkunda village



Organic Sugarcane Field



Organic Pigeonpea



Cattle shed



Vermi-compost pits



Researcher interviewing the farmer



Azolla cultivation

Water Conservation Measures

Mallinath had constructed check dams across nallas in his fields and did some soil and water conservation works by availing funds from ‘*Krishi Ponds*’ scheme of the government. He planted neem trees along the border to help enrich micro-climate. When the check dams collected rain water, water table had risen gradually over a period of time. The bore wells which were considered dried and failed once upon a time, started getting recharged. Sometimes, water oozes out of dead borewells, automatically without any of the efforts of water lifting. With the recharging of aquifers, he was able to conserve water and use it for providing life-saving irrigation for his crops. This success story of Mallinath’s water conservation efforts was published for many times in newspapers, magazines and he became quite popular among the agricultural officials of the district as well as the state.

Vegetable Production

Over a period of time, in order to increase his profits, he took up vegetable production in 4 acres through organic farming techniques. Gradually most of the farmers of his village (who were having assured irrigation) started growing vegetables; green leafy vegetables, palak, methi, amaranthus, tomato, brinjal, bhendi, chillies etc., by taking advantage of the proximity of their village to Gulbarga city which provided them the assured market.

Pigeonpea Seed Production

Mallinath had also participated in the Farmer to Farmer seed exchange programme. He used to grow certified seeds of pigeonpea in his fields (See Plate IV) and distribute his produce among fellow farmers of the village as seed for next sowing season. In this way, he earned more profit per acre.

Over a period of time, Mallinath became a member of the *Savayava Krishi Parivar* and became famous among the farming community and agricultural officials of the district. Through his persuasion and influence, many of the farmers of the village started adopting organic farming practices.

Under the new scheme of Karnataka Chief Minister's one day stay at Organic Farmer's home, Mallinath was chosen and he was quite happy to play host to former Chief Minister (CM) Honorable Sh. B. S. Yediyurappa and proudly announces: "Organic Farming brought CM to my home".

Strategies suggested by Mallinath Kollur for Promoting Organic Farming:

- Banks should extend credit facilities to farmers for building up of infrastructure facilities required for adopting organic farming practices. The interest rate should also be made cheaper to avoid commission agents exploiting the farmers.
- Government should come out with a special scheme of organizing 'Organic Field Town' across the state in order to show model organic farmers and demonstrations to interested farmers.
- Pesticide companies need to be banned/closed in order to ensure large scale adoption of organic farming practices by the farmers.

Convinced with organic farming since it involves indigenous technical knowledge (ITK), Mallinath declares thus:

*"Farmers should help one another.
They should come together for sharing knowledge and
come out with new innovations in organic farming... Then
I give guarantee, no one will fail in organic farming"*

Reflections

1. Mallinath Kollur has passed through hardships and the need to convert to organic farming had been strongly felt by him. Co-incidentally, timely technical support from KVK had reinforced his determination to shift the whole paradigm from one of helpless dependence to one of sustainability and sovereignty at farm level. Hence Mallinath could succeed in his organic farming efforts.
2. Simple soil conservation practices like constructing check dam across nallas in his fields had resulted in wonderful recharging of aquifers and brought alive dead bore wells. He became quite famous with this single remarkable

achievement of his life. His perseverance and patience paid him in the end with dividends and bonuses of prosperity.

3. Dairy farming activities being taken care of by women folk and aged parents had been a boon to Mallinath as it rescued him and his family from misery while the crops could not sustain his livelihood. In addition the continuation of dairying had helped him in speedy recovery when converting to organic farming by providing adequate farm yard manure and compost for nutrient management of dryland crops. Hence dairying should be encouraged since it is an essential component for promotion of organic farming among farmers.
4. Media also played a pivotal role by bringing an ordinary farmer like Mallinath into limelight through his water recharging of dead borewells and providing him space for airing his views on organic farming, water conservation, vegetable production and farmer to farmer seed exchange programme. With media support, his influence among the villagers has also spread even bringing Chief Minister (CM) to his doorstep and allowing him for providing “*Athithi Satkara*” to honorable CM of the state.

Case Study 4: Basawaraj Jewangi "The Bold Innovator"

“For the first time, I sowed pigeonpea by mixing compost with seeds. In the next crop, I added cow urine with compost anticipating some improvement. For the 3rd season, I soaked pigeonpea seeds in Jeevamrutha before sowing. For the 4th time, I treated seeds with Trichoderma. In this way, I was initially trying ways and means of improving pigeonpea yields”

Basawaraj is an ardent experimenter. He was sure that his experiments may not give disastrous results, because he was using simple inputs, available on his own farm. He was able to observe visible changes in organic farming practices. His constant urge to improve was the precursor to all his bold experiments, Indeed he was a bold innovator and experimenter among the organic farmers.

Basawaraj Jewangi, 42 is an organic farmer of Pattan village in Aland taluk of Gulbarga district. He is a large farmer owning approximately 50 acres of land. He grows *kharif* crops: pigeonpea (See Plate V), sunflower, green gram, black gram, etc

and *rabi* crops: Jowar, chickpea, rapeseed, etc. and other crops like sugarcane, vegetables and papaya in his fields. In addition, he has other allied sources of income.

Background Situation

Inorganic farming using chemical fertilizers and pesticides had become unsustainable over a period of time. In spite of being a large farmer with 50 acres of land and a good dairy farm, his economic condition was going down, year after year. He wanted to try something new. He was looking for alternative means of farming. This was the prime reason behind his conversion to organic farming.

In addition, he had good rapport with agricultural officials of the district. Since he was a large farmer and exerted a lot of positive influence in local politics, he has easy access to agricultural officials, who gave him technical advice and support to convert his farm into an organic farm.

Initial Experiences

Owing to the two reasons cited above: the ‘push’ factor of unsustainable inorganic farming and the ‘pull’ factor of the technical guidance and support from agricultural officials, Basawaraj had converted to organic farming, six years ago in 2005.

When he got initiated into organic farming practices, he used to take up all sorts of experiments to see and verify the performance of each organic farming practice suggested to him. In seed treatment alone, he began many experiments of trying with vermi-compost, cow urine, *Jeevamrutha* or *Trichoderma* etc. for treating pigeonpea seeds before sowing.

Seeing his bizarre ways, other farmers in the neighbourhood started criticising him and ridiculing his ways. But he did not care for their comments and continued to practice organic farming. He had a gut feeling that he was always right but had great patience and perseverance to witness visible changes and acceptable results. He never bothered about any risks of failure as he was having other sources of income in his family. He was a resourceful large farmer, who has diversified his farm with field crops, dairying, horticultural crops, and agro-forestry (See Plate V).

Building Necessary Infrastructure for Organic Farming

From the very beginning, Basawaraj Jewangi was encouraged by the results of organic farming. He was happy to note that costs have reduced considerably, yields were maintained at acceptable levels and soil productivity had improved. At present he was practicing organic farming in 26 acres.

“Converting 26 acres under organic farming is indeed a very big task. I needed huge amounts of farm yard manure, crop residues and vermi-compost for maintaining soil productivity”

Reminisces, Basawaraj, who took extra pains to collect organic waste from all available sources (internal and external). First, he had constructed large vermi-compost pits (See Plate V) for which he got a subsidy of Rs.30,000/- from government. He had cattle at home that provided adequate quantities of cowdung and waste for composting. In case of shortage, he used to purchase cowdung from neighbours for preparing vermi-compost.

In this way, he gradually reduced purchasing fertilizers and has now completely internalised inputs for nutrient management on his farm with farm yard manure, vermi-compost, green manuring with dhaincha and other legumes and special concentrates like *Panchagavya*, *Jeevamrutha* as sources of soil plant nutrients.

Basawaraj Jewangi gave special importance to enhance soil productivity by increasing levels of organic carbon in soil. He purchased two rotavators and engaged labourers to incorporate crop residues into the soil immediately after harvest. This was beneficial to the soil as adequate bio-mass gets added to soil, thereby increasing soil biological activity.

But, his fellow farmers used to burn the crop residues to keep the field clean for taking up next crop. On seeing this, Basawaraj persuaded them not to burn but give him, thereby reducing their burden of burning it. He used to get the crop residue from other farmer’s fields and incorporate in his own field. When the neighbours saw improvements in crop yields in Jewangi’s fields, they stopped giving him and started incorporating crop residues in their own fields.

Basawaraj Jewangi of Pattan village



Bio-digester tanks



Vermi-compost pits



Diversified organic farm



Organic pigeonpea



Researcher interviewing the farmer



Organic Papaya farm

Mulching was another organic farming practice that Basawaraj practiced regularly, as he found very clear benefits of mulching in maintaining soil temperature, avoiding weed growth, conserving *in-situ* soil moisture and improving soil biological activity. He used to apply one crop residue as mulch in another crop field.

For pest and disease management, Basawaraj constructed a series of bio-digester tanks, earmarked for specific solutions for plant nutrition and plant protection. Each tank was marked with the formula of ingredients (See Plate V) and their specific doses to be added to the bio-digesters. This has facilitated the labourers in their works. At the base of each tank, a tap is fitted to facilitate easy collection of botanical extract for spraying in crop fields.

Commercial success

Along with dryland crops, Basawaraj had also taken up sugarcane cultivation and reaped good harvest. He had also started papaya cultivation initially in 2-3 acres. When he found that he achieved complete competence on papaya cultivation techniques, he expanded acreage under papaya to 16 acres. He has grown a new hybrid of papaya (See Plate V), whose seed costs Rs.1.85 lakh per kg (sufficient for 50 acres). He had adopted organic farming practices, except resorting to a few sprays of chemical pesticides in extreme cases of severe viral disease attack. With 970 plants per acre, and an yield of 50 kg of papaya per plant, Basawaraj claims proudly that he earned an income of Rs. two lakh per acre by selling papaya at Rs. 4 per kg. He sells his papayas with spot payments of cash in his own field. In fact a group of Gujarat traders descend in Gulbarga district and start negotiating with farmers, and once the deal is finalised, get the harvesting done, pack them and transport papaya to Delhi's wholesale market. In 2011, Basawaraj, planned to grow papaya in 75 acres by taking land on lease from neighbours. He has also taken up vegetable cultivation as he found assured market in nearby Gulbarga city.

Equipment, Machines and Infrastructure

Basawaraj Jewangi had become quite famous in the region as the organic farmer with big infrastructure of large vermi-compost pits, bio-digesters, sprayers, rotavators etc. He felt strongly that necessary effort needs to be done to mechanize

even organic farm to reduce heavy dependence on manual labour. He had purchased a rain gun which can irrigate crop by heavy jets of water sprays in case of failure of rains. He has also a large collection of tractor drawn implements designed for intercultural operations.

Personal Insights

Basawaraj found that the first and foremost benefit that got accrued through organic farming was the reduction in cost of cultivation as internalisation of inputs was achieved. The second important benefit was improved soil biological activity due to increased humus content because of increased bio-mass incorporation in soil, resulting ultimately in enhanced levels of soil fertility. The third most important benefit of organic farming was pesticide-residue-free safe food for human beings as well as animals. Safe and better quality food could be obtained through organic farming that has got more demand in the market.

Strategies suggested by Basawaraj

Organic farming is a labour intensive practice. Labour shortage and drudgery issues may loom large in future. Hence it is suggested that agricultural engineers design new machines, new tools, and new implements that can reduce labour requirement. The machines and implements that were already tested need to be manufactured on commercial level and sold to the farmers at subsidized rates.

The Agricultural Produce Marketing Committee (APMC) should have separate section for marketing of organic produce and for providing training and awareness to farmers.

Reflections

1. Basawaraj Jewangi has been conducting experiments in organic farming in his own fields. Having understood the key issues of organic nutrient management and botanical pesticides in organic farming, he constructed large vermi-compost pits and bio-digesters on his farm. This infrastructure has played a key role in the success of his big organic farm.

2. His discontent with unsustainable inorganic farming and his rapport and influence among agricultural officials of the district had pushed him to seek alternative means and hence converted his farm into an organic farm. Since he is a resourceful large farmer, he took bold initiatives to build up large infrastructure base for managing 26 acres of organic farm.
3. Basawaraj Jewangi had taken initiative in devising and implementing strategic plans for practicing organic farming in 26 acres, nearly half of his total owned land. He foresaw labour shortages and built large infrastructure of compost pits and bio-digesters for nutrients, weeds, and pest and disease management, through organic means, on his large organic farm. He will constantly look for new machines, tools and equipment that may reduce dependency on manual labour, and would try their performance on his farm.
4. Basawaraj was able to successfully apply large quantities of organic manures in his fields. He even brought crop wastes from other farmers' fields. This is an indication of his strong conviction that adequate biomass is required to enhance soil biological activity which is crucial to organic farming practice. It was evident from this case study that organic farming could be practiced quite successfully on large farms also without any false apprehensions of lack of organic resources of manuring crop fields and orchards.
5. Basawaraj is large farmer with huge political and social influence. By his organic farming practices, he is known as "an organic farmer with mechanical farm". Through his papaya cultivation, he is known as 'papaya man' of the region. He is most respected among the officials of the district administration for his excellent organic farming practices. Basawaraj has shown very clearly that organic farming is possible, once the farmer is convinced, even on a large scale.
6. Basawaraj had also suggested that government should invest in providing adequate infrastructure in district and taluk levels, in order to give major boost to organic farming, without any delays and apprehensions. Organic farming is beneficial to everyone: soils, human beings, animals and agro-ecosystem as a whole.

Discussion

A thorough analysis of the four case studies and their reflections was done to bring out useful lessons for promotion of organic farming: improving soil health, building infrastructure for organic farming, enriching natural resource base, marketing of organic produce, and diversification of agriculture. These are discussed below;

1. Improving Soil Health

Soil is the living medium of millions of micro-flora and fauna and ensuring soil health would be the foundation for sound organic farming practices. Using rotavator to chop and mix crop residues for increasing soil bio-mass, application of cowdung manure and vermi-compost would enhance soil microbial activity and enhance soil health and soil fertility. Mulching the top soil would reduce soil moisture loss and help maintain conducive soil temperature.

Shivalingappa Chorgasthi and Shivananda Belli had great conceptual clarity on these basic issues of soil health management, the backbone of sound organic farming practice. They have been successful organic farmers only because they took adequate care of maintaining soil fertility through enhancing organic carbon in their organic farms.

2. Building Infrastructure for organic farming

Organic farming requires huge quantities of organic manures and bio-pesticides for practicing organic farming in large farms. Hence adequate infrastructure is required: large vermi-compost pits for making vermi-compost, large bio-digesters for making bio-pesticides, and adequate space for stock-piling crop residue wastes, farm yard manure and vermi-compost. In addition, rotavators are required for chopping and mixing crop residues in the soil for enhancing soil biomass.

Shivalingappa Chorgasthi, Shivananda Belli, Mallinath Kollur and Basawaraj Jewangi have all took steps in building compost pits and bio-digesters on their farms. In addition, all of them have used special machines and equipment for soil

conservation measures, mixing crop residues in fields, and improving natural resource base of their organic farms.

3. Enriching natural resource base

Soil and water are the two natural resources that farming relies on. So adequate care is required for soil and water conservation. The nallahs passing through the fields may be protected by building check dams so that soil erosion is reduced and water is harvested for irrigation purposes. The aquifers get recharged if adequate water conservation measures are taken at right time. Mallinath Kollur could achieve this feat of rejuvenating his dead bore wells in his fields. Growing several forest tree species like teak on bunds had helped in efficient use of the open farm spaces and its leaf litter had been used in mulching and vermi-compost preparation, Neem trees were used in preparation of NSKE for plant protection of their crops. Other plant species like *Calotropis*, *Datura*, *Vitavax*, etc. have been used to make bio-pesticides in bio-digesters. Through these measures, the agro-ecosystem of their organic farms has been restored and enriched.

4. Marketing of Organic Produce

Finding appropriate market for organic produce is the key to the success of organic farming. Since the organic produce has its own special qualities like better taste, and healthy (being pesticide-free), these organic produce need to be popularised among health-conscious urban people, who may be willing to pay extra money for better quality. Shivananda Belli tactfully exploited this aspect in marketing his organic produce by selling at his farm gate at higher prices. He had mastered the technique of luring his customers to his farm by sampling his products freely to his farm visitors.

Since the yield loss in the initial years was high in organic farms, the farmers need to be provided adequate marketing support through better prices rather than giving subsidies. Better marketing infrastructural set up may be established to enable certification, grading, packing and trading facilities under a single roof would help ensure better price for organic farmers and genuine organic produce for consumers.

5. Diversification in agriculture

Agriculture does not mean only growing crops. It needs to be supplemented with raising cattle, cows and buffaloes, growing trees, and fruit trees. The cow dung from dairy has been a great source of plant nutrition used in making *Panchagavya*, *Jeevamrutha*. Various sub systems of the organic farm: the agri-horticulture, agri-silviculture, silvi-horticulture and silvi-pasture systems have been practiced by these successful organic farmers. Organic farming basically adopts a systems approach to farming, wherein on-farm resource use is emphasised to help build self-reliance on the organic farm with low dependence on external inputs. It also highlights the synergistic effect of various components of the diversified agro-ecosystem and their interdependence through recycling of resources from one sub system to another.

Conclusion

It can be concluded that these case studies have brought key lessons for organic farming promoters and organic farmers to enable them to develop specific strategies for further spread of organic farming among pigeonpea growers of the region as well as for the whole state of Karnataka. Starting with improving soils and developing infrastructure for making organic manures and bio-pesticides would play a pivotal role in further spread of organic farming across the state and country.

Research Paper III

Economic Viability of Organic Farming *vis-à-vis* Conventional Farming

Abstract

In a study conducted in Gulbarga district of Karnataka among pigeonpea growers, an attempt to critically analyse and compare the economic viability of organic pigeonpea cultivation revealed that the cost benefit ratio (BC ratio) in all the three systems of sole pigeonpea crop, pigeonpea + green gram and pigeonpea + black gram was higher in organic farming in comparison to conventional farming. The cost benefit ratio for pigeonpea + green gram was the highest at 1:1.56, while it was lowest at 1:1.16 for sole crop of pigeonpea grown under conventional farming practices. Costs incurred in the management of nutrients, pests, diseases and weeds were lower in case of organic farming of pigeonpea either as a sole crop or as an intercrop with green gram or black gram.

Keywords: Economic viability, cost-benefit ratio, organic farming, conventional farming, pigeonpea based cropping systems

Introduction

All stakeholders the farmers, researches, policy makers, extension workers, and consumers are increasingly concerned about productivity and economic viability of different farming practices. While conventional farming practices give better yields, it is argued that costs incurred may be more compared to organic farming practices, but organic yields may be less. Some would say that labour costs would be more in organic farming, while some others may say the fertilizer and spraying costs may be more in conventional farming. But scientific evidence was meager to say which one is good for farmers

However, scanning through few studies, the following key issues emerged: Expenditure on fertilizers and sprays was substantially lower in organic farming than in conventional system in almost all cases. It has been estimated that these two critical inputs accounted for nearly 30 per cent of total cost in the conventional farming (Padel and Lampkin, 1994; Offerman and Nieberg, 1999).

In India, the economics of cotton cultivation over a period of six years indicated that there was a reduction in cost of cultivation and increased gross and net

return in organic cotton compared to conventional cotton cultivation (Gera, 2010). In Gujarat, organic production of sapota (chickoo), banana and coconut had higher profitability but field crops and mango had both lower input costs as well as yields (Naik, 2001).

The common organic agricultural combinations of lower input costs and favorable price premiums can offset reduced yields and make organic farming equally and often more profitable than conventional farms (Hanson, *et al.*, 1997; Peterson *et al.*, 1999).

Hence, both yield and costs need to be calculated for pigeonpea cultivation in order to assess their economic viability. Calculating costs of cultivation is a contentious issue with variability of input use, labour use across farming system among the farmers. So an attempt was made here to bring clarity to the issue of economic viability by empirical observation, analysis and inference by collecting data from farmers and various costs and returns and subject the data to further data analysis to draw inferences.

Methodology

The study was conducted in Gulbarga district in Karnataka, the pulse bowl of the India. Sixty organic farmers and sixty farmers practicing conventional farming were selected through random sampling. Data on costs of cultivation were collected, using a structured schedule, from forty farmers (20 organic and 20 farmers practicing conventional farming) from each group of farmers growing pigeonpea under three cropping systems: (i) sole crop of pigeonpea, (ii) inter-cropping of pigeonpea with black gram and (iii) inter-cropping of pigeonpea with green gram (See Plate VI). The data thus collected were vetted with the officials of Tur Board to remove any errors.

The detailed procedure adopted in calculating costs can be seen in Appendix-II, where in all the details of the amount of inputs, their unit costs, number of labour used (man days) were given on per hectare basis. These details were given separately for organic farming practices and for conventional farming practices. While calculating costs, all variable costs were computed for inputs (Cost A) and to which were added fixed costs and interest on fixed costs (Cost B) and to which the imputed value of family labour was added to arrive at total cost (Cost C). Data on yield (main crop and inter-crop), cost of production per quintal of product was computed. Then

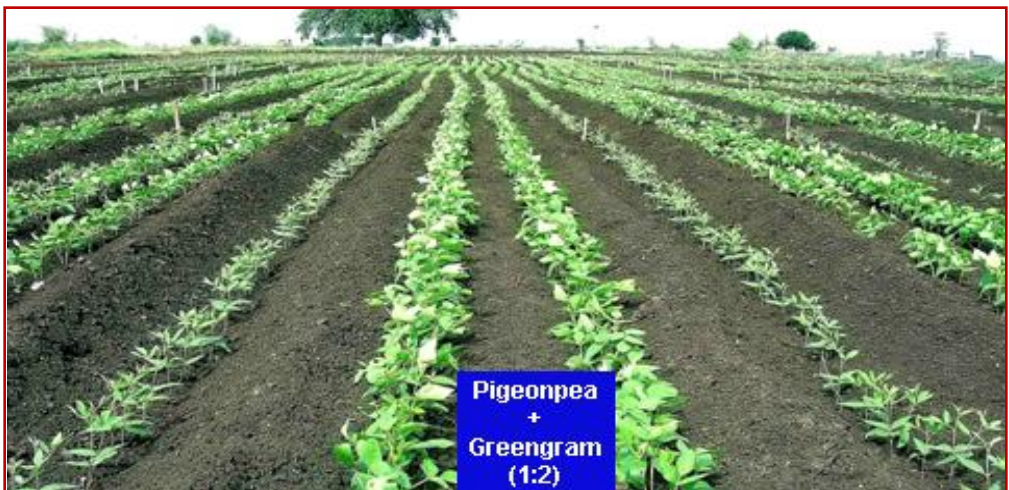
Pigeonpea based cropping systems



Pigeonpea (sole crop)



Pigeonpea + Black gram



Pigeonpea + Green gram

values of main crop product and inter-crop product were computed taking the market price to arrive at gross returns. In addition, return on variable cost (Cost A) and return on total cost (Cost C) were also computed. In the end cost benefit ratios over variable costs and over total cost were computed. All the computations were done on per hectare basis.

Results and Discussion

In order to assess the level of productivity and economic viability, the cost of cultivation was computed and compared between organic and conventional pigeonpea cultivation. Three systems of pigeonpea cultivation; sole crop, inter-cropped with black gram and green gram were also compared.

Sole Crop of Pigeonpea

In the cultivation of sole crop of pigeonpea, the cost of cultivation per hectare was presented in Table 4.3.1. It was observed that the yield per hectare in organic cultivation of pigeonpea was slightly lower (12 q) when compared to conventional cultivation of pigeonpea (12.5 q). Similar result was reported by Manjunath (2005).

A comparison of the results revealed that the total variable cost (Cost A) for organic pigeonpea (₹ 23956/-) was lower than pigeonpea grown under conventional farming (₹ 26346/-) and accounted for 72 per cent and 85 per cent of total cost respectively. The major costs incurred on nutrient, weed, pest and disease management were lower at ₹9945/-(29.9%) in organic pigeonpea than at 12310/- (35.22%) in conventional pigeonpea cultivation. However costs incurred in land preparation and basal organic manure application were higher in case of organic farming (₹9317/- : 28%) than in conventional farming (₹ 6169/- : 17.65%) of pigeonpea. Costs on all other components were more or less similar in both cases.

Cost B of organic pigeonpea (₹ 31446/-) was lower than pigeonpea grown under conventional farming (₹ 33837). The rental value was same for both systems of pigeonpea cultivation.

Table 4.3.1: Comparative analysis of economic viability of organic and conventional Pigeonpea cultivation N=40

No.	Particulars	Organic Pigeonpea (n=20)		Conventional Pigeonpea (n=20)	
		Value (₹/ha)	% to total cost	Value (₹/ha)	% to total cost
A.	Cost A				
1.	Seed	911	2.74	1107	3.17
2.	Seed Treatment	53	0.16	41	0.12
3.	Organic manure	3609	10.85	1407	4.03
4.	Land preparation	5708	17.16	4762	13.62
5.	Sowing	1647	4.95	1707	4.88
6.	Weed management	1399	4.21	2057	5.89
7.	Nutrient management	2374	7.14	3183	9.11
8.	Irrigation	292	0.88	609	1.74
9.	Pest and disease management	2563	7.71	5663	16.20
10.	Harvesting and threshing	2703	8.13	2707	7.75
11.	Grading and packing	233	0.70	236	0.68
12.	Miscellaneous	897	2.70	1144	3.27
13.	Working capital (Variable cost)	22389	67.33	24623	70.45
14.	Interest on working capital @7%	1567	4.71	1724	4.93
15.	Total variable cost (Cost A)	23956	72.04	26346	84.84
B.	Cost B				
16.	Rental value of owned land	7000	21.05	7000	20.03
17.	Interest on fixed capital @7 %	490	1.47	490	1.40
18.	Total Cost B	31446	94.56	33836	96.81
C.	Cost C				
19.	Imputed value of family labor	1809	5.44	1114	3.19
20.	Total cost (Cost C)	33255	100.00	34950	100.00
	Returns				
21.	Yield (Productivity)	12 q		12.5 q	
22.	Cost of production/q	1996		2108	
	Economic viability				
23.	Value of main product Organic Pigeonpea @ ₹ 3600/q Conventional Pigeonpea @ ₹ 3250/q	43200		40625	
24.	Gross return	43200		40625	
25.	Return over variable cost (Cost A)	19244		14278	
26.	Net returns	9945		5674	
27.	Cost Benefit Ratio over variable cost (Cost A)	1:1.80		1:1.54	
28.	Cost Benefit Ratio over total cost (Cost C)	1:1.30		1:1.16	

Cost C includes cost B and imputed value of family labour. The imputed value of labour in organic cultivation of pigeonpea was much higher (₹ 1809/- : 5.44%) than in pigeonpea grown under conventional farming (₹ 1114/- : 3.19%), due to the fact that organic farmers family members were engaged more in preparing in organic inputs, weeding, pest and disease management.

Return were estimated and compared. The price realized in the market for organic and conventional pigeonpea was ₹ 3600/- and ₹ 3250/- per quintal, respectively. Gross returns were estimated at ₹ 43200/- for organic and ₹ 40625/- for conventional pigeonpea cultivation under sole crop of pigeonpea.

Return over total variable cost was higher for organic (₹ 19244/-) than conventional pigeonpea (₹ 14275/-). The net returns were ₹ 9945/- for organic pigeonpea and ₹ 5674/- for pigeonpea grown under conventional farming practices, cultivation under sole crop of pigeonpea (See Fig.4.3.1a).

A thorough analysis further clarified that out of the total variable costs (₹ 23956/-), incurred in organic cultivation of pigeonpea, ₹ 19244/- (80.33%) was recovered as return on variable costs, which left the organic farmer with adequate working capital for the next season. But the return on variable costs in conventional pigeonpea cultivation were meager at ₹ 5674/- which was 54.19% of the variable costs (₹ 26347/-) incurred by farmer practicing conventional farming, which probably resulted them in indebtedness. Thus the economic viability of organic pigeonpea cultivation was much superior to that of conventional pigeonpea cultivation.

The cost benefit ratio (CBR) was calculated to assess the profit gained over costs incurred. CBR over variable cost was estimated to be 1:1.81 for organic pigeonpea and 1:1.54 for conventional pigeonpea cultivation.

CBR over total cost for organic pigeonpea was 1:1.30 compared to 1:1.16 for conventional pigeonpea cultivation, in case of sole crop of pigeonpea (See Fig.4.3.1b).

Thus it could be concluded that organic pigeonpea growers were quite satisfied with their organic farming practices since they did not borrow money from others, internalized all inputs and resources, and enjoyed freedom in farming. Their

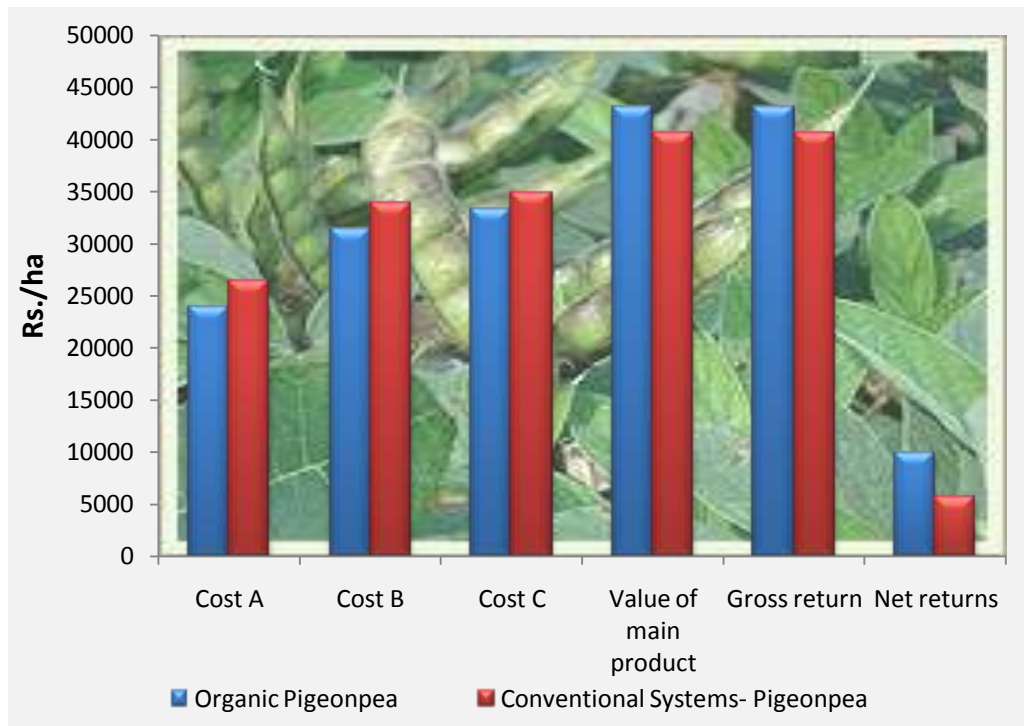


Fig. 4.3.1 (a) Costs and Returns of Organic and Conventional Farming Systems of Pigeonpea cultivation

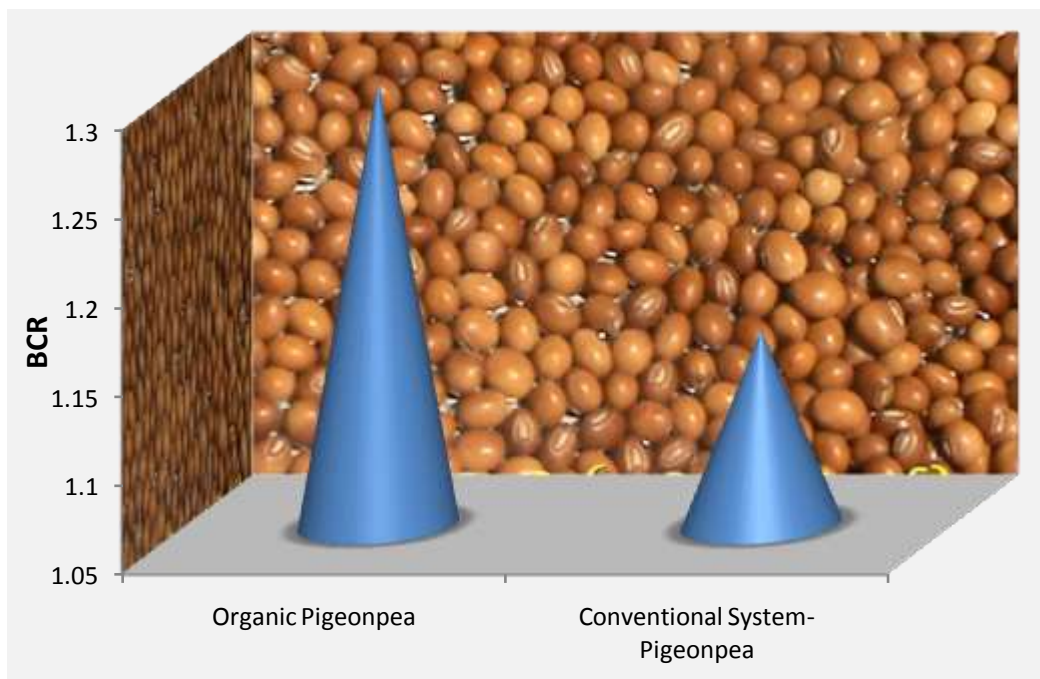


Fig. 4.3.1 (b) Cost Benefit Ratio of organic and Conventional System- Pigeonpea (sole crop) cultivation

agro-ecosystem was safe and sustainable and their produce was free from chemical (fertilizer and pesticide) residues. They were quite happy enjoying the price premium as well as reduced costs and freedom from indebtedness.

Comparative Analysis of economic viability of pigeonpea grown under organic and conventional farming practices as intercropped with black gram and green gram

Usually in dry land regions, as a part of contingency planning farmers grow pigeonpea with inter crops like green gram, black gram, soyabean, jowar, sunflower, sesamum, horse gram etc.

Pigeonpea + Black gram

The results of analysis of cost of cultivation of pigeonpea intercropped with black gram were presented in Table 4.3.2. It was observed that the yield per hectare of organic pigeonpea was slightly lower (9.5q) when compared to yield of pigeonpea under conventional farming (10.1q). Intercrop black gram's yields followed same pattern with organic black gram yield being lower (4.5q) compared conventional black gram yield (4.9 q). Similar result was reported by Manjunath (2005).

A comparison of the results revealed that the total variable cost (Cost A) for intercropped (black gram) organic pigeonpea (₹ 24588/-) was lower than pigeonpea grown under conventional system (₹ 26856/-) and accounted for 73 per cent and 76 per cent of total costs respectively. The major costs incurred on nutrient, weed, pest and disease management were lower at ₹9942/- (29.4 per cent) in organic pigeonpea than 12314/- (34.72 per cent) in conventional pigeonpea cultivation. However costs incurred in land preparation and basal organic manure application were higher in case of organic farming (₹ 9310/- : 27.56 per cent) than in conventional farming (₹ 6159/-: 17.36 per cent) of pigeonpea. Costs on all other components were more or less similar in both cases.

Cost B of organic pigeonpea + black gram (₹ 32078/-) was lower than conventional pigeonpea + black gram (₹ 34346/-). The rental value was same for both systems of pigeonpea cultivation.

Cost C includes cost B and imputed value of family labour. The imputed value of labour in organic cultivation of pigeonpea + black gram was much higher

(` 1703/- : 5.04 per cent) than in conventional pigeonpea + black gram (` 1123/- : 3.17 per cent), due to the fact that organic farmers' family members were engaged more in preparing in organic inputs, weeding, pest and disease management.

Table 4.3.2: Comparative analysis of economic viability of organic and conventional Pigeonpea + black gram cultivation N=40

No.	Particulars	Organic Pigeonpea (n=20)		Conventional Pigeonpea (n=20)	
		Value (`./ha)	% to total cost	Value (`./ha)	% to total cost
A.	Cost A				
1.	Seed	1031	3.05	1067	3.01
2.	Seed Treatment	73	0.22	71	0.20
3.	Organic manure	3604	10.67	1406	3.96
4.	Land preparation	5706	16.89	4753	13.40
5.	Sowing	1650	4.88	1705	4.81
6.	Weed management	1397	4.14	2052	5.79
7.	Nutrient management	2376	7.03	3188	8.99
8.	Irrigation	297	0.88	606	1.71
9.	Pest and disease management	2565	7.59	5668	15.98
10.	Harvesting and threshing	3150	9.32	3200	9.02
11.	Grading and packing	237	0.70	239	0.67
12.	Miscellaneous	893	2.64	1144	3.23
13.	Working capital (Variable cost)	22979	68.02	25099	70.76
14.	Interest on working capital @7%	1609	4.76	1757	4.95
15.	Total variable cost (Cost A)	24588	72.79	26856	75.72
B.	Cost B				
16.	Rental value of owned land	7000	20.72	7000	19.74
17.	Interest on fixed capital @7 %	490	1.45	490	1.38
18.	Total Cost B	32078	94.96	34346	96.83
C.	Cost C				
19.	Imputed value of family labor	1703	5.04	1123	3.17
20.	Total cost (Cost C)	33781	100.00	35469	100.00
	Returns				
21.	Yield (Productivity)				
	Main Crop: Pigeonpea		9.5 q		10.1 q
	Intercrop: Black gram		4.5 q		4.9 q
22.	Cost of production/q		2588		2659
	Economic viability				
23.	Value of main crop: Pigeonpea Organic @ ` 3600/q Conventional @ ` 3250/q		34200		32825
24.	Value of intercrop: Black gram Organic @ ` 3200/q Conventional @ ` 3000/q		14400		14700
25.	Gross return		48600		47525
26.	Return over variable cost (Cost A)		24012		20669
27.	Net returns		14819		12056
28.	Cost Benefit Ratio over variable cost (Cost A)		1:1.98		1:1.77
29.	Cost Benefit Ratio over total cost (Cost C)		1:1.44		1:1.34

Returns were estimated and compared. The prices realized in the market for organic and pigeonpea grown under conventional production system were `3600/- and `3250/- per quintal, respectively and for black gram the prices were `3200/- and `3000 per quintal of organic and black gram under conventional farming respectively. The value of main crop of organic pigeonpea was `34200/- and that of pigeonpea grown under conventional practices was `32825/-. The value of intercrop- organic black gram was `14400/-, and that of black gram produced following conventional practices was `14700/-. Gross returns were estimated at `48600/- for organic pigeonpea + black gram and `47525/- for pigeonpea + black gram under conventional cultivation.

Return over total variable cost was higher for organic pigeonpea + black gram (`24012/-) than pigeonpea + black gram (`20669/-) under conventional farming. The net returns were `14819/- for organic pigeonpea + black gram and `12056/- for pigeonpea + black gram under conventional cultivation practices (See Fig.4.3.2a).

A thorough analysis further clarified that out of the total variable costs (`24,588/-), incurred in organic cultivation of pigeonpea + black gram, `24,012/- (97.65 per cent) was recovered as return on variable costs, which left the organic farmer with adequate working capital for the next season. But the returns on variable costs in pigeonpea + black gram conventional cultivation were meager at `20669/- which was 76.96 per cent of the variable costs (`26856/-) incurred by farmer practicing conventional farming, which probably results in indebtedness. Thus the economic viability of organic pigeonpea + black gram cultivation was much superior to that of pigeonpea+ black gram under conventional cultivation.

The cost benefit ratio (CBR) was calculated to assess the profit gained over costs incurred. CBR over variable cost was estimated to be 1:1.98 for organic pigeonpea + black gram and 1:1.34 for pigeonpea + black gram under conventional cultivation practices.

CBR over total cost for organic pigeonpea + black gram was 1:1.44 compared to 1:1.34 for pigeonpea + black gram in conventional cultivation (See Fig. 4.3.2b).

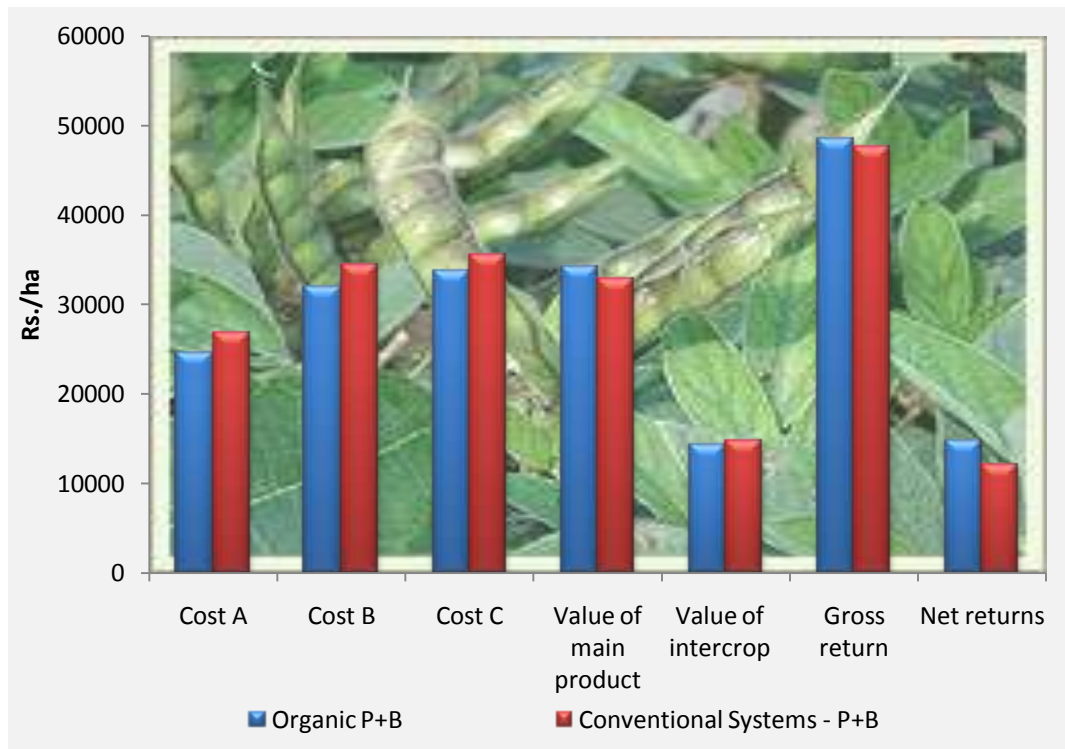


Fig.4.3.2 (a) Costs and Returns of Organic and Conventional Farming Systems of Pigeonpea + Black gram (P+B) cultivation

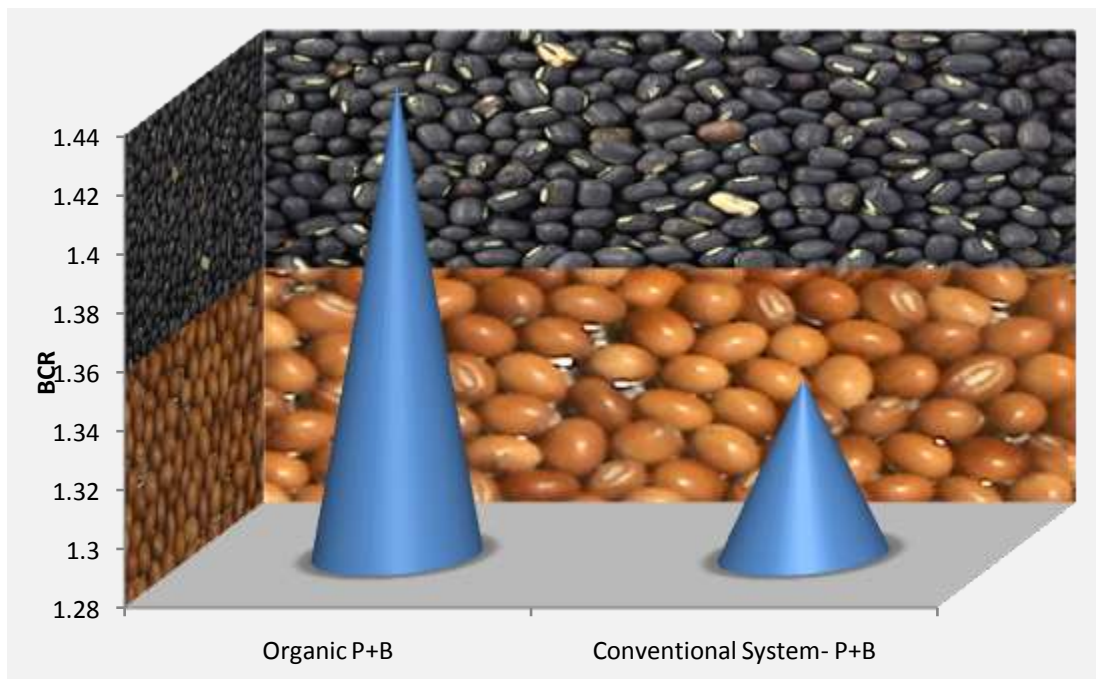


Fig.4.3.2 (b) Cost Benefit Ratio of Organic and Conventional Farming Systems of Pigeonpea + Black gram (P+B) cultivation

Thus it could be concluded that organic pigeonpea + black gram growers were quite satisfied with their organic farming practices since they did not borrow money from others, internalized all inputs and resources and enjoyed freedom in farming.

Their agro-ecosystem is safe and sustainable and their produce was free from chemical (fertilizer and pesticide) residues. They were quite happy enjoying the price premium as well as reduced costs and freedom from indebtedness.

Pigeonpea + Green gram

The results of analysis of cost of cultivation of pigeonpea intercropped with green gram were presented in Table 4.3.3. It was observed that the yield per hectare of organic pigeonpea was slightly lower (10.2 q) when compared to yield of pigeonpea produced under conventional farming (11.0 q). Intercrop green grams' yields followed the same pattern with organic green gram yield being lower (5.0 q) when compared with green gram yield (5.2 q) under conventional production system. Similar result was reported by Manjunath (2005).

A comparison of the results revealed that the total variable cost (Cost A) for intercropped (black gram) organic pigeonpea (₹ 24588/-) was lower than pigeonpea in conventional system (₹ 26856/-) and accounted for 73 per cent and 76 per cent of total costs respectively. The major costs incurred on nutrient, weed, pest and disease management were lower ₹9908/- (29.02 per cent) in organic pigeonpea than ₹12326/- (34.51%) in conventional pigeonpea cultivation. However costs incurred in land preparation and basal organic manure application were higher in case of organic farming (₹9396/- : 27.52 per cent) than in conventional farming (₹6222/-: 17.42 per cent) of pigeonpea. Costs on all other components were more or less similar in both cases.

Cost B of organic pigeonpea + green gram (₹ 32355/-) was lower than pigeonpea + green gram grown under conventional system (₹ 34597/-). The rental value was same for both systems of pigeonpea cultivation.

Cost C includes cost B and imputed value of family labour. The imputed value of labour in organic cultivation of pigeonpea + green gram was much higher (₹1803/- : 5.28 per cent) than in pigeonpea + green gram in conventional production

(` 1120/- : 3.14 per cent), due to the fact that organic farmers family members were engaged more in preparing in organic inputs, weeding, pest and disease management.

Table 4.3.3: Comparative analysis of economic viability of organic and conventionally grown Pigeonpea + Green gram cultivation N=40

No.	Particulars	Organic Pigeonpea (n=20)		Conventional Pigeonpea (n=20)	
		Value (`/ha)	% to total cost	Value (`/ha)	% to total cost
A.	Cost A				
1.	Seed	1203	3.52	1201	3.36
2.	Seed Treatment	81	0.24	83	0.23
3.	Organic manure	3599	10.54	1409	3.94
4.	Land preparation	5797	16.98	4813	13.48
5.	Sowing	1665	4.88	1709	4.78
6.	Weed management	1389	4.07	2062	5.77
7.	Nutrient management	2356	6.90	3192	8.94
8.	Irrigation	301	0.88	609	1.71
9.	Pest and disease management	2564	7.51	5663	15.86
10.	Harvesting and threshing	3150	9.23	3198	8.95
11.	Grading and packing	233	0.68	243	0.68
12.	Miscellaneous	882	2.58	1152	3.23
13.	Working capital (Variable cost)	23220	68.02	25334	70.93
14.	Interest on working capital @7%	1625	4.76	1773	4.97
15.	Total variable cost (Cost A)	24845	72.78	27107.38	75.89
B.	Cost B				
16.	Rental value of owned land	7000	20.51	7000	19.60
17.	Interest on fixed capital @7 %	490	1.44	490	1.37
18.	Total Cost B	32335	94.72	34597.38	96.86
C.	Cost C				
19.	Imputed value of family labor	1803	5.28	1120	3.14
20.	Total cost (Cost C)	34138	100.00	35717.38	100.00
	Returns				
21.	Yield (Productivity)				
	Main Crop Pigeonpea	10.2 q		11.0 q	
	Intercrop Green gram	5.0 q		5.2 q	
22.	Cost of production/q	2436		2464	
	Economic viability				
23.	Value of main product Organic Pigeonpea @ ` 3600/q Conventional Pigeonpea @ ` 3250/q	36720		35750	
24.	Value of intercrop: Green gram Organic @ ` 3330/q Conventional @ ` 3100/q	16650		16120	
25.	Gross return	53370		51870	
26.	Return over variable cost (Cost A)	28525		24763	
27.	Net returns	19232		16153	
28.	Cost Benefit Ratio over variable cost (Cost A)	1:2.15		1:1.91	
29.	Cost Benefit Ratio over total cost (Cost C)	1:1.56		1:1.45	

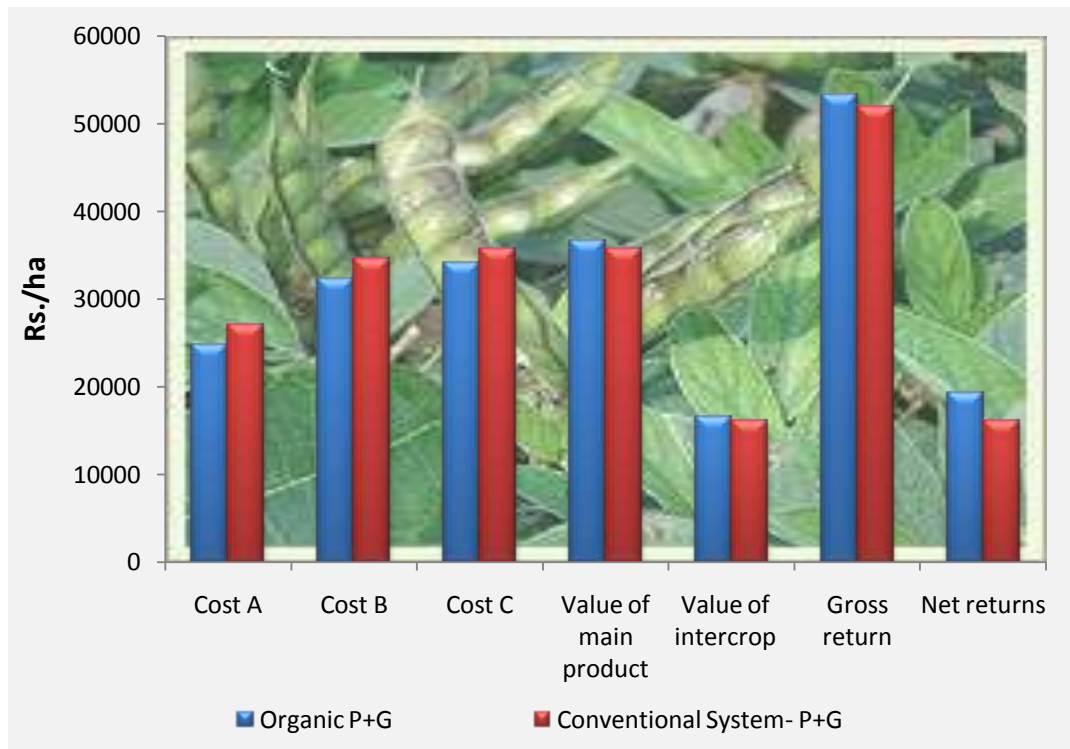


Fig.4.3.3 (a) Costs and Returns of Organic and Conventional Farming Systems of Pigeonpea + Green gram (P+G) cultivation

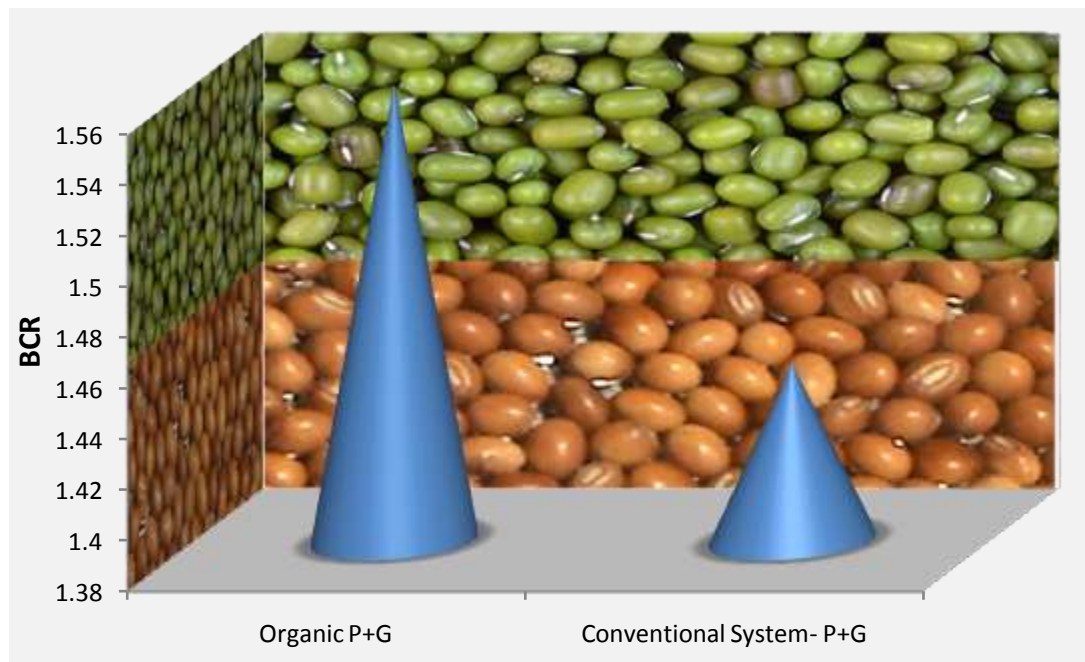


Fig.4.3.3 (b) Cost Benefit Ratio of Organic and Conventional Farming Systems of Pigeonpea + Green gram (P+G) cultivation

Returns were estimated and compared. The price realized in the market for organic and conventionally produced pigeonpea was `3600/- and `3250/- per quintal, respectively. For intercrop of green gram the prices were `3330/- and `3100/- respectively for organic and conventionally produced green gram. The value of main crop of organic pigeonpea was `36720/- and that of conventionally grown pigeonpea was `35750/-. The value of intercrop- organic green gram was `16650/-, and that of conventionally grown green gram was `16120/-. Gross returns were estimated at `53370/- for organic pigeonpea + green gram and `51870/- for conventional pigeonpea + green gram cultivation.

Return over total variable cost was higher for organic pigeonpea + green gram (`28525/-) than conventional production system of pigeonpea + green gram (`24763/). The net returns were `19232/- for organic pigeonpea + green gram and `16153/- for conventional production system of pigeonpea + green gram cultivation (See Fig. 4.3.3a).

A thorough analysis further clarified that out of the total variable costs (`24845/-), incurred in organic cultivation of pigeonpea, `28525/- (115.19 per cent) was recovered as return on variable costs, which left the organic farmer with adequate working capital for the next season. But the return on variable costs in conventional pigeonpea cultivation were meager at `24763/- which was 91.35 per cent of the variable costs (`27107/-) incurred by farmer practicing conventional farming, which probably results in indebtedness. Thus the economic viability of organic pigeonpea cultivation was much superior to that of conventional pigeonpea cultivation.

The cost benefit ratio (CBR) was calculated to assess the profit gained over costs incurred. CBR over variable cost was estimated to be 1:2.15 for organic pigeonpea + green gram and 1:1.91 for conventionally grown pigeonpea + green gram cultivation. CBR over total cost for organic pigeonpea + green gram was 1:1.56 compared to 1:1.45 for conventional pigeonpea + green gram cultivation (See Fig.4.3.3b).

Thus it could be concluded that organic pigeonpea + green gram growers were quite satisfied with their organic farming practices since they did not borrow money from others, internalized all inputs and resources and enjoyed freedom in farming. Their agro-ecosystem was safe and sustainable and their produce was free from chemical (fertilizer and pesticide) residues. They were quite happy enjoying the price premium as well as reduced costs and freedom from indebtedness.

Table 4.3.4: Comparison of economic viability of organic and conventional farming in three pigeonpea based cropping systems

No.	Parameters of Comparison	Pigeonpea (Sole crop)			Pigeonpea + Black gram			Pigeonpea + Green gram		
		Organic	Difference (%)	Conventional	Organic	Difference (%)	Conventional	Organic	Difference (%)	Conventional
1.	Yield of Pigeonpea (Productivity in q)	12	-4.0	12.5	9.5	-5.94	10.1	10.2	-7.27	11.0
2.	Yield of Intercrop (Productivity in q)	--	--	--	4.5	-8.16	4.9	5.0	-3.85	5.2
3.	Cost of production/q (₹)	1996	-5.31	2108	2588	-2.67	2659	2436	-1.14	2464
4.	Value of main product (₹)	43200	+6.34	40625	34200	+4.19	32825	36720	+2.71	35750
5.	Value of intercrop product (₹)	--	--	--	14400	-2.04	14700	16650	+3.29	16120
6.	Gross return (₹)	43200	+6.34	40625	48600	+2.26	47525	53370	+2.89	51870
7.	Return over variable cost (Cost A) (₹)	19244	+34.78	14278	24012	+16.17	20669	28525	+15.19	24763
8.	Net returns (₹)	9945	+75.27	5674	14819	+22.92	12056	19232	+19.06	16153
9.	Cost Benefit Ratio over variable cost (Cost A) (₹)	1:1.80	+16.88	1:1.54	1:1.98	+11.86	1:1.77	1:2.15	+12.56	1.91
10.	Cost Benefit Ratio over total cost (Cost C)	1:1.30	+12.07	1:1.16	1:1.44	+7.46	1:1.34	1:1.56	+7.59	1:1.45

Note: Sale Price: Organic Pigeonpea @ ₹ 3600/q Inorganic Pigeonpea @ ₹ 3250/q
 Organic Black gram @ ₹ 3200/q Inorganic Black gram @ ₹ 3000/q Organic Green gram @ ₹ 3330/q Inorganic Green gram @ ₹ 3100/q

**The percentage differences were computed over conventional farming data as a base.*

Comparison of Parameters of Economic Viability

The yields of pigeonpea, black gram and green gram from conventional cultivation were more than those from organic cultivation. But the difference in yields was in the range of 4-7 per cent, i.e., the yield of pigeonpea in organic farming was lesser when compared to conventionally grown pigeonpea yields in all three cropping systems. But when the parameters of economic viability were considered, the results appeared to be encouraging. Hence an attempt was made to compare the economic viability parameters of the three pigeonpea based cropping systems. The differences in values were computed in percentage to enable easier comparison and the results are given in Table 4.3.4.

As can be seen from the results, the costs of cultivation of pigeonpea in organic farming were lesser than the costs in conventional farming in the range of 1-5.3 per cent. But the gross returns differed in the range of 2-6 per cent with maximum gross returns in pigeonpea+ Green gram and least in sole crop of pigeonpea. The difference in net returns between organic and conventional farming were maximum in the sole crop of pigeonpea (75.27%) and it was 22.92% in case of pigeonpea+ Black gram and least (19.06%) in pigeonpea+ Green gram cropping system. The differences in cost benefit ratio over variable cost (Cost A) and over total cost (Cost C) between organic and conventional farming of pigeonpea based cropping systems were highest in case of pigeonpea+ Green gram, moderate in pigeonpea + Black gram and least in sole crop of pigeonpea. So organic pigeonpea cultivation was found to be much more profitable when intercropped with green gram or black gram.

Comparison of Net Returns

Now, it is seen that there were clear differences between the mean values of net returns obtained from organic farming and conventional farming in the three pigeonpea based cropping systems. It has been hypothesized that *'there is difference in the economic viability of organic and conventional farming in the three pigeonpea based farming systems'* (GH-I). In order to test this hypothesis, the following three empirical hypotheses were formulated:

Empirical Hypothesis (EH-I-1): There is no significant difference in the net returns of organic farming and conventional farming in pigeonpea (sole crop) cropping system.

Empirical Hypothesis (EH-I-2): There is no significant difference in the net returns of organic farming and conventional farming in pigeonpea + black gram cropping system.

Empirical Hypothesis (EH-I-3): There is no significant difference in the net returns of organic farming and conventional farming in pigeonpea + green gram cropping system.

So the mean values of net returns obtained from organic and conventional farming were compared by using a 't' test. The results are given in Table 4.3.5.

Table: 4.3.5: Mean Differences in Net Returns in Pigeonpea Cultivation

Pigeonpea based Cropping system	Mean Differences	Standard Deviation	Standard Error Mean	't' value
Pigeonpea (Sole Crop)	4271.00	75.58	16.90	255.35**
Pigeonpea + Black gram	2763.00	36.46	8.15	339.40**
Pigeonpea + Green gram	3079.00	212.36	47.48	64.16**

The results clearly revealed that the mean differences in net returns obtained from organic and conventional farming systems in all the three pigeonpea based cropping systems were significant at 0.01 level of probability. Hence, all the empirical hypotheses (EH-I-1, EH-I-2 and EH-I-3) were rejected. Hence the alternate hypothesis is accepted. In other words, it can be said that there are significant differences in economic viability pigeonpea cultivation between organic farming and conventional farming in all the pigeonpea based cropping systems.

Conclusion

Thus it can be concluded that organic pigeonpea growers were able to reap better incomes compared to farmers practicing conventional farming when they grew pigeonpea along with green gram as an intercrop. Intercropping had benefited both organic and conventional farmers immensely when compared to return gained in sole crop cultivation of pigeonpea. Since investment was lesser and returns were higher, organic farming of pigeonpea with green gram or black gram yields better and gives higher income.

**Resource Utilization Efficiency of Organic Farming *vis-à-vis*
Conventional Farming Practices*****Abstract***

In a study conducted among pigeonpea growers with organic and conventional practices in Gulbarga district of Karnataka, an attempt was made to assess the resource use efficiency of pigeonpea cultivation in three pigeonpea based cropping systems. The results revealed that human labour, land, seeds, plant protection measures have contributed significantly to the production elasticities. The co-efficient of multiple determinations for all three production functions fitted ranged between 0.96 and 0.98 indicating that the production function fitted was sound and could help explain the variation in gross returns in pigeonpea based cropping systems. The returns to scale in all the pigeonpea based cropping systems were superior in organic farming compared to conventional farming.

Key Words: Organic farming, resource utilization efficiency, Cobb Douglas Production Function, Returns to scale

Introduction

India is an agricultural country, where sizable proportion of the population is dependent on agriculture, the development of agricultural sector becomes a prerequisite. The agriculture sector has a direct impact on the level of farm income as well as national income of the country. If farmers can increase their production, they shall improve the national economy as well as their own economy. Therefore, it has become an urgent need to increase agricultural production.

There are two feasible options available for increasing the agricultural production in a country. The first option is: through extension of area under cultivation by reclamation of wastelands and by external land augmentation without shrinking of the area and productivity of any activity. The second one is: increasing the productivity of land by cultivating normal soils through optimal allocation of available resources and utilizing the full potential of existing technology. The

adoption of new agricultural technology is necessary for the development of agricultural sector, which depends on the availability of various inputs and resources in the region.

The agricultural growth is affected by the various resources such as seeds, manures, fertilizers, irrigation facilities, labour, bullock labour, working capital, farm implements, machinery, crop protection inputs, etc. The rationality in the allocation of resources by the farmers is a crucial issue in agricultural production. Here the focus needs to be on the resource use efficiency. The farm income is determined by the efficiency with which all farmers are able to utilize the resources at their own command. If farmers are efficient in the use of scarce resources, then farmers can surely increase agricultural production and their income.

The optimum allocation of available resources is necessary for the growth of agricultural production. The crux of the problem of increasing agricultural production in any area is: *how to increase the output per unit of an input*. In general, agricultural production continues to be at lower level despite the use of critical inputs. Sometimes, the crucial inputs are either under-utilized or over-utilized in the crop production. Resource use inefficiency exists on the farms. If resource use is inefficient, production can be increased by making adjustment in the use of factors of production in the optimal direction.

The cost of agricultural resources is increasing by quantum jumps, thereby making agriculture a losing proposition. Increasing costs of cultivation has made agriculture vulnerable and exposed to greater risks, thus making it an unviable option of one's livelihood. Efficient resource use is the only option available now. Hence, it is necessary that the available resources should be used economically and efficiently.

To drive home this crucial issue, many researchers have worked on assessing the resource use efficiency in various crops: paddy (Suresh and Reddy, 2006), onion (Sankhayan and Sirohi, 1971; Naik, *et al.*, 1998; Verma, 2002), mesta (Sunanda and Narender, 2003), redgram based cropping systems (Biradar and Rajkumar, 2007) and cropping systems and farming systems (Ganesh, 2000; Wadear, 2003; Rajeshwari, 2004; Saikumar, 2005). Mixed cropping systems: potato and maize (Sankhayan and Sirohi, 1971), maize-sunflower (Nagraj *et al.*, 1996).

Resource use efficiency was measured in terms of partial 'b' coefficients contributing to the significant variation in production function. The contribution of land and human labour was positive (Muralidharan, 1987), and that of land and farm yard manure was positive (Naik et al., 1998). The ratio of Marginal Value Product (MVP) to Marginal Factor Cost (MFC) of land was greater than one, and MVP of labour was less than one. It was negative for seeds, fertilizers and pesticides in conventional farms. In case of farm practicing IPM, this ratio was greater than one for land, labour, and seeds, but negative for fertilizers. (Vishweshwar, 1994).

Hence, it was attempted in this study with an objective to assess and compare resource use efficiency of organic and conventional farming in three pigeonpea based cropping systems.

Methodology

Gulbarga district is considered the pulse bowl of India. Pigeonpea is predominantly grown with an organic practice in Aland and Gulbarga taluks. So, district and taluks were purposively selected and two villages from each taluk were randomly selected for the study. Accordingly, the study was conducted in the four villages of Gulbarga district in Karnataka state and survey approach was used for the present study. Sixty farmers who were actively involved in organic farming and sixty farmers practicing conventional farming formed a random sample of one hundred and twenty respondents.

Data on resource use were collected from forty farmers (20 organic and 20 farmers practicing conventional farming) from each group of cropping systems: (i) sole crop of pigeonpea, (ii) intercropping of pigeonpea with black gram and (iii) intercropping of pigeonpea with green gram. A specially designed semi-structured schedule was used.

Cobb-Douglas production function is used to estimate resource use efficiency and returns to scale in pigeonpea and pigeonpea based cropping system. The resource factors like land, human labour, manures and fertilizers, seeds and plant protection measures were used in both organic and conventional farming and hence they are considered in the present study. The operational definitions of resources/factors chosen in the study are as follows:

Output (y): The output has been defined as the sum of gross value output of the crops (pigeonpea, black gram and green gram) evaluated at the prevailing market price during the year 2010-11, irrespective of being consumed, sold or maintained in the stock.

Land (x_1): In the present study, the actual area for the particular crop (pigeonpea, black gram and green gram) was considered as the land resource. The land was taken in hectares.

Human Labour (x_2): The labour force on a farm consists of farmer's labour and hired labour.

a. **Family Labour:** Family labour is one of the most important factors in the growth of economic factor. Family labour considered with the actual work carried out by family members for crop production was evaluated at the prevailing wage rates for hired labour.

b. **Hired Labour:** It included the hired labour employed for crop production. The hired labour was evaluated at actual amount paid in cash. Human labour was also divided into male and female labour with varying wage rates. The work turn out of a male or female adult for a period of 8 hours is taken in to consideration.

Manures and Fertilizers (x_3): Manures made from the wastes of plant materials and animals are used as sources of plant nutrients. Farm produced manures (farm yard manure, vermi-compost) were charged at prevailing local rates. Chemical fertilizers and other manures purchased were charged at the rates actually paid.

Seeds (x_4): For the production own seeds or market seeds have been used in the farm. The farm produced seed was charged at the market price and purchased seed was charged at the rates actually paid.

Plant protection measures (x_5): Labour costs incurred in mechanical measures and cultural measures were computed. The purchased pesticides for the use of plant protection were evaluated at the actual price paid in market and the value of bio-pesticides/insecticides produced in bio-digesters on the farm were evaluated as per costs incurred in making them.

Cobb-Douglas Function

The functional model adopted is of the following form,

$$y = a \cdot x_1^{b_1} \cdot x_2^{b_2} \cdot x_3^{b_3} \cdot x_4^{b_4} \cdot x_5^{b_5} \cdot u$$

y = value of output (in rupees)

x_1 = Land area (in hectares)

x_2 = value of human labour used (in rupees)

x_3 = Value of Manures and Fertilizers (in rupees.)

x_4 = value of seeds (in rupees)

x_5 = Value of Plant Protection (in rupees)

u = Error term

b_1 to b_5 are production elasticities of factors x_1 to x_5 respectively and 'a' is the intercept. The above equation can be transformed into log form as follows:

$$\text{Log } y = \text{Log } a + b_1 \text{Log } x_1 + b_2 \text{Log } x_2 + b_3 \text{Log } x_3 + b_4 \text{Log } x_4 + b_5 \text{Log } x_5 + \text{Log } u$$

In the present study, the above function was fitted in log term with output (y) as dependent variable and five inputs as independent variables.

Result and Discussion

The collected data was subjected to statistical analysis using the Cobb Douglas production function. The results of the analysis: coefficients of production elasticities and returns to scale (sum of production elasticities) are presented below.

Pigeonpea (sole crop)

The production elasticities and other related statistics for pigeonpea are presented in Table 4.4.1. It was observed from the results that in organic farming, the Co-efficient of multiple determination (R^2) is 0.97 indicating that the explanatory e in organic farming.

Table 4.4.1: Resource Utilization Efficiency of Organic and Conventional farming practices in Pigeonpea (sole crop)

Types of farmers	No. of observations	Degree of freedom	Constant	Land	Human labour	Manures and fertilizers	Value of seeds	Plant protection	Return to scale	R²
Organic	20	19	-7.61 (5.61)	-0.85 (0.36**)	1.09 (0.55**)	-0.16 (0.33)	0.63 (0.15*)	0.77 (0.27**)	1.48	0.97
Conventional	20	19	0.43 (9.78)	0.20 (0.14)	0.15 (0.21)	0.56 (0.17*)	-0.24 (0.28)	0.71 (0.96)	1.38	0.98

Note: figure in parenthesis are standard errors of the regression co-efficient.

*Significance at 10 per cent level

** Significance at 5 per cent level

***Significance at 1 per cent level

In organic farming, it was observed from the results that among the variables included in the function, the production elasticity of human labour was positive and significant at 1 per cent level of probability. The production elasticity of land, manure and seeds was positive and insignificant. For plant protection, it turned out to be negative and insignificant and it was also observed that resource utilization was excessive in organic farming.

The sum of production elasticities (returns to scale) for organic farming in pigeonpea + Black gram was 1.54, which was more than one, indicating increasing returns to scale.

In case of conventional farming, it was observed from the results that explanatory variables included in the function have explained 96 percent of total variation in gross returns. Among the variables selected in the function, the production elasticity of fertilizers was positive 1.42 and significant. It means that 1 percent increase in fertilizer would increase output by 1.42 percent, when other variables are kept constant. The elasticity co-efficient of land, seeds and plant protection were positive and insignificant and elasticity co-efficient of human labour was negative and insignificant.

The sum of production elasticities which is an indicator of the return to scale was more than one (1.23) indicating increasing returns to scale, but less compared to organic farming which was clearly revealed by the analysis.

Pigeonpea + Green gram

The production elasticities and other related statistics for pigeonpea + Green gram cropping system are presented in Table 4.4.3. It was observed from the results that in organic farming, the co-efficient of multiple determination (R^2) is 0.98 indicating that the explanatory variables such as land, human labour, manure and fertilizers, value and seeds and plant protection, have explained of percent of total variation in gross returns.

In organic farming, it was observed from the results that among the variables included in the function, the production elasticity of human labour was positive 1.24 and significant. It means that 1 percent increase in human labour would increase

Table 4.4.2: Resource Utilization Efficiency of Organic and Conventional farming practices (Pigeonpea + Black gram)

Types of farmers	No. of observations	Degree of freedom	Constant	Land	Human labour	Manures and fertilizers	Value of seeds	Plant protection	Return to scale	R ²
Organic	20	19	0.54 (8.27)	0.28 (0.36)	0.81 (0.40***)	0.86 (0.73)	0.50 (0.40)	-0.91 (1.09)	1.54	0.97
Conventional	20	19	4.02 (8.61)	0.36 (0.52)	-0.82 (0.94)	1.42 (0.49**)	0.22 (0.49)	0.05 (0.76)	1.23	0.96

Note: figure in parenthesis are standard errors of the regression co-efficient.

*Significance at 10 per cent level

** Significance at 5 per cent level

***Significance at 1 per cent level

output by 1.24 percent, when other variables are kept constant. The production elasticities of land, manure and plant protection was positive and insignificant. The production elasticity of seeds was negative and insignificant and it was also observed that resource utilization was excessive in organic farming.

The sum of production elasticities (Returns to scale) for organic farming in pigeonpea was 1.62, which is more than one, indicating increasing returns to scale.

In case of conventional farming, it was observed from the results that explanatory variables included in the function have explained 98 percent of total variation in gross returns. Among the variables selected in the function, the production elasticity of plant protection was positive and significant at 10 per cent level. The elasticity co-efficient of human labour and seeds were positive and insignificant and elasticity co-efficient of land and fertilizers was negative and insignificant.

The sum of production elasticities which is an indicator of the return to scale was more than one (1.14) indicating increasing returns to scale, but less compared to organic farming which was clearly revealed by the analysis.

Hypotheses were formulated to test the differences of resource utilization efficiency in pigeonpea cultivation between organic and conventional farming systems. They are:

General Hypothesis (GH-II)

There is association between the various factors of production and the resource utilization efficiency of organic and conventional farming in the three pigeonpea based farming systems.

Empirical Hypothesis (EH-II-1): There is no relationship between the various factors of production and the resource utilization efficiency of organic farming and conventional farming in pigeonpea (sole crop) cropping system.

Empirical Hypothesis (EH-II-2): There is no relationship between the various factors of production and the resource utilization efficiency of organic farming and conventional farming in pigeonpea + black gram cropping system.

Empirical Hypothesis (EH-II-3): There is no relationship between the various factors of production and the resource utilization efficiency of organic farming and conventional farming in pigeonpea + green gram cropping system.

The results of Cobb-Douglas function have revealed that there is association between factors of production and the resource use efficiency of pigeonpea cultivation between organic and conventional farming systems. The co-efficient of multiple determination (R^2) in all the six functions fitted ranged between 0.96 and 0.98, indicating that the factors of production were able to contribute significantly. Thus, the association between the factors of production and resource utilization efficiency (returns to scale) was statistically significant. The factors of production: land, human labour, plant protection have significantly contributed to returns to scale.

Thus the empirical hypotheses (EH-I-1, EH-I-2, and EH-I-3) stand rejected. Hence it can be concluded that the organic farming and conventional farming systems were significantly different from one another in terms of resource utilization efficiency.

Discussion

On comparing the organic farming with conventional farming in sole crop of pigeonpea cultivation, the elasticity coefficients for land, human labour, seeds and plant protection measures were positive and significant in organic farming situation, while only one input, manures and fertilizers was positive and significant in pigeonpea grown with conventional practices.

In pigeonpea + black gram cropping system, elasticity coefficient of human labour was positive and significant in organic farming situation, but in conventional farming situation, elasticity coefficient of manures and fertilizers was positive and significant in conventional farming situation. Similar results were also found in case of pigeonpea + green gram cropping system.

Conclusion

It can be concluded that human labour was the sole contributor in all pigeonpea based cropping systems, as pigeonpea is a long-duration (160-180 days) dryland pulse crop demanding more labour use. In case of sole crop, however, other inputs: land, seeds and plant protection measures have contributed in addition to human labour. Resource use efficiency was observed to be more in organic farming.

Table 4.4.1

Table 4.4.3: Resource Utilization Efficiency of Organic and Conventional farming practices (Pigeonpea + Green gram)

Types of farmers	No. of observations	Degree of freedom	Constant	Land	Human labour	Manures and fertilizers	Value of seeds	Plant protection	Return to scale	R²
Organic	20	19	-2.18 (3.91)	0.06 (0.13)	1.24 (0.57**)	0.30 (0.23)	-0.10 (0.13)	0.12 (0.15)	1.62	0.98
Conventional	20	19	1.11 (1.56)	-0.01 (0.05)	0.32 (0.31)	-0.37 (0.21)	0.26 (0.20)	0.94 (0.22*)	1.14	0.98

Note: figure in parenthesis are standard errors of the regression co-efficient.

*Significance at 10 per cent level

** Significance at 5 per cent level

***Significance at 1 per cent level

CHAPTER IV
RESEARCH PAPER - V

Sustainability of Organic *vis-à-vis* Conventional Farming Practices

Abstract

In a study of organic and pigeonpea growers' conventional farming systems of Gulbarga district in Karnataka, an attempt was made to assess the sustainability of organic vis-à-vis conventional farming practices. Sixty organic farmers and sixty farmers practicing conventional farming from four villages of Aland and Gulbarga taluks were randomly selected for the study. Results of the study had shown that the set of organic farming practices of pigeonpea cultivation with respect to land preparation and seed treatment, weed management, nutrient management, plant protection, and seed storage practices were found to be more sustainable compared to conventional farming practices. So, organic farming practices were found to be ecologically sustainable, economically viable and socially compatible.

Key Words: Organic farming, Sustainability: ecological, economic, social

Introduction

Sustainable agriculture does not represent a return to pre-industrial revolution methods; rather it combines traditional conservation based farming techniques with modern technologies. Here, emphasis is placed on crop rotations, building up soil, diversifying crops and livestock, and controlling pests naturally (Reganold *et al.*, 1990). The means of achieving sustainable farming is the optimization of on-farm resources in ways that provide acceptable levels of sustainable crop yields and livestock production and result in economically profitable returns along with the minimization of off-farm resources such as purchased fertilizers and pesticides, whenever and wherever possible, to lower production costs, to avoid pollution of surface and ground water, to reduce pesticide residues in food, to reduce farmers' overall risk, and to increase both short and long term profitability (Parr *et al.*, 1989) Organic farming is a sustainable farming model where the emphasis lies in the potential of ecosystem to produce a good crop in the absence of any external input, i.e., chemical fertilizers for the crop nutrition as well as the pests and diseases is also

well taken care of without the application of synthetic pesticides. Thus, the overall system keeps itself in a self sustainable manner.

Though the organic farming emphasizes on removal of external inputs, organic integrated nutrient management is important to keep the system viable to produce good crop. Incorporation of organic nutrient sources, like vermi-compost, biofertilizers like, rhizobium, azolla and other legumes and green manures like sesbania (*Sesbania aculeate*), sunhemp (*Crotalaria juncea*), and cowpea (*Vigna unguiculata*) can maintain the soil as nutrient rich. There are several supporting evidences to prove these. From several other reports it can be concluded that even vermi-compost has the efficiency to act as a single source of nutrients in organic farming since it contains 1.5 per cent Nitrogen, 0.5 per cent Phosphorus, 0.8 per cent Potassium and other essential micronutrients.

Over time, organic farming practices promote the formation of soil humus and accumulation of nutrient reserves in the bodies of soil organisms and in the readily decomposable form of soil organic matter (Wander *et al.*, 1994).

While comparing the advantage of organic farming practices over conventional farming practices to the ecosystem, reports of several studies indicated that excessive use of chemical fertilizers resulted in degradation of soil, water and environmental resources (Ghosh 2003, Pachauri and Sridharan 1998, Singh *et al.* 1987). On the other hand, the organic farming had beneficial effects on human health, sustainability of soil, water, and environmental resources and crop yields in the long run (Blaise 2006, Gareau 2004, Rahudkar and Phate 1992, Rajendran *et al.*, 2000, Singh and Swarup 2000, Thakur and Sharma 2005).

A review of over 300 published reports showed that out of 18 environmental impact indicators, organic farming systems performed significantly better in twelve and performed worse in none. There are also high pre-consumer human health costs to conventional agriculture, particularly in the use of pesticides. (Gera, 2010).

With this background, the study was planned to assess the sustainability aspects of different organic farming practices in comparison with conventional farming technologies.

Methodology

Pigeonpea is the principal crop in Gulbarga district and predominantly grown in Aland and Gulbarga taluks. So, the district and taluks were purposively selected and two villages from each taluk were randomly selected for the study. Accordingly the study was conducted in the four villages of Gulbarga district in Karnataka state and survey approach was used for the present study. Sixty farmers who were actively involved in organic farming and sixty farmers practicing conventional farming system formed a random sample of one hundred and twenty respondents. The data were collected through personal interviews from both organic and farmers practicing conventional farming with a semi-structured schedule, adopting the GTZ Sustainet parameters of sustainability (See Appendix III).

Sustainet (Sustainable Agriculture Information Network) is composed of a German network and three further networks in the pilot regions of India, Kenya / Tanzania and Peru / Bolivia. This network operates a Sustainet India group in India with several grassroots level NGOs working in several states in India. Through extensive workshops, they have developed a set of criteria to evaluate whether an agricultural practice is sustainable or not. (GTZ, Sustainet, 2006). The Sustainet parameters includes: ecological, economic, social and cultural parameters. Pigeonpea cultivation practices with clear-cut difference in organic and conventional farming were put into five sets: land preparation and seed treatment, weed management, nutrient management, plant protection and seed storage. The sustainability of five sets of pigeonpea cultivation practices of organic farming and conventional farming systems were analysed against these three parameters. Each of these parameters has six indicators. So, eighteen indicators were included to assess sustainability of these organic and conventional farming practices.

Sixty organic farmers' responses to the indicators under each of the three parameters of sustainability were sought as to whether they agree or disagree with the statement in relation to the set of organic pigeonpea cultivation practices under study. Similarly responses of sixty farmers of conventional systems were sought on the sustainability of practices of conventional farming systems of pigeonpea cultivation. If the farmer respondent perceives a set of practices as sustainable, then a numerical

code of 1 is given and if not a numerical code of zero is given. The frequencies and percentages of positive responses were calculated and tabulated.

Results and Discussion

The collected data were analyzed and the frequency distributions of respondents agreeing to the bipolar indicators of sustainability for the five sets of pigeonpea cultivation practices are given in Tables 4.5.1 to 4.5.5.

SUSTAINABILITY OF LAND PREPARATION AND SEED TREATMENT PRACTICES

The set of practices related to land preparation and seed treatment followed by organic farmers were; incorporation of crop residues in soil, deep summer ploughing, *in-situ* green manuring (all cultural practices meant for enhancing the soil fertility) and seed treatment with on-farm resources, like cow urine, *panchagavya* and microbial inoculants (See Plate VII). The set of practices related to land preparation and seed treatment followed by farmers of conventional farming were: burning of crop residues and seed treatment with chemicals (See Plate VII).

Ecological parameter: The organic farming practices were found sustainable by organic farmers on all six indicators of ecological parameter of sustainability. Majority of organic farmers perceived that the set of practices related to land preparation and seed treatment would help conserve soil fertility, conserve quality and availability of water, enhance biodiversity and avoid spread of hazardous substances and affects the landscape in a positive manner and help improve micro-climate of the organic farm as a whole.

On the other hand, the conventional farming practices were found to be not at all sustainable on four parameters of ecological sustainability. About 10 per cent of them perceived that the conventional farming practices would affect the landscape in a positive manner. About 21 per cent of them perceived that these conventional farming practices would help avoid the spread of hazardous substances.

Land Preparation and Seed Treatment Practices



Deep ploughing in summer



Land preparation by bullocks



Seed treatment with chemicals



Trichoderma viride for seed treatment



Sowing operation

Table 4.5.1: Sustainability of Land preparation and Seed treatment

Organic Practices: Incorporation of crop residues in soil, Deep summer ploughing, *In-situ* Green manuring, Seed treatment with resources, like cow urine, Panchagavya and microbial inoculants.

Conventional Farming Practices: Burning of crop residues, Seed treatment with chemicals.

N= 120

No.	Sustainability Indicators	Farmers' Response (Agree)			
		Organic farmers (n ₁ =60)		Conventional farmers (n ₂ =60)	
		f	%	f	%
A.	Sustainability: Ecological Parameter				
1.	Conserve soil fertility	54	90	0	0
2.	Conserve the quality and availability of water	52	86.7	0	0
3.	Increase biodiversity	48	80	0	0
4.	Avoid spread of hazardous substances	54	90	13	21.7
5.	Affect the agro-ecosystem	57	95	6	10
6.	Improve the micro-climate	39	65	0	0
	Mean Value of All Ecological Indicators	51	85	3	5
B.	Sustainability: Economic Parameter				
7.	Improve net incomes	52	86.7	13	21.7
8.	Lead to Food and Income security	30	50	7	11.7
9.	Enable to accumulate working capital	55	91.7	13	21.7
10.	Nutritional situation and food availability secured	45	75	8	13.3
11.	Can compete with other sectors	45	36.7	8	13.3
12.	Can aggregate an economic gain at national level	22	36.7	7	11.7
	Mean Value of All Economic Indicators	42	70	9	15
C.	Sustainability: Social and cultural parameter				
13.	Rural poor involved in the approach	43	71.7	8	13.3
14.	Indigenous knowledge recognized within the approach	44	73.3	0	0
15.	Division of labor and distribution of income	13	21.7	4	6.7
16.	Improve the health situation	49	81.7	0	0
17.	Equitable access to assets	54	90	13	21.7
18.	Technology safer to human and animals	57	95	10	16.7
	Mean value of All Social and cultural Indicators	43	71.7	6	10
	Overall Mean value of Sustainability	45	75	6	10

Economic parameter: More than 86 per cent of organic farmers perceived that the organic farming practices related to land preparation and seed treatment would help improve net incomes and enable farmers to accumulate working capital for the next crop season. About 75 per cent organic farmers perceived that the nutritional situation would get improved and food availability would get secured. About 50 per cent of organic farmers perceived that the organic farming practices would lead to food and

income security among farmers. About 36 per cent of organic farmers opined that the organic farming practices can compete with other sectors and can thus aggregate an economic gain at national level.

With respect to farmers of conventional systems, majority of them perceived that the conventional farming practices were not at all sustainable. Only less than 21 per cent of them perceived that the practices of burning crop residues and seed treatment with chemicals could improve net incomes or enable farmers to accumulate working capital.

Socio-cultural parameter: More than 71 per cent of organic farmers perceived that the practices related to land preparation and seed treatment fulfilled the social and cultural parameter of sustainability. The organic farming practices were cheaper and involved use of on farm resources. Hence these practices were perceived to be sustainable, since they allowed for involvement and participation of rural poor, recognized indigenous knowledge, improved health situation, allowed for equitable access and were perceived to be safer to human beings and animals.

But among the farmers of conventional systems, the practices of burning crop residues and seed treatment with chemicals were perceived to be not at all sustainable with respect to social and cultural parameter of sustainability. Only 10 per cent of farmers of conventional systems perceived that these practices were sustainable.

Thus it was concluded that while more than 75 per cent of organic farmers perceived that the practices related to land preparation and seed treatment were sustainable on more than 13 out of 18 sustainability indicators, where as only 10 per cent of farmers of conventional systems perceived the conventional farming practices as sustainable on only 11 out of the 18 sustainability indicators.

All the listed organic farming practices under the set of land preparation and seed treatment were found to be sustainable by the organic farmers against all the eighteen indicators. They were perceived to be ecologically friendly and sustainable by more than 85 per cent organic farmers. On economic parameters of sustainability, about 70 per cent of the organic farmers found the practices related to land preparation and seed treatment as economically sound and profitable. On the social and cultural parameter of sustainability too, about 72 per cent of organic farmers were

satisfied with the organic farming practices related to land preparation and seed treatment such as incorporation of crop residues in soil, Deep summer ploughing, *In-situ* Green manuring, Seed treatment with resources like cow urine, Panchagavya and microbial inoculants.

A cursory look at the various organic farming practices under study revealed that all these organic farming practices were socially and culturally compatible, economically profitable, ecologically safe and sustainable (See Fig.4.5.1). They were cheaper and relied heavily on locally available on-farm resources, such as crop residues, cow urine, cow dung, *panchagavya* and microbial inoculants. While summer ploughing helped capture soil moisture of first showers of monsoon, green manuring helped improve soil fertility.

On the other hand, the practices of crop residues burning and seed treatment with chemicals were found to be not at all sustainable by more than 90 per cent of farmers of conventional systems. These two practices were ecologically unfriendly and unsafe, economically unprofitable and socially and culturally incompatible. These practices were found to not conserve the quality of water and biodiversity but instead spread hazardous substances in ecosystem, diminished the worth of indigenous knowledge, did not improve health and not safer to both human beings and animals. On the economic parameter, these practices would not help farmers to accumulate adequate working capital for next crop season. These practices of burning crop residues in the fields were harmful to the soil micro flora and fauna. The chemicals were also harmful to soil microorganisms and earth worms and other soil insects.

SUSTAINABILITY OF WEED MANAGEMENT PRACTICES

The analysis of sustainability of weed management practices were presented in Table 4.5.2. The weed management practices followed by organic farmers were; manual weeding, mulching, harrowing, soil solarization, use of biological agents like *Zygomycetes* sp., etc. (See Plate VIII). Among the farmers of conventional systems, the weed management practices included were: manual weeding and application of pesticides (See Plate VIII).

Ecological parameter: Weed management practices to conserve soil fertility by 83 per cent of organic farmers, conserve quality of water by 85 per cent of them, increase

Weed Management Practices



Intercultural operation by bullocks



Manual weeding



Mulching



Incorporating weed into Soil by rotavator



Spraying weedicides



Weedicides

biodiversity by nearly 92 per cent of them, avoid spread of hazardous substances by 88 per cent of them and improve micro-climate by nearly 87 per cent of organic farmers. About 35 per cent of them perceived that the organic weed management practices would affect the ecosystem in a positive manner.

But the perception of farmers of conventional systems practicing conventional ways of weed management was quite different. While 8 per cent of them perceived that spread of hazardous substances may be avoided by chemical use in weed management, nearly 12 per cent of them perceived that the agro-ecosystem may be affected. Thus 88 per cent of them perceived that chemical weed control affects adversely the agro-ecosystem.

Thus 78 per cent of organic farmers perceived the organic farming systems related to weed management to be ecologically sustainable and environment friendly, whereas only 3 per cent of farmers perceived so.

Economic parameter: Weed management practices followed by organic farmers were perceived to be economically sustainable by them. They were perceived to improve net incomes by 88 per cent of organic farmers, lead to food and income security by nearly 87 per cent of them, improve nutritional situation and secure food availability by 88 per cent of them, and can compete with others sectors by 88 per cent of them. These management practices were perceived to enable organic farmers to accumulate working capital by nearly 62 per cent of them and to aggregate an economic gain at national level by 68 per cent of organic farmers.

On the contrary, only 58 per cent of farmers of conventional systems perceived the chemical weed control practices to improve their net incomes, lead to food and income security by nearly 57 per cent of them, enable farmers of conventional systems to accumulate working capital for next crop season, and improve nutritional situation and secure food availability by 63 per cent of them.

Thus the overall comparison of economic parameter of sustainability of weed management practices between organic and farmers of conventional systems revealed that 80 per cent of organic farmers and only 35 per cent of farmers of conventional systems perceived their weed management as economically sound, profitable and sustainable (See Fig.4.5.2).

Table 4.5.2: Sustainability of Weed management Practices

Organic Practices: Mulching, Manual weeding, Harrowing, Soil solarization, Use of Biological agents like *Zygotropha* sp.

Conventional Farming Practices: Manual weeding and Application of Herbicides

N= 120

No.	Sustainability Indicators	Farmers' Response (Agree)			
		Organic farmers (n ₁ =60)		Conventional farmers (n ₁ =60)	
		f	%	f	%
A.	Sustainability: Ecological Parameter				
1.	Conserve soil fertility	50	83.3	0	0
2.	Conserve the quality and availability of water	51	85	0	0
3.	Increase biodiversity	55	91.7	0	0
4.	Avoid spread of hazardous substances	53	88.3	5	8.3
5.	Affect the agro-ecosystem	21	35	7	11.7
6.	Improve the microclimate	52	86.7	0	0
	Mean Value of All Ecological Indicators	47	78	2	3
B.	Sustainability: Economic Parameter				
7.	Improve net incomes	53	88.3	35	58.3
8.	Lead to Food and Income security	52	86.7	34	56.7
9.	Enable to accumulate working capital	37	61.7	2	61.7
10.	Nutritional situation and food availability secured	53	88.3	38	63.3
11.	Can compete with other sectors	53	88.3	6	10
12.	Can aggregate an economic gain at national level	41	68.3	8	13.3
	Mean Value of All Economic Indicators	48	80	21	35
C.	Sustainability: Social and cultural parameter				
13.	Rural poor involved in the approach	53	88.3	19	31.6
14.	Indigenous knowledge recognized within the approach	44	73.3	0	0
15.	Division of labor and distribution of income	48	80	4	6.7
16.	Improve the health situation	48	80	0	0
17.	Equitable access to assets	53	88.3	6	10
18.	Technology safer to human and animals	55	91.7	0	0
	Mean Value of All Social and cultural Indicators	50	83	5	8
	Overall Mean Value of Sustainability	48	80	9	15

Socio-cultural parameter: All the weed management practices perceived to be socially and culturally compatible and sustainable by 73-92 per cent of organic farmers. They were perceived to involve rural poor by 88 per cent of organic farmers, emphasize indigenous technical knowledge (ITK) by 73 per cent of them, and improve health of people by 80 per cent and safer to human beings and animals by nearly 92 per cent of them. They were found to be equitable in the division of labor,

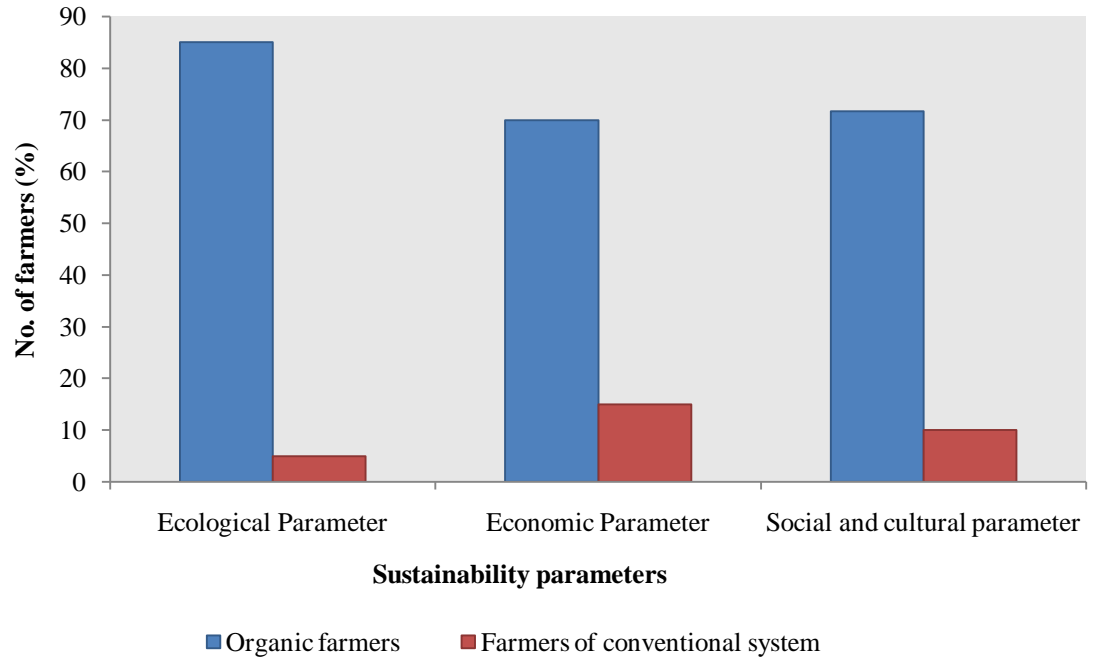


Fig. 4.5.1 Sustainability of Land Preparation and Seed Treatment Practices

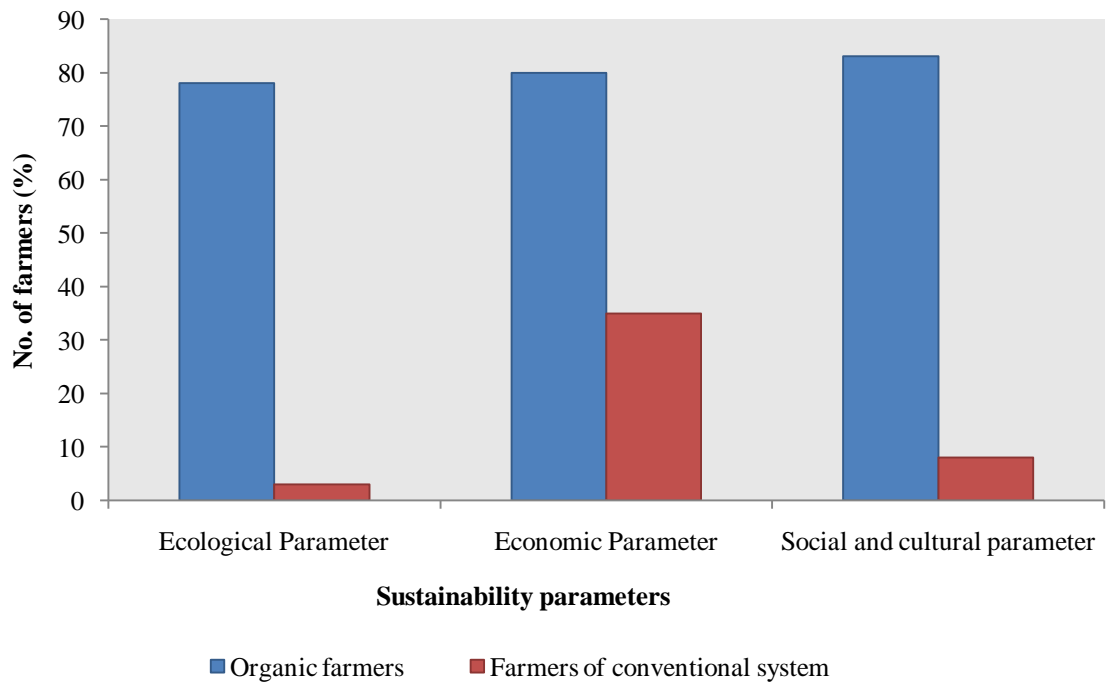


Fig. 4.5.2 Sustainability of Weed Management Practices

distribution of income by 80 per cent of them and provide equitable access to assets by 88 per cent of organic farmers.

But the picture of social and cultural compatibility of chemical weed control practices among the farmers of conventional systems was quite different from that of organic farmers. About 31 per cent of farmers of conventional systems perceived that the weed management practices were found to involve rural poor and provide equitable division of labor.

Thus 83 per cent of organic farmers and only 8 per cent of farmers of conventional systems perceived weed management practices as socially and culturally compatible and sustainable (See Fig.4.5.2).

SUSTAINABILITY OF NUTRIENT MANAGEMENT PRACTICES

Nutrient management is one of the key practices that distinguish organic farming. The practices related to nutrient management were; application of farm yard manure, incorporation of crop residues, *ex-situ* green manuring, crop rotation and application of *panchagavya*, oil cakes and tank silt (See Plate IX). All these practices emphasize extensive use of on-farm resources and reduced use of external inputs for plant nutrition.

On the other hand, the conventional farming practices related to nutrient management were; application of chemical fertilizer and micro-nutrients (See Plate IX). These practices emphasize the extensive use of external and costly inputs and non-use of any on farm resources. Thus the sources of nutrients were organic in nature in organic farming. The results of the analysis were compiled and presented in Table 4.5.3.

Nutrient Management Practices



Vermi-compost pits



Farm Yard Manure Application



Bio-digester tanks



Azolla cultivation



Tank Silt Application



Chemical Fertilisers

Table 4.5.3: Sustainability of Nutrient Management Practices

Organic Practices: FYM, Vermi-compost, Incorporation of crop residues, Ex-situ green manuring, Crop rotation, Panchagavya, Oilcakes, Tank silt application

Conventional Farming Practices: Application of Chemical Fertilizers and Micro-nutrients

N= 120

No.	Sustainability Indicators	Farmers' Response (Agree)			
		Organic Farmers n=60		Conventional Farmers n=60	
		<i>f</i>	%	<i>f</i>	%
A.	Sustainability: Ecological Parameter				
1.	Conserve soil fertility	56	93.3	7	11.7
2.	Conserve the quality and availability of water	32	53.3	0	0
3.	Increase biodiversity	53	88.3	0	0
4.	Avoid spread of hazardous substances	54	90	0	0
5.	Affect the agro-ecosystem	56	93.3	13	21.7
6.	Improve the micro-climate	45	75	0	0
	Mean Value of All Ecological Indicators	49	82	3	5
B.	Sustainability: Economic Parameter				
7.	Improve net incomes	53	88.3	28	46.7
8.	Lead to Food and Income security	57	95	24	40
9.	Enable to accumulate working capital	52	86.7	7	11.7
10.	Nutritional situation and food availability secured	53	88.3	7	11.7
11.	Can compete with other sectors	55	91.7	5	91.7
12.	Can aggregate an economic gain at national level	57	95	6	10
	Mean Value of All Economic Indicators	54	90	13	21.7
C.	Sustainability: Social and cultural Parameter				
13.	Rural poor involved in the approach	54	90	32	53.3
14.	Indigenous knowledge recognized within the approach	57	95	0	0
15.	Division of labor and distribution of income	40	66.7	4	6.7
16.	Improve the health situation	52	86.7	0	0
17.	Equitable access to assets	40	66.7	5	8.3
18.	Technology safer to human and animals	55	91.7	0	0
	Mean Value of All Social and cultural Indicators	50	83	7	12
	Overall Mean Value of Sustainability	51	85	8	13

Ecological parameter: An analysis of ecological parameter of sustainability of practices related to nutrient management revealed that the organic farming practices related to nutrient management were perceived to be sustainable on all the six ecological sustainability indicators. About 88-93 per cent of organic farmers perceived that the nutrient management practices followed by them would conserve soil fertility, enhances biodiversity, avoids spread of hazardous substances and affects the ecosystem in a beneficial way. About 75 per cent of them perceived that these practices help improve the micro-climate of the agro-ecosystem.

Indeed all the nutrient management practices followed by organic farmers were ecologically friendly and help improve the ecosystem as they were all involved in the sustainable use of on-farm resources and reduced use of any external resources.

But the nutrient management practices followed by farmers of conventional systems presented a completely contrasting picture of sustainability. All the conventional farming practices related to nutrient management, i.e., application of chemical fertilizers and micro-nutrients were perceived to be not at all sustainable by more than 95 per cent of respondents. Nearly 22 per cent opined that these practices would affect agro-ecosystem in a positive and beneficial manner. None of the farmers of conventional systems gave their agreement to four ecological sustainability indicators: they did not perceive that these practices would conserve soil quality of water, increase biodiversity; but they rather spread hazardous substances and did not improve micro-climate.

Thus it could be concluded that the nutrient management practices followed by farmers of conventional systems were ecologically sustainable and environment friendly, while those practices followed by farmers of conventional systems were ecologically unsustainable and environment unfriendly.

The mean scores of frequencies and percentages of the six ecological sustainability indicators were computed. While 82 per cent of organic farmers perceived that their practices of organic manure application were sustainable ecologically, only 5 per cent of farmers of conventional systems perceived their practices of chemical fertilizer application were ecologically sustainable and environmentally friendly.

Economic parameter: The organic farmers' practices of nutrient management were perceived to be sustainable economically by 86-95 per cent of organic farmers, since all the practices involved the use of cheaper on-farm resources; they were economically sound and profitable. There organic nutrient management practices were found to improve net incomes, led to food and income security, enabled organic farmers to accumulate working capital for next season, improve nutritional situation and ensured food availability. In addition, these practices competed with other sectors and could aggregate economic gain at national level.

On the other hand, application of fertilizers and micro-nutrients being followed by farmers of conventional systems relied heavily on external resources and fossil fuel based inputs. Hence they were perceived to be sustainable by nearly 47 per cent of farmers of conventional systems in terms of improving net income and 40 per cent of them in terms of leading to food and income security.

Overall, while 90 per cent of organic farmers perceived their practices related to nutrient management as quite sustainable, only 21 per cent of farmers of conventional systems felt so. This was very contrasting picture for both organic farmers and farmers of conventional systems.

Socio-cultural parameter: All the nutrient management practices followed by organic farmers were perceived to be sustainable by organic farmers. They were found to involve rural poor by 90 per cent of organic farmers, to recognize indigenous knowledge by 95 per cent of them, to improve the health by nearly 87 per cent of them and were safer to human beings and animals by nearly 92 per cent of them. Nearly 67 per cent of organic farmers opined that these organic nutrient practices were equitable in division of labour, distribution of income and access to assets. Overall the nutrient management practices were perceived to be socially and culturally sustainable by 67-92 per cent of organic farmers.

The situation among farmers of conventional systems presented a very contrasting picture of sustainability of nutrient management practices of conventional systems by 7 to 53 per cent of farmers of conventional systems. About 53 per cent of farmers of conventional systems perceived that the application of chemical fertilizers was found to involve rural poor in their adoption. On three indicators of social and cultural sustainability none of the farmers of conventional systems gave their agreement: emphasis on ITK, health of people and safety to human beings and animals.

Thus with respect to social and cultural parameter of sustainability of nutrient management practices, about 83 per cent of organic farmers and 12 per cent of farmers of conventional systems perceived these practices to be socio-culturally compatible and sustainable.

The overall picture for the comparison of perception of organic farmers and farmers of conventional systems was very contrasting. While 85 per cent of the organic farmers perceived the nutrient management practices to be sustainable, only 13 per cent of farmers of conventional systems perceived them to be sustainable (See Fig. 4.5.3).

SUSTAINABILITY OF PLANT PROTECTION PRACTICES

Plant protection practices form an integral part of the pegenpea cultivation. While pegenpea growers of conventional systems were found to apply various kinds of chemical pesticides, organic farmers found to resort to various kinds of non-chemical pest management practices.

The plant protection practices followed by organic pegenpea growers were; application of neem seed kernel extract (NSKE), botanical pesticides, neem oil, leaf extracts, bio-digest extracts, vermi-wash, use of bio-control agents, pheromone traps, bird perches, light traps, sticky plates, shaking of plants, manual collection and destruction of eggs and larvae and growing trap crops (See Plate X). These practices rely heavily on use of local resources and application of techniques to control the pest through multi-pronged approaches.

The farmers of conventional systems were found to use various chemical based plant protection practices including application of pesticides, insecticides, acaricides, fungicides and bactericides (See Plate X).

An analysis of sustainability parameters of the various plant protection measures was done and the results were presented in the Table 4.5.4.

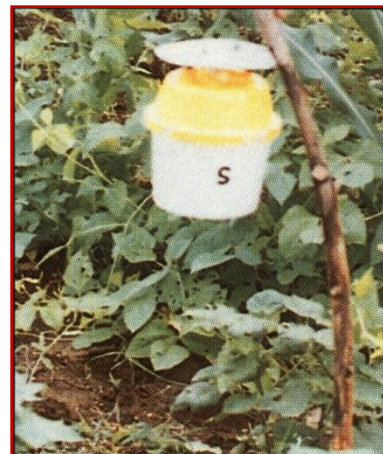
Ecological parameter: All the plant protection practices followed by organic farmers were found to be ecologically sustainable. They were found to conserve soil fertility by 95 per cent, enhance biodiversity by 95 per cent, avoid spread of hazardous substances by nearly 87 per cent, and improve the micro-climate as putforth by 88 per cent of the organic farmers.



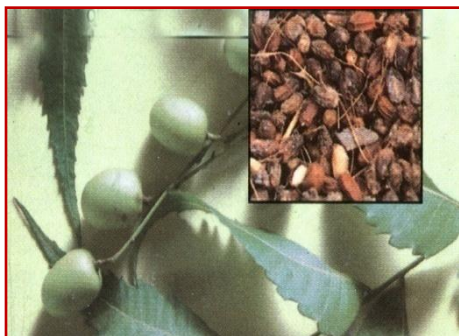
Light Traps



Bird perching on a Pheromone Trap



Pheromone Traps



Neem Seeds



Making NSKE

Plant Protection Practices



Sticky Light Traps



Shaking Plants



Pesticide spray



Hand Picking

Table 4.5.4: Sustainability of Plant Protection practices

Organic Practices: NSKE, Use of Botanicals like Neem oil, Leaf extracts etc., Use of Bio-control agents, Bio-digest extract, Vermi-wash, Pheromone traps, Bird perches, Light traps, Sticky plates, Trap crops, Shaking of plants, Manual collection and destruction of eggs and larvae

Conventional Farming Practices: Insecticides, Fungicides, Acaricides and other chemical based plant protection chemicals.

N= 120

S. No	Sustainability Indicators	Farmers' Response (Agree)			
		Organic farmers n=60		Conventional farmers n=60	
		<i>f</i>	%	<i>f</i>	%
A.	Sustainability: Ecological Parameter				
1.	Conserve soil fertility	57	95	0	0
2.	Conserve the quality and availability of water	13	21.7	0	0
3.	Increase biodiversity	57	95	0	0
4.	Avoid spread of hazardous substances	52	86.7	10	16.7
5.	Affect the agro-ecosystem	13	21.7	5	8.3
6.	Improve in micro-climate	53	88.3	0	0
	Mean Value of All Ecological Indicators	41	68	3	5
B.	Sustainability: Economic Parameter				
7.	Improve net incomes	53	88.3	6	10
8.	Lead to Food and Income security	54	90	13	21.7
9.	Enable to accumulate working capital	52	86.7	5	8.3
10.	Nutritional situation and food availability secured	53	88.3	6	10
11.	Can compete with other sectors	53	88.3	18	30
12.	Can aggregate an economic gain at national level	53	88.3	35	58.3
	Mean Value of All Economic Indicators	53	88	14	23
C.	Sustainability: Social and cultural Parameter				
13.	Rural poor involved in the approach	56	93.3	36	60
14.	Indigenous knowledge recognized within the approach	53	88.3	0	0
15.	Division of labor and distribution of income	43	71.7	3	5
16.	Improve the health situation	55	91.7	0	0
17.	Equitable access to assets	48	80	7	11.7
18.	Technology safer to human and animals	52	86.7	0	0
	Mean Value of All Social and cultural Indicators	51	85	8	13
	Overall Mean Value of Sustainability	48	80	8	13

But the chemical pesticide practices followed by farmers of conventional systems were found to be perceived as ecologically safe and sustainable by only 8-17 per cent of them.

A comparison of two samples of respondents revealed that their perception of ecological sustainability of plant protection practices was quite varying. While 68 per

cent of organic farmers perceived these plant protection measures to be ecologically safe, friendly and sustainable, only 5 per cent of farmers of conventional systems perceived them to be so.

Economic parameter: Among the organic farmers, all the plant protection practices followed by them were perceived to be economically sound, profitable and sustainable by 87-90 per cent of them. They were perceived to be improving net incomes by 88 per cent of organic farmers, to be leading to food and income security by 90 per cent of them, enabling organic farmers to accumulate working capital for next crop season by nearly 87 per cent of them, improving nutritional situation and securing availability of food by 88 per cent of them, competing with other sectors by 88 per cent of them and aggregating an economic gain at national level by 88 per cent of organic farmers. But the chemical plant protection practices followed by farmers of conventional systems were found to be economically sustainable by 8-58 per cent of farmers of conventional systems.

Thus the comparison of two samples on perception of economic sustainability revealed that 88 per cent of organic farmers perceived organic plant protection practices as economically sustainable and profitable, and 13 per cent of farmers of conventional systems perceived so. A contrasting picture emerged on economic sustainability of plant protection practices.

Socio-cultural parameter: All the organic plant protection measures were perceived to be socially and culturally compatible and sustainable by 72-93 per cent of organic farmers. They were perceived to be involving rural poor by 93 per cent of organic farmers, to be emphasizing the indigenous knowledge by 88 per cent of them, to be improving health of people by 92 per cent of them and to be safer to human beings and animals by 87 per cent of them, providing equitable division of labour and distribution of income by 72 per cent of them and providing equitable access to assets by 80 per cent of organic farmers.

But with respect to chemical plant protection practices, about 60 per cent of farmers of conventional systems perceived that these practices involved rural poor and hence socially and culturally sustainable.

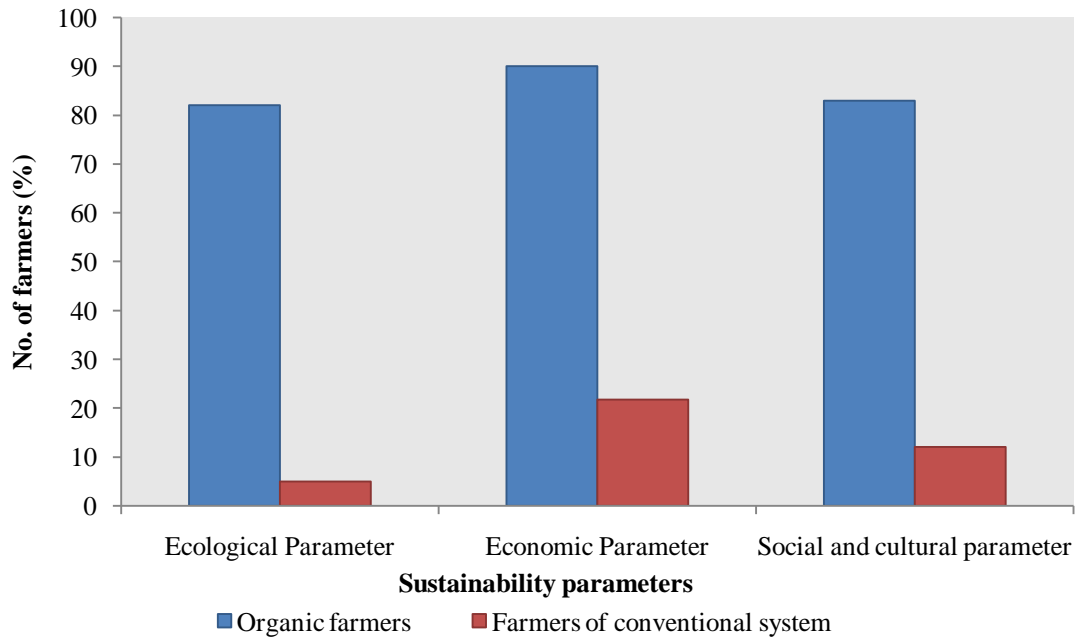


Fig. 4.5.3 Sustainability of Nutrient Management Practices

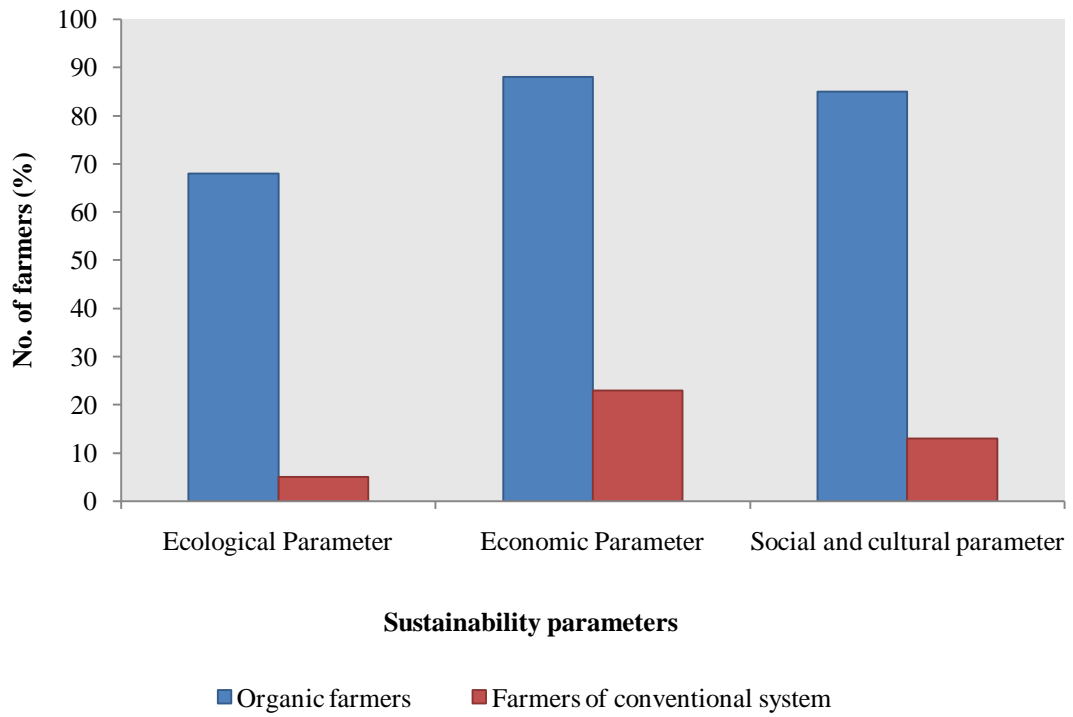


Fig. 4.5.4 Sustainability of Plant Protection Practices

A comparison of two samples of respondents revealed that 85 per cent of organic farmers and only 13 per cent of farmers of conventional systems perceived their plant protection practices as socially and culturally compatible and sustainable.

Overall picture of sustainability of organic plant protection practices and conventional chemical plant protection practices revealed very contrasting results. While 80 per cent of organic farmers perceived plant protection practices as sustainable, whereas only 13 per cent of farmers of conventional systems perceived chemical plant protection practices as sustainable (See Fig. 4.3.4).

SUSTAINABILITY OF SEED STORAGE PRACTICES

Seed storage is an integral aspect of pigeonpea cultivation. The organic farming practices related to seed storage were; sun drying and storage at dry places, incorporation of neem leaves into the produce (See Plate XI). Conventional farming practices related to seed storage were; chemical treatment with fungicides, dormancy inhibitors and germination inhibitors (See Plate XI).

The analysis of sustainability of seed storage practices followed by organic farmers and farmers of conventional systems was done and the results were given in Table 4.5.5. Among the six indicators of ecological sustainability, two sustainability indicators were dropped as they were not appropriate to seed storage but were related to soil fertility and agro-ecosystem.

Ecological parameter: All the seed storage practices followed by organic farmers were perceived to be sustainable and ecologically safe by 50-95 per cent of organic farmers.

They were perceived to be conserving the quality of water by 65 per cent of organic farmers, to be increasing bio-diversity by 95 per cent of them, to be avoiding spread of hazardous substances by 50 per cent of them, and to be improving the micro-climate of organic farms by 53 per cent of organic farmers. But among the farmers of conventional systems, the seed storage practices were found to be sustainable on only one indicator- avoiding the spread of hazardous substances by nearly 17 per cent of organic farmers. Thus the comparison of perception of organic

Seed Storage Practices



Seeds stored with dried Neem leaves



Seeds stored with chemicals

farmers and farmers of conventional systems on ecological sustainability revealed that 58 per cent of organic farmers.

Table 4.5.5: Sustainability of Seed Storage practices

Organic Practices: Sun drying and Storage at dry places, Incorporation of Neem leaves into the produce.

Conventional Farming Practices: Chemical treatment with Fungicides, Dormancy-inhibitors and Germination inhibitors.

N=120

S. No	Sustainability Indicators	Farmers' Response (Agree)			
		Organic farmers n=60		Conventional farmers n=60	
		<i>f</i>	%	<i>f</i>	%
A.	Sustainability: Ecological Parameter				
1.	Conserve soil fertility	0	0	0	0
2.	Conserve the quality and availability of water	39	65	0	0
3.	Increase biodiversity	37	95	0	0
4.	Avoid spread of hazardous substances	30	50	10	16.7
5.	Affect the agro-ecosystem	0	0	0	0
6.	Improve the micro-climate	32	53.3	0	0
	Mean Value of all Ecological Indicators	34	58	3	5
B.	Sustainability: Economic Parameter				
7.	Improve net incomes	53	88.3	40	66.7
8.	Lead to Food and Income security	52	86.7	13	21.7
9.	Enable to accumulate working capital	57	95	7	11.7
10.	Nutritional situation and food availability secured	45	75	7	11.7
11.	Can compete with other sectors	52	86.7	13	21.7
12.	Can aggregate an economic gain at national level	48	80	8	13.3
	Mean Value of All Economic Indicators	51	85	13	22
C.	Sustainability: Social and cultural Parameter				
13.	Rural poor involved in the approach	55	91.7	20	33.3
14.	Indigenous knowledge recognized within the approach	56	93.3	0	0
15.	Division of labor and distribution of income	13	21.7	6	10
16.	Improve the health situation	42	70	0	0
17.	Equitable access to assets	13	21.7	5	8.3
18.	Technology safer to human and animals	53	88.3	0	0
	Mean Value of All Social and cultural Indicators	39	65	5	8
	Overall Mean Value of Sustainability	38	63	7	12

Economic parameter: The seed storage practices followed by organic and conventional farming practices were perceived to be economically sound, profitable and sustainable by 75-95 per cent of organic farmers. These practices were perceived to be improving net incomes by 88 per cent of organic farmers, to be leading to food and income security by nearly 87 per cent of them, to be enabling organic farmers to

accumulate adequate working capital for next crop season, to be improving nutritional situation and secure food availability by 75 per cent of them, to be able to compete with other sectors by nearly 87 per cent of them and to be able to aggregate an economic gain at the national level by 80 per cent of organic farmers.

But the situation in case of perception of economic sustainability by organic farmers was quite different. The seed storage practices, followed by farmers of conventional systems, were perceived to be improving net incomes by nearly 67 per cent of farmers of conventional systems. Nearly 22 per cent of them perceived that the seed storage practices would lead to food and income security and to be able to compete with other sectors.

A comparison of two samples of respondents on their perception of economic sustainability of seed storage practices revealed that 85 per cent of organic farmers and only 22 per cent of farmers of conventional systems perceived that these practices were economically sound, cheaper and sustainable.

Socio-cultural parameter: All the organic farming practices related to seed storage practices were found to be socially and culturally compatible by 70-93 per cent of them on only four indicators of sustainability. They were perceived to be involving rural poor by nearly 92 per cent of organic farmers, to be emphasizing indigenous knowledge by 93 per cent of them, to be safer to human beings and animals by 88 per cent of them and to be improving the health of people by 70 per cent of organic farmers.

But the case of farmers of conventional systems presented a contrasting picture of sustainability of conventional seed storage practices. About 33 per cent of farmers of conventional systems perceived that the increase in seed storage practices to involve rural poor.

The comparison of two samples of respondents on their perception of seed storage practices revealed that 65 per cent of organic farmers and only 12 per cent of them perceived that these practices were socially and culturally compatible and sustainable. The overall picture of sustainability of seed storage practices among organic and conventional practices revealed that 63 per cent of organic farmers perceived these practices to be sustainable on all three parameters of sustainability,

whereas only 12 per cent of farmers of conventional systems perceived so (See Fig.4.3.5).

Differential Perception of Sustainability among Organic and farmers of conventional systems

The mean scores of each of the sustainability indicators was computed by calculating sum of all the responses of sixty respondents on each indicator and dividing the sum by number of respondents.

Table 4.5.6: Mean differences of perceived sustainability scores between organic and farmers of conventional systems

No.	Sustainability Indicators	Mean Differences	Std. Deviation	Std. Error Mean	't' value
	Ecological Parameter				
1.	Conserve soil fertility	4.12	1.01	0.13	31.573**
2.	Conserve the quality and availability of water	3.12	1.32	0.17	18.344**
3.	Increase biodiversity	4.17	1.04	0.13	30.908**
4.	Avoid spread of hazardous substances	3.43	1.38	0.18	19.239**
5.	Affect the agro-ecosystem	1.95	1.24	0.16	12.172**
6.	Improve the micro-climate	3.70	1.17	0.15	24.521**
	All Ecological Indicators	20.48	5.82	0.75	27.245**
	Economic Parameter				
7.	Improve net incomes	2.38	1.52	0.20	12.151**
8.	Lead to Food and Income security	2.58	1.34	0.17	14.888**
9.	Enable to accumulate working capital	3.67	1.35	.17	21.057**
10.	Nutritional situation and food availability secured	3.07	1.33	0.17	17.915**
11.	Can compete with other sectors	3.48	1.51	0.20	17.838**
12.	Can aggregate an economic gain at national level	2.62	1.22	0.16	16.579**
	All Economic Indicators	17.80	5.98	0.77	23.069**
	Social and Cultural Parameter				
13.	Rural poor involved in the approach	2.47	1.47	0.19	13.026**
1.	Indigenous knowledge recognized within the approach	4.25	.95	0.12	34.652**
15.	Division of labor and distribution of income	2.27	1.74	0.22	10.116**
16.	Improve the health situation	4.10	1.12	0.14	28.473**
17.	Equitable access to assets	2.87	1.47	0.19	15.139**
18.	Technology safer to human and animals	4.37	1.01	0.13	33.560**
	All Social and Cultural Indicators	20.32	6.01	0.78	26.186**

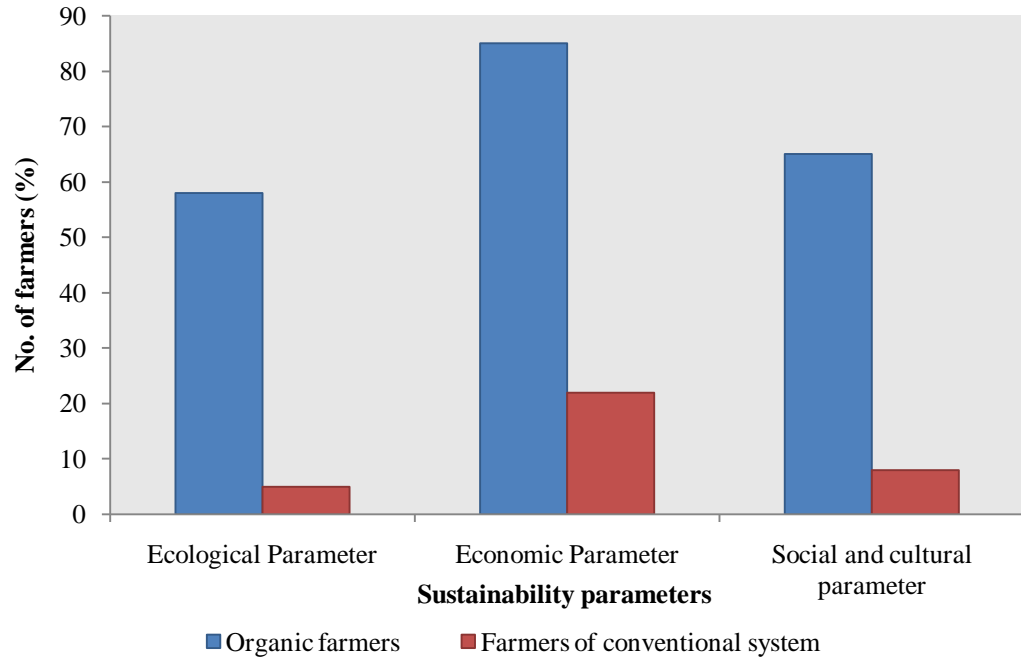


Fig. 4.5.5 Sustainability of Seed Storage Practices

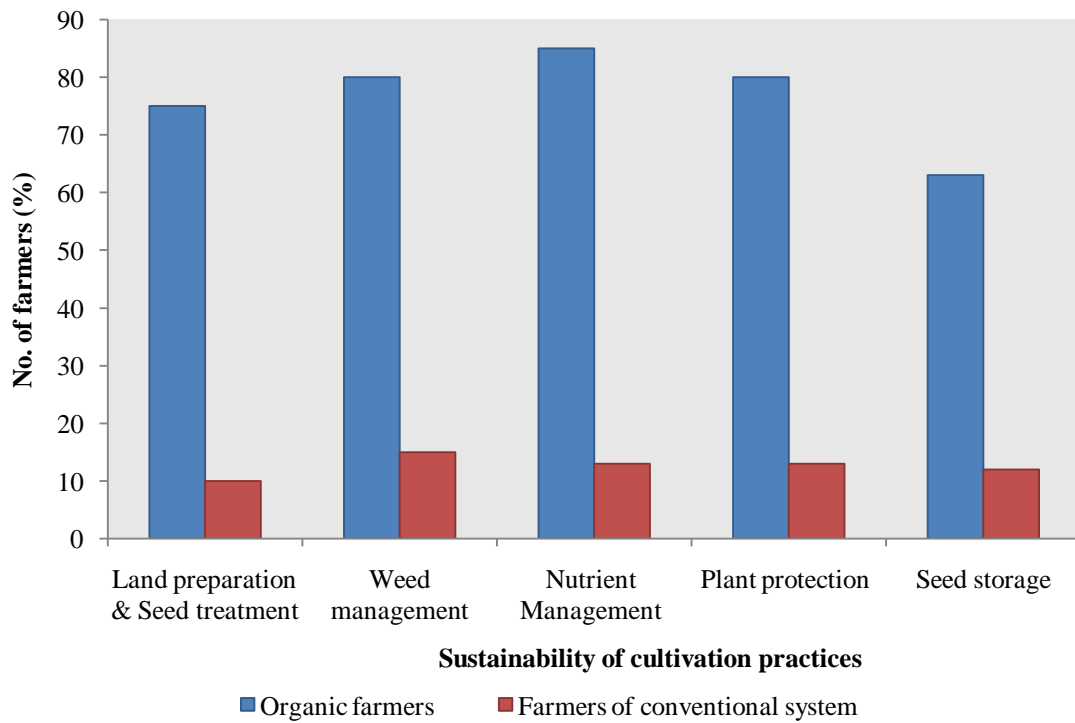


Fig. 4.5.6 Sustainability of Five Sets of Pigeonpea Cultivation Practices

In this study it became necessary to test whether two samples differ from one another significantly in their means or whether they may be regarded as belonging to the same population. Hence, the Fisher's 't' test was applied for testing significance of mean differences of perceived sustainability scores of two samples of respondents. The results are presented in Table 4.5.6.

It was hypothesized that there is difference in the sustainability of pigeonpea cultivation practices between organic and conventional farmers. The findings of the study, as can be seen from the results presented in Table, reveal that all the mean differences on all eighteen sustainability indicators were significantly different as the calculated 't' values are statistically significant at 0.01 level of probability. Hence the empirical hypothesis namely "*There is no significant difference in the sustainability of pigeonpea cultivation practices between organic and conventional farmers*" was considered as rejected. Hence the alternate hypothesis is accepted. In other words, it can be said that there is significant difference in the perceived sustainability of pigeonpea cultivation practices between organic farmers and conventional farmers. This clearly proves that the organic farming practices were significantly different from conventional farming practices on their sustainability parameters (See Fig.4.5.6).

Conclusion

It can be concluded that organic pigeonpea cultivation practices were perceived to be highly sustainable by the organic farmers. They were ecologically friendly, economically profitable and socio-culturally compatible. Contrasting picture emerged with the perception of pigeonpea cultivators of conventional systems on the conventional farming practices, which were ecologically and economically unsustainable.

CHAPTER - V

GENERAL DISCUSSION

An attempt is made here to present a holistic view of all the research findings of the study by critically analyzing and synthesizing the discussion through relating with relevant literature. Such an attempt would help in putting the results in the right theoretical framework of past studies.

Motivating Factors for practicing organic farming

The study aimed at delineating the factors that motivated farmers to convert to organic farming and continue to practice. The results were interesting to highlight three sets of factors: economic, propaganda and ecological.

Economic Factors: The major set of motivating factors that prompted farmers were economic factors. Economic motive has been the prime driving force behind farming, and human welfare. Here the organic farmers considered '*reduction in cost of cultivation*' as the primary economic motive that pushed them to opt for organic farming. As costly external inputs like chemical fertilizers and pesticides were completely removed from organic way of farming, the costs of cultivation dropped significantly resulting in easier adoption by farmers. Anandakumar (1998) had cited similar reasons responsible for conversion to organic farming among Puducherry farmers: '*Increasing cost of inputs in conventional farming, increase in net return despite reductions in yield in organic farming*'. In fact, *conventional farming had*

resulted in eventual yield drops (Anandakumar, 1998) over years which forced farmers to rethink on their investment decisions in agriculture. Cost saving is indeed a great motivating factor for conversion to organic farming, as farmers were already experiencing yield stagnation or drops in conventional farming (Padel, 2001).

With reduced dependence on external inputs and '*enhanced internal dependency of inputs*', the farmers felt a sense of independence and freedom in farming (relieved from the thought of loan repayments to moneylenders). Similar reason was cited by Anandakumar (1998): '*farmers' own decision and intention to reduce expenditure*'. Indeed, economic motive, especially of reducing costs, resulting in enhanced incomes and profits, was the strong motivating force behind organic farming.

Economic viability studies of this research have clearly brought out the economic motive behind organic farming of pigeonpea based cropping systems. The cost-benefit ratios of 1.56, 1.44 and 1.30 obtained from pigeonpea + green gram, pigeonpea + black gram and pigeonpea (sole crop) were found to be superior to pigeonpea returns from all the three pigeonpea based conventional farming systems. The net returns of organic farming were in real terms much more but with inclusion of rental value of owned land and Interest on fixed capital at 7 percent rate of interest (Cost B) and adding imputed value of family labour, the costs have increased. In addition, social and environmental costs and benefits were not factored in for computing cost of cultivation and gross returns. If these were also calculated, the benefits of organic farming would be very interesting and stimulate more enthusiasm among farmers and then, many more farmers would be interested to join the organic farming movement.

Propaganda Factors: Persuasive communication appeals to the people in several ways. Propaganda along with sustained programmes and activities were the real 'pull' factors for organic farming. Government of Karnataka, through its Empowered Committee (of 14 development departments and research organizations) and Mini Mission on Organic Farming (See Appendix VII) had pooled up all resources and took up a single concerted approach to promotion of organic farming through several

programmes and activities: demonstration of organic farming techniques KVKs, SAUs, and subsidy schemes for soil health and fertility improvement, etc.

The successful organic farmers were given due recognition through felicitations of '*Krishi Pundit*' awards and *publicizing success stories of organic farmers* (supported by Anandakumar, 1998), and farmers' tours to their farms. All these promotional activities have motivated farmers to avail of subsidies and other benefits for setting up vermi-compost units, and bio-digesters in their farms. The promotional efforts of NGOs have also sensitized and stimulated farmers to opt for organic farming. Special price premiums announced by government, for organic produce and setting up of cooperatives: *Savayava Krishi Parivars*, especially for mobilizing and organizing organic farmers were other pull factors for joining the silent organic movement in the state. *Encouragements and advice from neighboring organic farmers*' was given as an important reason for conversion to organic farming by Anandakumar (1998).

The genuine efforts of agricultural officials were reflected in their concern for farmers for restoring farmers' confidence in agriculture and ensuring food and livelihood security poverty alleviation in rural areas.

Even in the promotional schemes of government, the key factor that motivated farmers, to participate in the programmes of organic farming promotion, was the monetary benefits of subsidies for purchasing farm equipment, for setting up vermi-compost units and bio-digesters. With subsidies as incentives, many farmers have developed adequate infrastructure at their farms for on-farm nutrient supply and pest management.

Ecological Factors: Two of the most important ecological factors that emerged from the study were: '*reduction in pesticide poisoning (nausea) cases*' and '*diversification of agriculture*'. With indiscriminate use of pesticides, often without proper precautionary safety measures while spraying, pesticide poisoning cases have increased. But with adoption of organic farming, complete removal of hazardous chemical pesticides from farming, immediate changes were noticed by farmers in such cases as well as gradual recovery of agro-ecosystem. This has pushed farmers to

opt for organic farming. Several researchers have also found that health issues loomed large while deciding to convert to organic farming. Concern over family's health (Anandakumar, 1998), personal health, environmental concerns and concern for the soil (John, 2000), animal health problems, conservation of environment, and personal health consciousness reasons (Padel, 2001), health (minimal artificial chemical residues in the product) (Locke *et al.*, 2002) concern for the wild life & the environment, concern for animal welfare, and avoidance of pesticides Panda *et al.*, (2005) were some of the ecological reasons cited for conversion to organic farming and for preferring for organic foods.

The public concern regarding the environmental and food safety implications of agricultural chemicals was paralleled by growing concern among farms regarding their effect on their own health and that of their families and livestock. This concern was an important reason for farmers to convert to organic farming (Lockerets and Madden, 1987)

In addition, to enrich the agro-ecosystem, diversification was introduced in agriculture through horticulture, animal husbandry, growing trees and pastures. Farmers have started realizing the hidden benefits of a healthy ecosystem for better and profitable agriculture, through organic farming.

Case studies

The 'model organic farmers ' whose case stories are presented in the thesis, were all very experienced farmers with adequate understanding of the current agrarian issues and strong conviction for organic farming principles. They have all undergone the struggles of survival during post-green revolution phase and made mid-stream corrections to their farms by taking advantage of the training coerces and the subsidy schemes for converting to organic farming.

During the conversion process to organic farming, all the organic farmers had exhibited great perseverance and determination and patiently waited for the recovery of their agro-ecosystems and restoration of natural resource bases. Their hard work in setting up vermi-compost units, bio-digesters and use of improved agricultural

implements for mixing crop residues and wastes in soil have enhanced bio-mass and humus in the soils of their organic farms.

With adopting mixed farming systems with dairying, mixed cropping, crop rotations, and several of the agri-horticultural-silvi-cultural farming systems, mulching crop fields, and growing organic fruit trees, these organic farmers have diversified their agriculture and there by enriched the micro-climate and agro-ecosystems of their organic farms.

These organic farmers had also highlighted the need for providing premium price support for producing and selling better tasting, pesticide-free and safe organic produce and need to be provided opportunities to evolve new marketing channels for organic products.

The successful 'model organic farmers ' have acquired adequate practical understanding of the organic farming principles and readily shared their experiences and expertise with other farmers who came visiting their organic farms. They have been recognized as community resource persons by the department of agriculture and KVK and took frequent help from them in sensitizing and motivating other farmers and training them in organic farming techniques.

Similar case studies were documented by researchers. According to a study conducted by Agriculture-Man-Ecology (1991) on the transitional experiences of twelve organic farmers in Tamil Nadu, Kerala and Karnataka revealed that, on an average, the farmers had seven to ten years of experience with organic farming. Soil fertility improved, yields increased during transition and even surpassed conventional levels. Changes in soil fertility management were well prepared and all at once or gradually chemical fertilizers were replaced by nitrogen fixing crops, green manures, animal manures, tank silt, and agro-industrial by products or wastes. Pest control measures were mainly derived from traditional farming.

Similar case studies were also presented by Loganadhan (2002), Malgatti (2008) Jaganathan (2009), and Shinogi (2011) in which the qualitative aspects of conversion process to organic farming, organic practices and their sustainability were highlighted.

Understanding the successful cases of organic farmers was necessary in this research study to draw lessons for evolving strategies for promoting organic farming among other farmers. The critical issues of ensuring soil health and soil fertility, setting up necessary infrastructure for making inputs for organic farming, diversifying agriculture, enriching natural resource base and marketing of organic produce, etc., were brought to light, through cases, as lessons for promoting organic farming.

Economic viability

One argument against organic farming was that it produces lesser yield compared to conventional farming and hence economically not viable. But literature reviewed has shown that there were contrasting reports on the yield stability in organic farming. Several reviewers argued that the yield loss would be seen in organic farming as pest problems persist and that it is not viable as labour costs would be more.

The evidence that was got from this research on cost of cultivation, gross returns, net returns, has been presented in Tables 4.3.1 through 4.3.4. In the three pigeonpea based cropping systems studied in this research project, it was found that yield loss was observed to the tune of 4-7 per cent in pigeonpea (sole crop), pigeonpea + black gram and pigeonpea + green gram organic farming systems compared to inorganic farming systems.

But with premium price support for organic pigeonpea from government of Karnataka, the percent net returns over costs incurred in pigeonpea cultivation were higher in organic farming across three pigeonpea based cropping systems. The organic systems of the long-term experimental fields were found to be more profitable in both corn and tomato among the 4-year rotations mainly due to the higher price premiums (Clark, 1999b).

In all the three cropping systems, the cost of cultivation per hectare in organic pigeonpea cultivation was lesser than that of inorganic farming. All the other parameters of economic viability: gross returns, net returns, cost-benefit ratio over variable cost and cost-benefit ratio over total cost were higher in organic farming conditions.

In case of a hypothetical situation where no price premiums were announced for organic farming of pigeonpea and if farmers were forced to sell at the same price as that of inorganic pigeonpea, then the net premiums may be lower. In case of sole crop of pigeonpea, the net returns even in such cases were in the positive side but in cropping systems of pigeonpea intercropped with black gram and green gram the returns were in the negative.

When comparing the profitability of farming systems, the study (Welsh, 1999) found that organic cropping systems were always more profitable than the most common conventional cropping systems if the higher premiums that organic crops enjoy were factored in. When the higher premiums were not factored in, the organic systems were still more productive and profitable in three of the six studies. Thus it can be concluded that organic farming would be profitable in the long run, even if adequate price premiums were not supported. Indeed such price support would be required only on short term basis to cope with yield losses in initial years

The net returns were higher in case of organic pigeonpea because of the price premiums got by the farmers from the state government of Karnataka. This price premium was given to organic farmers even without any organic certification requirements, only to provide incentives for conversion to organic agriculture. The price premium for pigeonpea was up to 10.77 percent, (with increase from Rs. 3250/- to Rs.3600/-). This price premium is similar to that given in other countries. The average national retail price premiums for certified organic food have been reported at 20-30 per cent in Austria, 10-15 percent in Germany, 10-100 percent in both the USA and UK and 80 per cent in Australia (Halpin and Brueckner, 2004).

The per cent of net returns over costs in organic pigeonpea (sole crop) were still higher to that of inorganic pigeonpea (sole crop). But they were lesser than inorganic farming in cases of pigeonpea intercropped with black gram or green gram.

A number of studies have shown that under drought conditions, crops in organic agriculture systems produce significantly higher yields than comparable conventional agricultural crops (Dormaar *et al.*, 1988; Stanhill, 1990), often out-yielding conventional crops (Lockeretz *et al.*, 1981; Wynen, 1994; Petersen *et al.*,

1999) by 7–90 per cent. In rain-fed systems, organic agriculture has demonstrated to out-perform conventional agricultural systems under environmental stress conditions (Stanhill, 1990; Wynen, 1994; Peters, 1994).

The actual benefits accruing from an organic agro-ecosystem will be in terms of ecosystem services, which when factored in would make organic farming much more profitable than conventional farming system that actually degrades an agro-ecosystem, contrary to organic farming.

The environmental costs of conventional agriculture are substantial, and the evidence for significant environmental amelioration via conversion to organic agriculture is overwhelming (Kler *et al.*, 2001; Kler *et al.*, 2002). Several studies (Altieri, 1995; Thrupp, 1996; Pretty *et al.*, 2003; Pretty, 2005; Pretty and Hine, 2001; Tilman *et al.*, 2002 and Sandhu *et al.*, 2010) have reiterated the benefits of organic farming to environment and ecosystem services of organic farming need to be factored in for assessing the economic viability of organic farming. The economic value of such ecosystem services as conservation of agro-ecosystems, food production, production of forage, biofuels, and fuel wood, biological control of insect pests, diseases, and weeds by predators, pollination, nutrient supply, biological nitrogen fixation, carbon sequestration, soil formation by earthworms, and regulating services for ecological processes, etc., need to be assessed for the two agro-ecosystems of organic and conventional farming systems.

On the other hand, the conventional farming systems may appear to be profitable when the external costs are not factored in, and hence may be misleading. The World Resources Institute, an environmental policy think tank, reports that when measured with traditional cost analysis methods the average farm shows an \$80/acre profit. After accounting for all the external costs of soil loss, water contamination and environmental degradation caused by farming practices however, the average farm shows a \$29/acre loss instead! (Vasilikiotis, 2000).

Resource utilization efficiency

The basic principle and the crucial point in organic farming is optimizing, i.e., when the organic farmer tends to achieve the highest available quality through the

least minimal costs (Sarudi *et al.*, 2003). Optimal allocation of resources in crop production would reduce costs for getting maximum returns.

In the present study, the returns to scale, which is the sum of production elasticities in all the three pigeonpea based cropping systems was more than 1 for both organic and inorganic farming situations. But it was more in case of organic farming: pigeonpea -sole crop (1.48), pigeonpea + blackgram (1.54) and pigeonpea + green gram (1.62) as can be seen in tables 4.4.1 to 4.4.3. in the case of inorganic farming these figures were 1.38, 1.23 and 1.4 respectively indicating a declining trend. Thus it can be concluded that the returns to scale in organic farming of pigeon were increasing gradually from sole crop of pigeonpea to intercropped pigeonpea.

When the elasticities of production of individual factors were considered, the elasticity of production for human labour, seeds and plant protection were positive and significant in case of organic pigeonpea (sole crop) cultivation.

But in case of organic pigeonpea intercropped with black gram or green gram, the elasticities of production for human labour were positive and significant. These results indicate that in organic farming the contribution of human labour is significantly more. In case of inorganic pigeonpea cultivation practices only manures and fertilizers were contributing to pigeonpea yields in pigeonpea (sole crop) as well as pigeonpea + black gram cropping systems. These results are supported by Murlidharan (1987) and by Vishweshwar (1994).

Sustainability of Pigeonpea Cultivation Practices

Results of the study had shown that the set of organic farming practices of pigeonpea cultivation with respect to land preparation and seed treatment, weed management, nutrient management, plant protection, and seed storage practices were found to be more sustainable (ecologically, economically and socially) compared to inorganic farming practices. These results are supported by Sandhu *et al.*, (2010).

Organic farming in pigeonpea based cropping systems was found to be sustainable as it has offered great potential in developing low cost, making use of locally available eco-technologies for providing adequate pulse yields without

adversely affecting the environment in these complex drought prone regions. These results are supported by Badgley et al., (2006) and UN, (2008) studies.

In addition, pigeonpea based organic farming systems as practiced by farmer respondents along with their mixed farming of cattle and livestock have provided ecological services in waste recycling, nutrient recycling, soil stabilization and natural plant protection. These results are supported by IFOAM, (1998) and FAO, (2003) studies.

It can be concluded that organic pigeonpea cultivation practices were perceived to be highly sustainable by the organic farmers. They were ecologically friendly, economically profitable and socio-culturally compatible.

SUMMARY AND CONCLUSION

Today agriculture is passing through a difficult phase. The ever increasing costs of cultivation due to excessive dependency on the external inputs, high fluctuations in market prices due to opening up of markets, reduced public support after liberalisation, coupled with the monsoon vagaries in dryland areas have all made agriculture based livelihoods unviable. Dryland crops like *pigeonpea* (Red gram), *Jowar* (Sorghum), *Bengal gram* (Chickpea), *Black gram* (Urdbean), *Green gram* (mungbean), etc are low priced and low yielding crops. So, it is of utmost importance to go for resource utilisation efficient farming. This ensures optimum utilisation of farm resources, reduces cost of cultivation and higher net income.

Resource utilization efficiency means using the farm resources like water, soil fertility, vegetative and animal wastes judiciously thereby enhancing the soil fertility by choosing better cropping systems. This ensures sustainability of dryland agriculture. *Sustainability* means crop yield is maintained without any fluctuations coupled with enhancement of human health and ecological health leading to ecologically sound agriculture.

So, organic farming is a kind of farming, which suffices resource utilisation efficiency and sustainable agriculture. *Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.* (IFOAM, 2008). Owing small units of dairy and

poultry engage the farmers throughout the year in addition to strengthening the interrelations with agriculture and animal husbandry. Considering its pivotal role in sustainable agriculture, organic farming is experiencing rapid worldwide growth through the creative energy of thousands of grassroots organizations, farmers, activists, and traders. In some countries there is good support from the public and private sectors.

The planners, researchers, and development professionals, everywhere, have raised more concerns about the sustainability of modern production technologies in agriculture as mounting evidences are found on declining factor productivity, stagnation of crop yields, and deteriorating natural resource base. Humankind instead of living in tune with nature, by protecting themselves and their environment through its judicious use and monitoring it, is out to destroy the very sustenance of diversified ecosystems including land, water, flora, and fauna. So, the pursuit of more sustainable forms of agriculture is of central importance in meeting the current challenges.

Proven alternatives to conventional agriculture exist in many parts of the world. Yet many skeptics raised objections to up-scale these organic farming practices especially in cereal and pulse crops citing apprehensions of losing food security for the masses. Organic farming proponents argue that it is high time to revert from unsustainable chemical farming to more sustainable organic farming due to the latter's capability in mitigating climate change, enhancing resource use efficiency, and restoring agro-ecology of the cropping systems. But modern agriculture proponents are quite apprehensive about such claims.

KVK and agriculture department had taken steps to promote pulse production through promotion, demonstration and adoption of IPM (integrated pest management) in pigeonpea among the farmers in the Pulse Bowl of the state comprising Bidar, Gulbarga and Yadgir districts. Encouraged by the results, the agriculture department proposed and implemented special schemes on promotion of organic farming schemes of the state government across the state. Pigeonpea farmers also have taken advantage of the financial subsidies under these schemes (subsidies for bio-digester tanks, subsidies for setting up of vermi-compost units, subsidies on purchase of farm equipment like rotavators, inter-cultivators, chaff-cutters, etc., financial aid for

rejuvenation of krishi ponds, and for farmer-to-farmer seed exchange, etc.), accepted and adopted organic farming techniques.

Hence, it has been envisaged in this research study to assess and compare the economic viability of organic farming and conventional farming practices, assess and compare the elasticities of production of these two systems of farming, and evaluate whether these organic and conventional farming practices are sustainable or not. In addition, another crucial issue that demands a thorough understanding is the kind of motivating factors that persuade farmers to opt for organic farming techniques, in spite of the risks of lower yields and pest problems. Hence, the key research problem of this study is to analyse organic *vis-à-vis* conventional farming systems and practices. While assessing the quantitative data on organic and conventional farming, it was also thought imperative to analyse the process of transformation (through qualitative descriptive data) that a successful organic farmer passes through while converting his farm to organic farming. In the context of above discussion, the present study makes an attempt to study the following research objectives.

Specific Objectives

1. To study the factors motivating farmers to practice organic farming.
2. To document the cases of successful '*model organic farmers*'.
3. To analyse the economic viability of organic *vis-à-vis* conventional farming systems.
4. To study the resource utilization efficiency in organic *vis-à-vis* conventional farming systems.
5. To assess the sustainability of organic *vis-à-vis* conventional farming practices.

Research Methodology

An ex-post-facto and survey research design was adopted for the study and Gulbarga district of Karnataka state was taken purposively as study area. Aland and

Gulbarga taluks were also selected purposively and two villages from each taluks were selected randomly

Case study technique was adopted and a sample of four cases (one case of model organic farmer from each village) was taken for case writing and analysis. Since a case study approach was adopted for the study to bring home the qualitative aspects like the motivating factors involved, and interventions in adoption of organic farming practices, four '*model organic farmers*' from four villages were treated as four units for case study and analysis.

Since the study aims at analysing resource use efficiency and sustainability of organic farming, a survey approach was adopted for assessing the economic viability, resource utilization efficiency and sustainability comparisons of organic and conventional farming, fifteen organic farmer respondents and fifteen conventional farmer respondents were selected randomly from each village for personal interviews. The farmers who have been practicing organic farming of pigeonpea in their fields for the last three years were considered for the study. A sample of 60 organic and 60 conventional farmers were taken through simple random sampling for data collection. The data collected were analysed with the help of SPSS package.

MAJOR FINDINGS

Objective: I. To study the factors motivating farmers to practice organic farming

- ✓ Economic factors such as '*reduction in cost of cultivation*', '*enhancement of net income and profit*', '*internal dependency on inputs*', '*sustain livelihood security*' and '*better price for organic produce*' were considered important motivating factors by the respondents.
- ✓ Propaganda factors like '*Krishi Pundit awards*', '*promotional schemes and advertisements of the government*', '*awareness campaign by government organizations and NGOs*', and '*success stories of organic farmers*' were considered to be motivating farmers to practice organic farming.

- ✓ Ecological factors such as '*reduction in pesticide poisoning (nausea) cases*', '*diversification of agriculture*', and '*increase in productivity of soil and improvement in soil health*' were considered to be high motivating factors.

Objective: II. To document the successful cases of '*model organic farmers*'

A thorough analysis of the four case studies and their reflections was done to bring out useful lessons for promotion of organic farming like,

- ✓ **Improving Soil Health:** Shivalingappa Chorgasthi and Shivananda Belli had great conceptual clarity on these basic issues of soil health management, the backbone of sound organic farming practice. They have been successful organic farmers only because they took adequate care of maintaining soil fertility and soil health.
- ✓ **Building Infrastructure for organic farming:** Shivalingappa Chorgasthi, Shivananda Belli, Mallinath Kollur and Basawaraj Jewangi have all took steps in building vermi-compost pits and bio-digesters on their farms. In addition, all of them have used special machines and equipment for soil conservation measures, mixing crop residues in fields, and improving natural resource base of their organic farms.
- ✓ **Enriching natural resource base:** Mallinath Kollur could achieve this feat of rejuvenating his dead bore wells in his fields. Growing several forest tree species like teak, on bunds had helped in efficient use of the open farm spaces and its leaf litter had been used in mulching and vermi-compost preparation, Neem trees were used in preparation of NSKE for plant protection of their crops. Other plant species like Calotropis, datura, vitavax, etc. have been used to make bio-pesticides in bio-digesters.
- ✓ **Marketing of Organic Produce:** Shivananda Belli tactfully exploited '*quality & taste*' of organic foods in marketing his organic produce by selling at his farm gate at higher prices. Since the yield loss in the initial years was high in organic farms, the farmers need to be provided adequate marketing support through better prices rather than giving subsidies.

- ✓ **Diversification in agriculture:** Agriculture does not mean only growing crops. It needs to be supplemented with raising cows and buffaloes, growing trees, and fruit trees, etc.

Objective: III To analyse the economic viability of organic *vis-à-vis* conventional farming systems

- ✓ It was found that yield loss was observed to the tune of 4-7 per cent in pigeonpea (sole crop), pigeonpea + black gram and pigeonpea + green gram organic farming systems compared to conventional farming systems. But with premium price support for organic pigeonpea from government of Karnataka, the percent net returns over costs incurred in pigeonpea cultivation were higher in organic farming across three pigeonpea based cropping systems.
- ✓ In all the three cropping systems, the cost of cultivation per hectare in organic pigeonpea cultivation was lesser than that of conventional farming.
- ✓ All the other parameters of economic viability: gross returns, net returns, cost-benefit ratio over variable cost and cost-benefit ratio over total cost were higher in organic farming conditions.

Objective: IV To study the resource utilization efficiency in organic *vis-à-vis* conventional farming systems

- ✓ The sum of production elasticities or *returns to scale* in all the three pigeonpea based cropping systems was more than 1 for both organic and conventional farming situations. But it was more in case of organic farming: pigeonpea-sole crop (1.48), pigeonpea+ black gram (1.54) and pigeonpea+ green gram (1.62). Thus it can be concluded that the returns to scale in organic farming of pigeon were increasing gradually from sole crop of pigeonpea to intercropped pigeonpea.
- ✓ When the elasticities of production of individual factors were considered, the elasticity of production for human labour, seeds and plant protection were positive and significant in case of organic pigeonpea (sole crop) cultivation.

But in case of organic pigeonpea intercropped with black gram or green gram, the elasticities of production for human labour were positive and significant.

- ✓ These results indicate that in organic farming the contribution of human labour is significantly more. In case of conventional pigeonpea cultivation practices only manures and fertilizers were contributing to pigeonpea yields in pigeonpea (sole crop) as well as pigeonpea + black gram cropping systems.

Objective: V. To assess the sustainability of organic *vis-à-vis* conventional farming practices

- ✓ Results of the study had shown that the set of organic farming practices of pigeonpea cultivation with respect to land preparation and seed treatment, weed management, nutrient management, plant protection, and seed storage practices were found to be more sustainable (ecologically, economically and socially) compared to conventional farming practices.
- ✓ It can be concluded that organic pigeonpea cultivation practices were perceived to be highly sustainable by the organic farmers. They were ecologically friendly, economically profitable and socio-culturally compatible.

Implications of the study

- ✓ Results of this study will clear the apprehensions of different stake holders about the economic viability of organic farming.
- ✓ The results of this study will provide clarification and useful guides for the policy makers and the government to devise programmes for promotion of organic farming in other areas.
- ✓ Practice of organic farming will ensure year round employment for the farmers and provide food, income and livelihood security.
- ✓ Practices of organic farming will ensure sustainability of the farm as a whole, and enrich the agro-ecosystem.

- ✓ Organic farming ensures better resource utilization efficiency and provide for optimal resource allocation.

Suggestions for future research

- ✓ Research studies can be taken up to explore few more ecological motivational factors, through farmers' education and training of agro-ecosystem, which can motivate farmers to switch over to organic farming.
- ✓ Research studies can be taken up to explore the reasons for quitting farming in various crops in different agro-climatic regions in order to diagnose the agrarian crisis and to find ways to restore farmers' confidence in agriculture.
- ✓ Studies can be taken up to compare the economic viability in organic farming and conventional farming in various agro-climatic conditions, farming systems, cropping systems, horticultural and agro-forestry systems and among farmers of different size of holdings and resources.
- ✓ Resource utilization efficiency studies can further explore the different farming systems by considering the social costs and environmental costs and benefits of the agro-ecosystem as a whole.
- ✓ Further research on quantification of various sustainability parameters would help assess the sustainability of agro-ecosystems of various farming systems of crops, trees, animals, etc.
- ✓ Studies can be taken up to assess and devise various teaching/training approaches to popularize and spread organic farming across all sections of farmers and farming systems/ cropping systems.

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ABSTRACT

In a study conducted among the farmers selected through simple random sampling from Aland and Gulbarga taluks in Gulbarga district of Karnataka, who were growing pigeonpea in pigeonpea based organic and conventional farming systems, the major motivating factors for practicing organic farming were identified as *reduction in cost of cultivation, enhancement of net income and profit, internal dependency on inputs, reduction in pesticide poisoning cases, and diversification in agriculture*. These pushed the farmers towards practicing organic farming. In addition to these push factors, were the pull factors of incentives in terms of prestige associated with *Krishi Pundit* awards, promotional schemes of government and awareness campaigns of NGOs, and success stories of other organic farmers.

The key lessons for organic farming promoters in evolving appropriate strategies were brought out by case studies of four '*model organic farmers*'. *They were*: On a first priority, improve soil health through enhancing biomass, by application of vermi-compost and FYM; build infrastructure like vermi-compost pits and bio-digesters for nutrient and pest management; enrich natural resource base through soil and water conservation; diversify the organic farms with multiple cropping and mixed farming; and find better marketing avenues for selling organic produce. The case studies highlighted the background and struggles of farmers in converting to organic farming and their coping strategies.

An attempt to critically analyse and compare the economic viability of organic pigeonpea cultivation revealed that the cost benefit ratio (BC ratio) in all the three systems of sole pigeonpea crop, pigeonpea + green gram and pigeonpea + black gram was higher in organic farming in comparison to conventional farming. The cost benefit ratio for pigeonpea + green gram was the highest at 1:1.56, while it was lowest at 1:1.16 for sole crop of pigeonpea in conventional farming system. Costs incurred in the management of nutrients, pests, diseases and weeds were lower in case of organic farming of pigeonpea grown as a sole crop as well as an intercrop with green gram or black gram. These results reiterate that organic farming is cost-effective.

An attempt made to assess the resource use efficiency of pigeonpea cultivation in three pigeonpea based cropping systems revealed that human labour, land, seeds, plant protection measures have contributed significantly to the production elasticities. The coefficients of multiple determination for all three production functions fitted ranged between 0.96 and 0.98 indicating that the production function fitted was sound and could help explain the variation in gross returns in pigeonpea based cropping systems. The returns to scale in all the pigeonpea based cropping systems were superior in organic farming compared to conventional farming. These results will help alleviate any fears against organic farming.

An attempt was made to assess the sustainability of five sets of practices: land preparation and seed treatment, weed management, nutrient management, plant protection, and seed storage practices organic vis-à-vis conventional farming practices. The sixty farmers cultivating pigeonpea with organic practices perceived them to be highly sustainable on ecological, economic and social parameters of sustainability. But the sixty farmers of the conventional farming systems felt that the practices they were adopting, involving fertilizers and chemical pesticides, were not at all sustainable. So, organic farming practices which were found to be ecologically sustainable, economically viable and socially compatible need be promoted for large scale adoption across the nation.

सारांश

कर्नाटक के गुलबर्गा जिले के आलंद और गुलबर्गा तहसीलों में सरल यादृच्छिक नमूना के माध्यम से चयनित किसानों के बीच तूर (अरहर) फसल आधारित जैविक और रसायनिक कृषि का एक अध्ययन किया गया। जिसमें जैविक खेती करने वाले किसानों को प्रेरित करने के प्रमुख कारकों में कम लागत, खेती की शुद्ध आय और लाभ, कृषि आदानों की आंतरिक निर्भरता, कीटनाशक विषाक्तता के मामलों में कमी, और कृषि के क्षेत्र में विविधीकरण की वृद्धि, जो किसानों द्वारा जैविक खेती के व्यापक अनुसरण की दिशा में काफी हद तक मददगार पाए गए। इन कारकों के अलावा, कृषि पंडित पुरस्कार के साथ जुड़े प्रतिष्ठा, सरकार और गैर-सरकारी संगठनों के द्वारा चलाये गए जागरूकता अभियानों एवं योजनाओं का प्रचार-प्रसार, और अन्य जैविक खेती करने वाले किसानों की सफलता की कहानियों के मामले में प्रोत्साहन के महत्वपूर्ण कारक सिद्ध हुए।

इस अध्ययन को उचित रणनीतिक के तौर पर चार सफल जैविक खेती करने वाले किसानों वृत्तांतों के माध्यम से यहाँ प्रस्तुत किया गया है। इनमें से महत्वपूर्ण थे: प्राथमिकता के तौर पर, बायोमास के बढ़ाने के माध्यम से मृदा स्वास्थ्य में सुधार, केंचुआ खाद और गोबर खाद के उपयोग से, पोषक तत्वों की उपलब्धता और कीट-प्रबंधन के लिए बायो-डाइजेस्टर एवं केंचुआ खाद बनाने के लिए केंचुआ खाद का गड्डे, जैसे बुनियादी ढांचे का निर्माण, मिट्टी और जल संरक्षण के माध्यम से प्राकृतिक संसाधन आधार का समृद्धिकरण, एकाधिक फसल और मिश्रित खेती के साथ जैविक खेतों में विविधता एवं जैविक उत्पादों को बेचने के लिए बेहतर विपणन के रास्ते खोजने। इन मामलों के अध्ययन की पृष्ठभूमि में जैविक खेती करने वाले किसानों और परिवर्तित जैविक कृषि कार्यकलापों के साथ संघर्ष एवं उनकी सहनशीलता की रणनीतियों पर विस्तृत प्रकाश डाला गया है।

तूर की जैविक खेती के आर्थिक व्यवहार्यता का एक गहन विश्लेषण और उसकी तुलना करने से पता चला है कि तूर के तीनों फसल प्रणालियों में लागत - लाभ अनुपात, एकमात्र तूर और अन्तःफसल के अंतर्गत तूर+मूंग और तूर+उरद की जैविक खेती रसायनिक खेती की तुलना में उच्च में पाया गया। यह लागत - लाभ अनुपात तूर+मूंग के लिए 1:1.56 पर उच्चतम था, जबकि यह 1:1.16 में रसायनिक खेती प्रणाली में तूर के एकमात्र फसल के लिए सबसे कम था। तूर के एकमात्र फसल के रूप में हो, या मूंग या उरद के साथ एक अन्तराल सस्य फसल के रूप में हो, तूर की जैविक खेती में पोषक तत्वों, कीट, रोग, और खरपतवार प्रबंधन में लागत खर्च कम थे। ये परिणाम दोहराते हैं कि जैविक खेती आर्थिक रूप से लागत प्रभावी है।

तूर आधारित फसल प्रणाली में तूर खेती के संसाधन उपयोग की क्षमता का आकलन करने के लिए एक प्रयास से पता चला है कि मानव-श्रम, भूमि, बीज, पौध-संरक्षण में उत्पादन का काफी योगदान पाया गया है। सभी तीनों उत्पादन कार्यों के सांख्यिकी मापक (एकाधिक दृढसंकल्प) 0.96 और 0.98 दर्शाता है कि उत्पादन समीकरण सक्षम है और तूर आधारित फसल प्रणालियों में सकल लाभ में भिन्नता को समझाने में मदद कर

सकता है। सभी तूर आधारित फसल प्रणाली में जैविक खेती बड़े पैमाने पर आमदनी में रसायनिक खेती की तुलना में बेहतर पाये गये। इन परिणामों से जैविक खेती के खिलाफ किसी भी आशंका को दूर करने में मदद करेगा।

पांच कृषि क्रियाओं, अर्थात् भूमि-तैयारी और बीज उपचार, खरपतवार प्रबंधन, पोषक-तत्व प्रबंधन, पौध-संरक्षण, बीज भंडारण प्रक्रिया की स्थिरता जैविक खेती व रसायनिक खेती के तुलनात्मक आंकलन का एक सार्थक प्रयास किया गया है। साथ जैविक किसानों ने तूर की जैविक कृषि पद्धतियों को पारिस्थितिकी के लिहाज से अत्यधिक स्थिरतापूर्ण, आर्थिक और सामाजिक मानदंडों पर कथित प्रथाओं स्थायी पाया गया। लेकिन रसायनिक खेती प्रणालियों के साथ किसानों ने यह महसूस किया है कि पद्धतियों को अपनाने से, जिसमें उर्वरक और रासायनिक कीटनाशक शामिल थे, पारिस्थिति टिकाऊ, आर्थिक रूप से व्यवहार्य और सामाजिक संगत नहीं होना पाया गया है। जैविक खेती पद्धतियों को देश भर में बड़े पैमाने पर अपनाने के लिए किसानों को प्रोत्साहित किये जाने कि जरूरत है।

Appendix I

INTERVIEW-SCHEDULE FOR ORGANIC FARMERS

Date:

Respondent No:

District:

Taluka:

Village:

1. Name of the farmer:

Sex: Male / Female: Age (years) :

2. Educational status:

Illiterate	Primary school	Middle school	High school	Junior college	Degree college

5. Occupational status:

Farming alone	Farming and Agril. related occupation.	Farming and other occupation.	Any other

6. No of members in the family:

7. Family Type: Joint / Nuclear

8. Type of house:

Thatched	Tiled	Concrete single storey	Concrete double storey

9. Livestock Possession

Cow buffalo goat bullock calf poultry others

10. Domestic Material Possessions

Components :	Score
a. Cooker / grinder:	
b. Bicycle / Automobile:	
c. Electricity connection:	
d. Telephone:	
e. Radio / T.V / Connection:	
f. Washing Machine	
g. Pump sets:	
h. Farm machinery and other equipments:	
i.	
j.	

11. Farming experience(in yrs): _____ 12. Farming experience (organic farming in yrs): _____

13. Size of the farm (in ha)

Particulars	Wet land	Garden land	Dry land	total	Source of Irrigation
Total cultivable owned					
Cultivable area leased in					
Cultivable area leased out					
Area sown more than once					

14. Area under organic farming (in ha)

Particulars	Wet land	Garden land	Dry land	Total
Total cultivable owned				
Cultivable area leased in				
Cultivable area leased out				
Area sown more than once				

15. Crops grown using organic farming Practices:

Kharif	Rabi	Summer

16. Social participation:

No.	Social institution	Member/office bearer	Frequency of exposure		
			regularly	occasionally	never
1.	Gram Panchayat				
2.	Cooperative credit society				
3.	Organic farmers association				
4.	Rural youth club				
5.	Anganwadi				
6.	Self help groups				
7.	Milk cooperative union				
8.	<i>SavayavaKrishiParivar</i>				
9.	Others, specify				

17. Resources for Sustainable Agriculture**A. Manures:**

No.	Resource	Available at home	Available with neighbours	Available at village	Available at outside the village/Town
1.	FYM				
2.	Vermicompost				
3.	Silt				
4.	Green Manure				
5.	Chemical Fertilizer				

B. Solutions to control Pests:

No	Resource	Available at home	Available with neighbours	Available at village	available at outside the villageTown
1.	Garlic+ chilli paste				
2.	Neem seed + neem leaf				
3.	Wild tulasi solution (Basil)				
4.	Custard apple leaves				
5.	Poisonous leaf solution				
6.	Botanicals				
7.	Cow dung +cow urine +hing				
8.	Panchagavya				
9.	Jeevamrutham				
10.	Beejamrutham/Bramasthram/ Neemasthram				

18. Area of pigeonpea under organic farming.

No	Cropping systems	Area (In ha)		
		2008-2009	2009-2010	2010-2011
CS 1.	Pigeonpea + Jowar			
CS 2.	Pigeonpea + Blackgram			
CS 3.	Pigeonpea + Soybean			
CS 4.	Pigeonpea + Greengram			
CS 5.	Pigeonpea sole crop			

19. Factors motivating farmers to practice organic farming.

No.	Motivational factors	v.high	high	medium	low	v.low
1.	Human Health:					
a	Reduction in pesticide poisoning cases (nausea)					
b	Reduction in Hospitalization and weakness					
c	Better quality of food & nutrition					
d	Better working capacity					
2.	Financial:					
a	Reduction in cost of cultivation					
b	Net income & profit enhancement					
c	Better price for organic produce					
d	Reduction in hospitalization costs					
3.	Ecological:					
a	Increase in productivity of Soil health					
b	Increase in earthworms population					
c	Diversification of agriculture					
d	Sustainable use of resources					
4.	Management:					
a	Independence					
b	Self-reliance					
c	Ability to survive a crisis (loss due to drought/heavy rain/calamity/pest attack, etc.)					
d	Sustain livelihood security.					
5.	Philosophical motives:					
a	Sustainable development					
b	'Live n let live' philosophy of life					
c	Stay with nature					
d	Harmony with nature					
6.	Propaganda and media:					
a	KrishiPandit Awards					
b	Promotional schemes & Advertisements of government					
c	Awareness campaigns by NGOs and other agencies					
d	Success stories of organic farming					

20. Economic viability of organic farming:

Costs and returns structure under pigeon pea based cropping System- (Rs. / ha)

SNo.	Particulars	Unit	Farmers data	
			Quantity	Value
I	Variable Cost (VC)			
1.	Human labour			
	a. Family labour	MD		
	b. Hired labour	MD		
2.	Machine labour	Hr		
3.	Bullock pair	BPD		
4.	Land Preparation			
	FYM	Kg		
	Micro-nutrients	Kg		
	Oil cakes	Kg		
	Bio-fertilizers	Kg		
5.	Seeds (Main crop)	Kg		
	Seeds (Inter crop)	Kg		
6.	Seed treatment	Litres		
7.	Sowing	Rs		
8.	Irrigation	Rs		
9.	Weed management			
	• Hand weeding	MD		
	• Weedicides	Litres/Kg		
	• Intercultural	BPD		
10.	Plant Protection operations			
	• Cultural	BPD		
	• Mechanical	Rs		
	• Biological	Rs		
	• Botanical pesticide spraying	Rs		
	• Others	Rs		
11.	Harvesting and drying	Rs		
12.	Threshing	Rs		
13.	Grading and packing	Rs		
8.	Miscellaneous charges	Rs		
9.	Interest on working capital	Rs		
	Total variable cost (TVC)	Rs		
	(% to total cost)			
II.	Fixed Cost (FC)			
1.	Land revenue	Rs		
2.	Depreciation	Rs		
3.	Rental value	Rs		
4.	Interest on fixed capital	Rs		
	Total fixed cost (TFC)	Rs		
	(% to total cost)			
III.	Total cost	Rs		
IV.	Returns			
	a. Main product	Qtl.		
	b. Byproduct	Qtl.		
	Gross returns	Rs		
V.	Net returns	Rs		
VI.	B:C ratio	Rs		

Note: MD=Mandays, Hr=Hours, BPD=Bullock pair days, Rs=Rupees, Qtl=Quintals, Kg= Kilograms

21. Sustainability of Organic farming Practices: put tick mark () if Organic farming methods mentioned below works against the Sustainable dimensions.

S.NO	Sustainability indicators	Organic practices				
		i	ii	iii	iv	v
I	Sustainability: Ecological dimensions					
1.	Conserve soil fertility					
2.	Conserve the quality and availability of water					
3.	Increase biodiversity					
4.	Avoids spread of hazardous substances					
5.	Affect the agro-ecosystem					
6.	Improvement in microclimate					
II	Sustainability: Economic dimension					
7.	Improve net incomes					
8.	Leads to Food and Income security					
9.	Enable to accumulate working capital					
10.	Nutritional situation and food availability secured					
11.	Can compete with other sectors					
12.	Can aggregate an economic gain at national level					
III	Sustainability: Social and cultural dimension					
13.	Rural poor involved in the approach					
14.	Indigenous knowledge recognized within the approach					
15.	Division of labor and distribution of income					
16.	Improve the health situation					
17.	Equitable access to assets					
18.	Technology safer to human and animals					

Organic farming practices:

- i. Land preparation and Seed treatment:** Incorporation of crop residues in soil, Deep summer ploughing, In-situ Green manuring, Seed treatment with resources like cow urine, *Panchagavya* and microbial inoculants.
- ii. Weed management:** Mulching, Manual weeding, Harrowing, soil solarization, Use of Biological agents like *Zygotropha* sp.
- iii. Nutrient management:** FYM, Vermi-compost, Incorporation of crop residues, Ex-situ green manuring, Crop rotation, *Panchagavya*, Oilcakes, Tank silt application
- iv. Plant protection practices:** NSKE, Use of Botanicals like Neem oil, Leaf extracts etc., Use of Bio-control agents, Biodigest extract, Vermi-wash, Pheromone traps, Bird perches, Light traps, Sticky plates, Trap crops, Shaking of plants, Manual collection and destruction of eggs and larvae
- v. Seed storage:** Sun drying and Storage at dry places, Incorporation of Neem leaves into the produce.

INTERVIEW-SCHEDULE FOR FARMERS PRACTICING CONVENTIONAL FARMING

Date:

Respondent No:

District:

Taluka:

Village:

1. Name of the farmer:

Sex: Male / Female: Age (years) :

2. Educational status:

Illiterate	Primary school	Middle school	High school	Junior college	Degree college

5. Occupational status:

Farming alone	Farming and Agril. related occupation.	Farming and other occupation.	Any other

6. No of members in the family:

7. Family Type: Joint / Nuclear

8. Type of house:

Thatched	Tiled	Concrete single storey	Concrete double storey

9. Livestock Possession

Cow buffalo goat bullock calf poultry others

10. Domestic Material Possessions

Components :	Score
a. Cooker / grinder:	
b. Bicycle / Automobile:	
c. Electricity connection:	
d. Telephone:	
e. Radio / T.V / Connection:	
f. Washing Machine	
g. Pump sets:	
h. Farm machinery and other equipments:	
i.	
j.	

11. Farming experience (in yrs): _____

12. Farming experience (Conventional farming in yrs): _____

13. Size of the farm (in ha)

Particulars	Wet land	Garden land	Dry land	total	Source of Irrigation
Total cultivable owned					
Cultivable area leased in					
Cultivable area leased out					
Area sown more than once					

14. Area under Conventional farming (in ha)

Particulars	Wet land	Garden land	Dry land	Total
Total cultivable owned				
Cultivable area leased in				
Cultivable area leased out				
Area sown more than once				

15. Crops grown using conventional farming Practices:

Kharif	Rabi	Summar

16. Social participation:

No.	Social institution	Member/office bearer	Frequency of exposure		
			regularly	occasionally	Never
1.	Gram Panchayat				
2.	Cooperative credit society				
3.	Organic farmers association				
4.	Rural youth club				
5.	Anganwadi				
6.	Self help groups				
7.	Milk cooperative union				
8.	<i>Savayava Krishi Parivar</i>				
9.	Others, specify				

17. Resources for Sustainable Agriculture

No.	Resource	Available at home	Available with neighbours	Available at village	Available at outside the village/Town
1.	FYM				
2.	Vermicompost				
3.	Silt				
4.	Green Manure				
5.	Chemical Fertilizer				
6.	Chemical Pesticides				

18. Cultivation particulars under Conventional farming of Pigeonpea

No	Cropping systems	In ha		
		2008-2009	2009-2010	2010-2011
CS 1.	Pigeonpea + Jowar			
CS 2.	Pigeonpea + Blackgram			
CS 3.	Pigeonpea + Soybean			
CS 4.	Pigeonpea + Greengram			
CS 5.	Pigeonpea sole crop			

19. Economic viability of Conventional farming practices:

Costs and returns structure under pigeon pea based cropping System- (/ ha)

SNo.	Particulars	Unit	Farmers data	
			Quantity	Value
I	Variable Cost (VC)			
1.	Human labour			
	a. Family labour	MD		
	b. Hired labour	MD		
2.	Machine labour	Hr		
3.	Bullock pair	BPD		
4.	Land Preparation			
	FYM	Kg		
	Fertilizers: N	Kg		
	P	Kg		
	K	Kg		
	Micro-nutrients	Kg		
	Oil cakes	Kg		
	Bio-fertilizers	Kg		
5.	Seeds (Main crop)	Kg		
	Seeds (Inter crop)	Kg		
6.	Seed treatment	Litres		
7.	Sowing	Rs		
8.	Irrigation	Rs		
9.	Weed management			
	• Hand weeding	MD		
	• Weedicides	Litres/Kg		
	• Intercultural	BPD		
10.	Plant Protection operations			
	A. Pesticides	Litres/Kg		
	• Fungicides	Litres/Kg		
	• Acaricides	Litres/Kg		
	B. Cultural	BPD		
	• Mechanical	Rs		
	• Biological	Rs		
	• Botanical pesticide spraying	Rs		
	• Others	Rs		
11.	Harvesting and drying	Rs		
12.	Threshing	Rs		
13.	Grading and packing	Rs		
14.	Miscellaneous charges	Rs		
15.	Interest on working capital	Rs		
	Total variable cost (TVC)	Rs		
	(% to total cost)			
II.	Fixed Cost (FC)			
1.	Land revenue	Rs		
2.	Depreciation	Rs		
3.	Rental value	Rs		
4.	Interest on fixed capital	Rs		
	Total fixed cost (TFC)	Rs		
	(% to total cost)			
III.	Total cost	Rs		
IV.	Returns			
	a. Main product	Qtl.		

	b. Byproduct	Qtl.		
	Gross returns	Rs		
V.	Net returns	Rs		
VI.	B:C ratio	Rs		

Note: MD=Man days, Hr=Hours, BPD=Bullock pair days, Rs=Rupees, Qtl=Quintals, Kg= Kilograms

20. Sustainability of Conventional farming Practices: put tick mark (✓) if Conventional farming methods mentioned below works against the Sustainable dimensions.

S.NO	Particulars	Conventional Practices				
		i	ii	iii	iv	v
I	Sustainability: Ecological dimensions					
1.	Conserve soil fertility					
2.	Conserve the quality and availability of water					
3.	Increase biodiversity					
4.	Avoids spread of hazardous substances					
5.	Affect the agro-ecosystem					
6.	Improvement in microclimate					
II	Sustainability: Economic dimension					
7.	Improve net incomes					
8.	Leads to Food and Income security					
9.	Enable to accumulate working capital					
10.	Nutritional situation and food availability secured					
11.	Can compete with other sectors					
12.	Can aggregate an economic gain at national level					
III	Sustainability: Social and cultural dimension					
13.	Rural poor involved in the approach					
14.	Indigenous knowledge recognized within the approach					
15.	Division of labor and distribution of income					
16.	Improve the health situation					
17.	Equitable access to assets					
18.	Technology safer to human and animals					

Conventional farming practices:

- i. **Land preparation and Seed treatment:** Burning of crop residues, Seed treatment with chemicals.
- ii. **Weed management:** Application of Herbicides
- iii. **Nutrient management:** Chemical Fertilizers and Micronutrients
- iv. **Plant protection practices:** Insecticides, Fungicides, Acaricides and other chemical based plant protection chemicals
- v. **Seed storage:** Chemical treatment with Fungicides, Dormancy-inhibitors and Germination inhibitors.

Interview Guides for Case Study

Name of the respondent:

Taluk:

Village:

Address:

1. Age (years):
2. Educational status:
3. Farming experience (in years):
4. Give a brief history of your family's engagement in dryland agriculture.
5. When did you start adopting organic farming?
6. Experience in organic farming(in years):
7. Size of the farm (in acres):
8. Area under organic farming:
9. What do you think about organic farming?
10. Why there is a need for organic farming?
11. Who do you think are the important motivators for your organic farming?
12. Give a brief description of your first experiments and experiences with organic farming?
On which crops and practices did you start organic farming?
13. What steps did you take personally to adopt organic farming practices?
14. What are all the strategies you are planning to manage organic farming?
15. How did others farmers respond to your shifting to organic farming practices?
16. How did your family members respond? Did they give any support? Did they criticize your actions?
17. What about the reactions of extension personnel?
18. How do the media cover the topic in terms of extent and selectivity of the coverage of organic farming?
19. Do you think that organic farming practices will reduce the environmental pollution?
20. How is it helping women and family laborers in particular?
21. Whether organic farming should be given priority over inorganic farming? If so state reasons.
22. Do any NGOs/other organizations promote organic farming? Why are they interested in promoting organic farming?
23. Explain the kind and extent of both positive and negative implications of promoting organic farming?
24. Do you think that organic methods of organic farming methods of cultivation are gaining importance in the present context of commercialization of agriculture?
25. Do you think that organic farming is economically viable over inorganic farming?
Yes/No. if yes, support your answer.

A. Standardized Rates and Details of Package of Organic Practices of Pigeonpea for One Hectare in Gulbarga district, Karnataka

No.	Particulars	Per hectare requirement	Approx. per unit cost	Approx. total cost
A.	Cost A	(in respective units)	(in `.)	(in `.)
1.	Seed	Sole crop: *PP-10kg Inter crop: PP-8kg + GG-3kg/ PP-8kg + BG-3kg	PP-90Rs/kg GG-60Rs/kg BG-60Rs/kg	PP-900 GG-200 BG-200
2.	Seed Treatment	<i>Trichoderma</i> sp.-4gram packet,	50Rs/packet,	50
3.	Organic manure	5 tons FYM	700Rs/ton	3500
4.	Land preparation	summer ploughing: 4 bullock pair, Men and women required for cleaning bunds, tank silt application, organic manure distribution to all parts of the field and sometimes incorporation of green manure, etc.	men-100, women-70, bullock pair-400	4500-5500
5.	Sowing	2 bullock pairs, 4 men, 2 women	men-100, women-70, bullock pair-400	1500-1800
6.	Weed management	20-25 women	women-70	1300-1600
7.	Nutrient management	6-7 bags of vermi-compost, <i>Panchagavya</i> *, <i>Jeevamrutha</i> *, etc * Cost differs from person to person for making other ingredients.	250Rs per bag of 75 kg,	2100-2500
8.	Irrigation	2-3 man days	men-120	360-400
9.	Pest and disease management	Physical shaking of plants-8men, Bio-digestor-2men, bird perches, pheromone traps, light traps, 10 litres of NSKE, 400ml of NPV.	men-100	2400-2800
10.	Harvesting and threshing	Harvesting and drying-12men, threshing-10 women, harvesting machine on rent	men-120, women-70, machine rent-	2500-2800
11.	Grading and packing	2 men, 1 woman	men-100, woman-70	250-300
12.	Miscellaneous	Repairs, travel & transport costs, small tools: spades, sickles, khurpi, etc.		700-1000
13.	Total Cost A (variable cost)	Sum total of all items from #1 to #13.		22000-25000
B.	Cost B			
14.	Rental value of land	5000-10,000 Rs/ha based on irrigation and type of soil		5000-10000
15.	Total Cost B	Sum total of #13 and #14.		30500-32000
C.	Cost C			
16.	Imputed value of family labor	10- man days, 10- women days	men-120, women-70	1700-1900
17.	Total cost C	Sum total of #15 and #16.		32500-34500

*PP=Pigeonpea, GG= Greengram, BG=Blackgram

B. Standardized Rates and Details of Pigeonpea grown with Conventional practices for One Hectare in Gulbarga district, Karnataka

No.	Particulars	Per hectare requirement	Approx. per unit cost	Approx. total cost
A.	Cost A	(in respective units)	(in `.)	(in `.)
1.	Seed	Sole crop: *PP-10kg Inter crop: PP-8kg + GG-3kg/ PP-8kg + BG-3kg	PP-90Rs/kg GG-60Rs/kg BG-60Rs/kg	PP-900 GG-200 BG-200
2.	Seed Treatment	thiram or capton powder packet	50Rs/packet,	50
3.	Organic manure	1-2 tons FYM	700Rs/ton	1300-1500
4.	Land preparation	ploughing: 4 bullock pair, Men and women required for cleaning bunds,	men-100, women-70, bullock pair-400	4500-5100
5.	Sowing	2 bullock pairs, 4 men, 2 women	men-100, women-70, bullock pair-400	1600-1800
6.	Weed management	20-25 women	women-70	1800-2100
7.	Nutrient management	Fertilizers: 3 bag urea 2 bag DAP	450/bag 750/bag	3000-3300
8.	Irrigation	2-3 man days	men-120	550-650
9.	Pest and disease management	Chemical pesticides	men-100	5000-6000
10.	Harvesting and threshing	Harvesting and drying-12men, threshing-10 women, harvesting machine on rent	men-120, women-70, machine rent-	2500-3000
11.	Grading and packing	2 men, 1 woman	men-100, woman-70	250-300
12.	Miscellaneous	Repairs, diesel, travel & transport costs, small tools: spades, sickles, khurpi, etc.		1100-1200
13.	Total Cost A (variable cost)	Sum total of all items from #1 to #13.		26000-26500
B.	Cost B			
14.	Rental value of land	5000-10,000 Rs/ha based on irrigation and type of soil		5000-10000
15.	Total Cost B	Sum total of #13 and #14.		33500-34000
C.	Cost C			
16.	Imputed value of family labor	10- man days, 10- women days	men-120, women-70	1100-1200
17.	Total cost C	Sum total of #15 and #16.		34500-35500

*PP=Pigeonpea, GG= Greengram, BG=Blackgram

Appendix III

Sustainet Parameters

Sustainet (Sustainable Agriculture Information Network) is composed of a German network and three further networks in the pilot regions of India, Kenya / Tanzania and Peru / Bolivia. This network operates a Sustainet India group in India with several grassroots level NGOs working in several states in India. Through extensive workshops, they have developed a set of criteria to evaluate whether an agricultural practice is sustainable or not. (GTZ, Sustainet, 2006). The Sustainet parameters includes: ecological, economic, social and cultural parameters.

Ecological dimension

- ❖ Does it help conserve soil fertility?
- ❖ Does it conserve the quality and availability of water?
- ❖ Does it increase biodiversity?
- ❖ Does it spread hazardous substances?
- ❖ Does it affect the landscape (relief, vegetation cover, settlement structure)?
- ❖ How much energy would be required if this technology is scaled up?
- ❖ If it is scaled up, would there be a significant impact on the climate?

Economic dimension

- ❖ Does the practice improve incomes?
- ❖ Does it lead towards food and income security?
- ❖ Does it enable farmers to accumulate their working capital?
- ❖ How would the nutritional situation and food availability change if the approach is applied on a large scale?
- ❖ Is it able to compete with other sectors?
- ❖ Is it possible to aggregate an economic gain to the national level?

Social and cultural dimensions

- ❖ Are the rural poor involved in the approach?
- ❖ How does the approach draw on or affect social customs, traditions, norms and taboos?
- ❖ Does the approach ensure a more equitable division of labour and distribution of income between men and women? Poor and rich? Young and old? Different ethnic groups and castes? Participating farmers and non-participants?
- ❖ Will broad adoption improve the health situation of the people?
- ❖ Does the approach assure equitable access to assets, agricultural inputs such as land (secure land-use rights), water, capital (credit), skills and knowledge? Is it accessible to the poor?
- ❖ Is the technology safe for humans and animals?
- ❖ Do the beneficiaries gain opportunities for empowerment, access to social services, control and decision-making?
- ❖ Is the approach legally stable?

Appendix IV

Karnataka government efforts in promoting organic farming:

Karnataka State policy on organic farming The Government of Karnataka was the first to frame the organic farming policy in India in the year 2004. In this policy, the following objectives are adopted:

1. To reduce the debt burden of farmers and to enable them to achieve sustenance (Swavalambana) and self respect (Swabhimana).
2. To enhance the soil fertility and productivity by increasing life in soil. To reduce the dependence of farmers for most of the inputs like seeds, manures and plant protection material by sourcing local natural resources thereby reducing the cost of cultivation.
3. Judicious use of precious water resources and maintenance of production level.
4. Improve farmers' income through production of quality produce.
5. To increase the food security by encouraging Siddaraju 059 traditional crops and traditional food habits.
6. To increase the rural employment opportunities to prevent migration to urban areas.
7. To facilitate farmers Self Help Groups for most of their requirements.
8. To make the environment safe and pollution free and also to protect health of human beings and animals.
9. To equip the farmers to effectively mitigate the drought situation in rain fed and drought prone areas.
10. To bring about suitable institutional changes in teaching and research on organic farming.

Strategies for promotion of organic farming in Karnataka The government of Karnataka adopt the following strategies for the promotion of organic farming under the Organic Farming Policy:

1. Integrated Approaches for Promotion of Organic Farming,
2. State Level Empower Committee for Promotion of Organic Farming,
3. Mini Mission on Organic Farming,
4. *Krishika Samaj* in Promotion of Organic Farming,
5. Self Help Groups (SHGs),
6. Farmers Co-operatives (*Savayava Krishi Parivar*),

7. Formation of Farmers Company (FC),
8. Area approach/Commodity/Crop approach,
9. Mixed Farming, Soil and Water Conservation,
10. Assistance for Conversion and Certification,
11. Marketing of Organic Products,
12. Credit Facility,
13. Export Promotion,
14. Research and Development,
15. Training and Extension and Study Tours.

Functions and Responsibilities of State Level Empowered Committee for Promotion of Organic Farming in State

1. Shall review from time to time, the state policy for promotion of organic farming with the advice of the Mini Mission in the state.
2. Ensure co-ordination among different department/ sectors and agencies involved in organic farming
3. To approve guidelines and schemes proposed for popularizing organic farming in the state.
4. To fix assistance/subsidies to different components of organic farming.
5. To formulate legislative measures if any relating to organic farming.
6. To co-ordinate with national and international organizations in all matters relating to organic farming.
7. To constitute Sub - Committees/Site Specific Committees wherever necessary for focussed action.
8. To guide and issue directions to Site Specific Committees.
9. To review the progress in Implementation of organic farming programmes by various agencies as per the state policy.
10. Any other issues related to promotion of organic farming in the state.
11. The committee shall meet at least once in three months.