भारतीय प्रबंध संस्थान बेंगलूर
INDIAN INSTITUTE OF MANAGEMENT
BANGALORE

WORKING PAPER NO: 316

16.
Spatial Clusters in Organic Farming – A Case Study of Pulses Cultivation in Karnataka[1]

BY

Gopal Naik
Professor
Economics & Social Science
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 5600 76
Ph: 080-26993266
gopalan@iimb.ernet.in

Vishnuprasad Nagadevara
Professor
Quantitative Methods & Information Systems
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 5600 76
Ph: 080-26993144
nagadev@iimb.ernet.in

16.

Spatial Clusters in Organic Farming – A Case Study of Pulses Cultivation in Karnataka[1]

Gopal Naik and Vishnuprasad Nagadevara

Introduction

Spatial cluster has become an important concept in economic development research and policy practice, especially after its popularization in the Competitive Advantage of Nations[2]. Clusters are geographic concentrations of firms in related industries that benefit not only from agglomeration economies derived from their spatial proximity, but also from the increased competitive pressure as a result of the co-location. Policymakers and professional developers use industry clusters to select, describe and promote groups of regional industries that already exhibit or have the potential to develop a regional competitive advantage[3]. Herr[4] argues that "industry cluster identification and analysis can also allow planners to identify local industries that have concentration of employment beyond the national average that may be an indicator of current stability and future growth or an ideal focus for the investment . . ."

Clusters development has so far been very successful in transforming the economy of many countries as well as in the spread of multi-national companies (MNCs). However, the concept has not gained adequate attention in the development of micro, small and medium enterprises (SMEs) where there is enormous potential for enhancing inclusive growth. The introduction of clusters in these enterprises can offer various advantages compared to a situation where such small businesses are located in geographically scattered areas. Such advantages include improved efficiency in production and marketing as well as conducive environment for innovation.

Gopal Naik, Indian Institute of Management Bangalore, India

Vishnuprasad Nagadevara, Indian Institute of Management Bangalore, India

Increasing consciousness about sustainable production, conservation of environment as well as health hazards associated with agrochemicals and consumers' preference to safe and

hazard-free food are the major factors that led to the growing interest in alternative forms of agriculture across the world. Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment where "inorganic chemical free" methods of production and post-harvest of crops is practiced. It has been gaining gradual momentum across the world both in terms of production and consumption. The awareness of the harmful effects of using inorganic fertilizers and chemical pesticides has increased the demand for organically produced food products. Scientific surveys and studies indicate that the residue of pesticides when transferred to humans and other living beings, cause a number of diseases, ailments and harmful effects. On the other hand, organically produced food contains more vitamins, minerals and even cancer-preventing antioxidants. This growing awareness of health and environmental benefits of organic agriculture has resulted in steadily increasing demand for such products both in the developed and developing countries with an annual average growth rate of 20–25%. However, economics of production of organic production of crops is often a major bottleneck in attracting farmers to take up production of organic agriculture. A switch from conventional to organic production can cause substantial loss due to yield reduction, absence of separate markets for organic products that help fetch premium price, non-availability of appropriate inputs, and high certification costs. These difficulties can be addressed effectively through the concept of clustering. Considering the potential environmental benefits of organic farming and its compatibility with integrated agricultural and rural development, organizing clusters of organic farming and other SMEs may be considered as a development vehicle for developing countries like India, in particular. Naik and Babu[5] suggested such an approach for development of bivoltine mulberry silk in India.

This study examines how cluster approach in organic production has helped to take advantage of potential competitive advantage in agriculture. Although the market for organically produced products has been experiencing rapid growth in recent decades, this growth of organic farms is concentrated in certain regions. Employing measures of spatial concentration and association, Eades and Brown[6] identified those counties in which organic production is clustered, represents a proportion of the agricultural economy greater than what would be expected by national trends. Their results show that spatial clustering of organic agriculture does exist. Counties with the largest location quotients for organic production were most often located in the western United States, especially California, Washington, and Oregon, the Great Plains states,

New England, and in some cases, select counties within Mid-Atlantic States. Organic production clusters as measured by the local Moran's I statistic followed a similar pattern. Results describing the correlation between organic support establishments and production within identified clusters suggest that organic operations in California and New England may be following different marketing strategies that promote or reduce the likelihood of identifying input-output relationships within these clusters.

The concentration of organic acreage and producers in certain regions seems to indicate that some form of clustering is present within the industry, and that there are factors which make organic agriculture more apt to survive and grow in some regions rather than others. From a regional science point of view, organic farms appear to be under the influence of "centripetal forces" that tend to concentrate and encourage economic activity in the form of agglomeration economies or economic clusters[7].

Many states in India have been formulating specific policies to promote organic farming. The marketability of organically produced products in distant markets depends largely on the certification and such certification requires spatial isolation of organic farms. While there is scale neutrality in production, market transactions for both inputs and products and certification have significant economies of scale. Therefore, it is essential to have a cluster approach for the organic farming to be successful[8].

Organic Farming

The concept of organic farming in India was well documented[9]. In the early twentieth century, Albert and Gabrielle Howard felt that it was a fundamental mistake to try the European practices of wheat cultivation in India. They argued that the present agricultural practices of India were worthy of respect, however strange and primitive they might first appear to Westerners. They felt that what was needed was the application of Western scientific methods to the local conditions to improve Indian agriculture on its own lines. The Howards developed a holistic approach to the cultivation of wheat that took into account the life and welfare of the plant in relation to its environment including such factors as manuring, soil conditions, irrigation, effect of mixed planting and crop rotation, diseases and pests[10].

In 1950, Rodel popularized the method of organic farming and also the term "sustainable agriculture"[11]. The organic farming received worldwide recognition with the formation of the International Federation of Organic Agricultural Movement in the year 1972 (IFOAM). Fukoka's experiments in organic farming showed the way forward for increasing the yields significantly without the application of either inorganic fertilizers or chemical fertilizers[12].

As the demand for organically produced farm products increased across the world, the need for setting standards and define guidelines has become essential. Codex issued the guidelines for organic farming in 1999. The UN-Organizations Food and Agriculture Organization (FAO), the World Health Organization (WHO) as well as the United Nations Conference on Trade and Development (UNCTAD) started negotiations on standards on organic agriculture in the 1990s and adopted the first edition in 1999. The 'Codex Alimentarius Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods' were developed in view of the growing production and international trade in organically produced foods to facilitate trade and prevent misleading claims[13]. The guidelines are intended to facilitate the harmonization of requirements for organic products at the international level, and they provide assistance to governments wishing to establish national regulations in this area. As a result, the certification of organically produced food and food products has become an essential ingredient of organic farming.

While the proponents of organic farming have highlighted the symbiotic relationship between the environmental quality and food production, there were other experts including Dr. Norman Borlaug, the father of green revolution, who maintained that organic agriculture cannot increase agriculture productivity and that the world population has to depend on the use of inorganic fertilizers and chemical pesticides[14].

Many have opined that use of organic fertilizer and natural methods of plant protection instead of inorganic fertilizers and chemical pesticides defines organic farming[15]. According to them, organic agriculture is a production system which avoids or largely excludes the use of synthetic fertilizer, pesticides, growth hormones, growth regulators and livestock feed additives.

The widely accepted definition for organic agriculture is that "Organic agriculture is a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity"[16]. 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, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system. An organic production system is designed to enhance biological diversity within the whole system; increase soil biological activity; maintain long-term soil fertility; recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources; rely on renewable resources in locally organized agricultural systems; promote the healthy use of soil, water and air as well as minimize all forms of pollution thereto that may result from agricultural practices; handle agricultural products with emphasis on careful processing methods in order to maintain the organic integrity and vital qualities of the product at all stages; become established on any existing farm through a period of conversion, the appropriate length of which is determined by site-specific factors such as the history of the land, and type of crops and livestock to be produced.

The concept of close contact between the consumer and the producer is a long-established practice. Greater market demand, the increasing economic interests in production, and the increasing distance between producer and consumer has stimulated the introduction of external control and certification procedures. An integral component of certification is the inspection of the organic management system. Procedures for operator certification are based primarily on a yearly description of the agricultural enterprise as prepared by the operator in cooperation with the inspection body. Likewise, at the processing level, standards are also developed against which the processing operations and plant conditions can be inspected and verified. Where the inspection process is undertaken by the certification body or authority, there must be clear separation of the inspection and certification function. In order to maintain their integrity, certification bodies or authorities that certify the procedures of the operator should be independent of economic interests with regard to the certification of operators.

Except for a small portion of organic agricultural commodities marketed directly from the farm to consumers, most products find their way to consumers via established trade channels. To minimize deceptive practices in the market place, specific measures are necessary to ensure that trade and processing enterprises can be audited effectively. The regulation of a process, rather than a final product, demands responsible action by all involved parties.

Import requirements should be based on the principles of equivalency and transparency as set out in the *Principles for Food Import and Export Inspection and Certification*[17]. In accepting imports of organic products, countries would usually assess the inspection and certification procedures and the standards applied in the exporting country. Recognizing that organic production systems continue to evolve and that organic principles and standards will continue to be developed under these guidelines, the Codex Committee on Food Labeling (CCFL) reviews these guidelines on a regular basis. The CCFL initiates the review process by inviting member governments and international organizations to make proposals to the CCFL regarding amendments to these guidelines prior to each CCFL meeting.

Foods should only refer to organic production methods if they come from an organic farm system employing management practices which seek to nurture ecosystems which achieve sustainable productivity, and provide weed, pest and disease control through a diverse mix of mutually dependent life forms, recycling plant and animal residues, crop selection and rotation, water management, tillage and cultivation. Soil fertility is maintained and enhanced by a system which optimizes soil biological activity and the physical and mineral nature of the soil as the means to provide a balanced nutrient supply for plant and animal life as well as to conserve soil resources. Production should be sustainable with the recycling of plant nutrients as an essential part of the fertilizing strategy. Pest and disease management is attained by means of the encouragement of a balanced host/predator relationship, augmentation of beneficial insect populations, biological and cultural control and mechanical removal of pests and affected plant parts. The basis for organic livestock husbandry is the development of a harmonious relationship between land, plants and livestock, and respect for the physiological and behavioural needs of livestock. This is achieved by a combination of providing good quality organically grown feedstuffs, appropriate stocking rates, livestock husbandry systems appropriate to behavioural needs, and animal management practices that minimize stress and seek to promote animal health

and welfare, prevent disease and avoid the use of chemical allopathic veterinary drugs (including antibiotics).

Organic Farming in Karnataka

In the Planning Commission of India constituted in 2000, a steering group on agriculture identified organic farming as National challenge, and suggested it should be taken in the form of a project as major thrust area for Tenth Plan. The group recommended organic farming in North East Region, rain-fed areas and in the areas where the consumption of agro chemicals is low or negligible. The National Agricultural Policy (2000) recommended promotion of traditional knowledge of agriculture relating to organic farming and its scientific upgradation. The Ministry of Commerce launched the National Organic Programme in April 2000 and Agricultural and Processed Food Products Export Development Authority (APEDA) is implementing the National Programme for Organic Production (NPOP)[18]. Under the NPOP, documents like National standards, accreditation criteria for accrediting inspection and certification agencies, Accreditation procedure, inspection and certification procedures have been prepared and approved by National Steering Committee (NSC). Under NPOP programme, the Government of India has developed National Standard for organic export. The Ministry of Agriculture, in principle, has accepted this standard for domestic purpose also. The scope of these standards is to lay down policies for development and certification of organic products; facilitate certification of organic products confirming the standards for organic production; institute a logo and prescribe its award by accrediting bodies on products qualifying for bearing "India organic label".

There are 12 accredited certifying agencies in the country. Tentative tariff structure for certification is as below[19]:

- Travel and Inspection: Rs. 12,000-Rs. 19,000 per day
- Report preparation: Rs. 5,000/-
- Certification: Rs. 5,000

This tariff structure is very expensive for an individual farmer particularly those having small holding. On the other hand, the tariff would become manageable when a number of farmers get together to form a group and get the certification done for the entire group.

In order to promote organic farming in the State, the Government of Karnataka has formulated an integrated policy. The main objectives of this policy are to

1. Reduce debt burden of the farmers
2. Enhance soil productivity
3. Reduce cost of cultivation through less dependence on external inputs and use of local natural resources
4. Judicious use of water
5. Improve farm income through quality produce.

An Expert committee on organic farming mission was set up in 2000. The committee submitted its report in April 2001. National guidelines on organic farming by Central government issued in July 2003 and the Broad framework was circulated. In March 2004, the Cabinet has announced a policy which indicated how to promote organic farming by providing backward and forward linkages, and what needs to be done.

One of the strategies for implementing this policy is to follow an Area/Commodity approach. The strategy is to start with small areas initially and use the experience to scale up. The emphasis in the initial stages is to concentrate on rain-fed areas of agriculture. It was also decided to involve many non-government organizations (NGOs) operating in the area as key players. Government is expected to act as a facilitator. It is to follow an integrated approach by pooling efforts of various departments such as agriculture, horticulture, watershed development, animal husbandry, sericulture, agricultural universities, etc.

One of the important requirements for the success of organic farming is that it cannot be practiced in isolation. It is necessary to bring in large tracts of contiguous agricultural land under organic farming. Otherwise, non-organic farming practices such as use of inorganic fertilizers and chemical pesticides will not only affect the organic produce but also the chemical residues will make their way into the organically produced output, and subsequently, results in the loss of certification. In other words, it is essential to develop a cluster approach for the success of the organic farming. This study aims to identify the factors that encourage cluster formation in organic farming.

Theoretical Framework

Clusters impact individual firm's economics through

1. Fostering interdependence due to geographical contiguity;
2. Input market development due to large volume of transaction;
3. Appropriate technology development at the local level;
4. Appropriate process development and knowledge sharing;
5. Development of quality standards and certification;
6. Output market development/access; and
7. Development of ancillary units

These factors contribute significantly towards reduction in the average cost of output. For example, clustered production enables better quality control of output as well as reduces certification cost. Certification cost being very high, bigger size of organic farming cluster reduces certification cost per unit area and therefore for unit of output. As more and more people adopt organic farming in the village, the average cost curve shits downwards (Figure 1) and therefore cost per unit reduces, say for example, from C_1 to C_2 for Q amount of production. With the reduced cost there will be increase in the supply of output in the market and therefore the supply of organic products shifts from say, S_1 to S_3 (Figure 2).

Figure 1. Cost Reduction through clusters

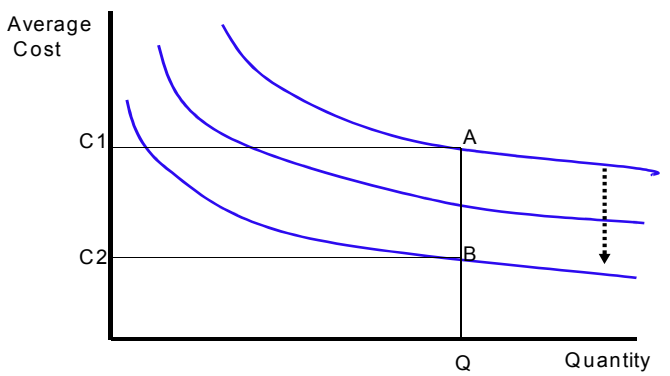
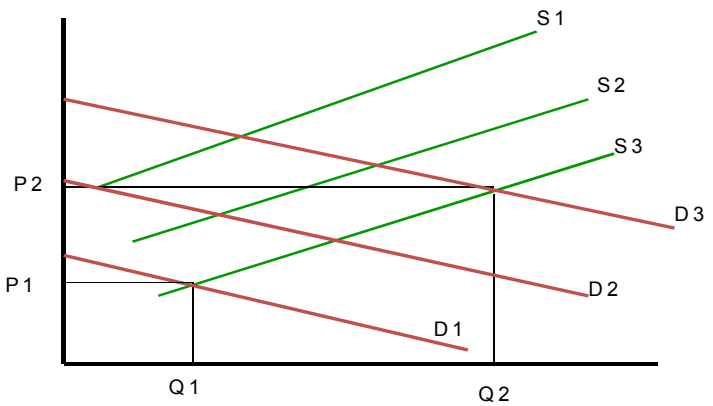


Figure 2. Market Supply, Demand and Price



As the quantity of organic production increases, it generates more demand. Traders and users from distant places would like to consider the cluster for their purchase decisions. If the quality is assured through reliable certification, buyers from distant places can meet their requirements with very little transaction cost. Therefore the demand shifts, say from D_1 to D_3. We can observe that at S_1 and D_1 the market would not exist, because the price at which the buyer is ready to purchase is far lower compared to the price at which the seller is ready to supply. As cluster develops, the supply shifts due to reduction in cost of production, the markets for output starts emerging. With only supply shift, the price and quantity transacted will be very low (P_1, Q_1). However, as demand shifts due to reduction in transaction costs, for buyers, market becomes larger and larger. This enables markets to develop for organic products.

In this study, we show empirically how cluster approach has helped in market development for organic products in Karnataka. We specifically analyse the extent of reduction in cost experienced, increase in price realized and increase in the net returns obtained by farmers.

Data Collection

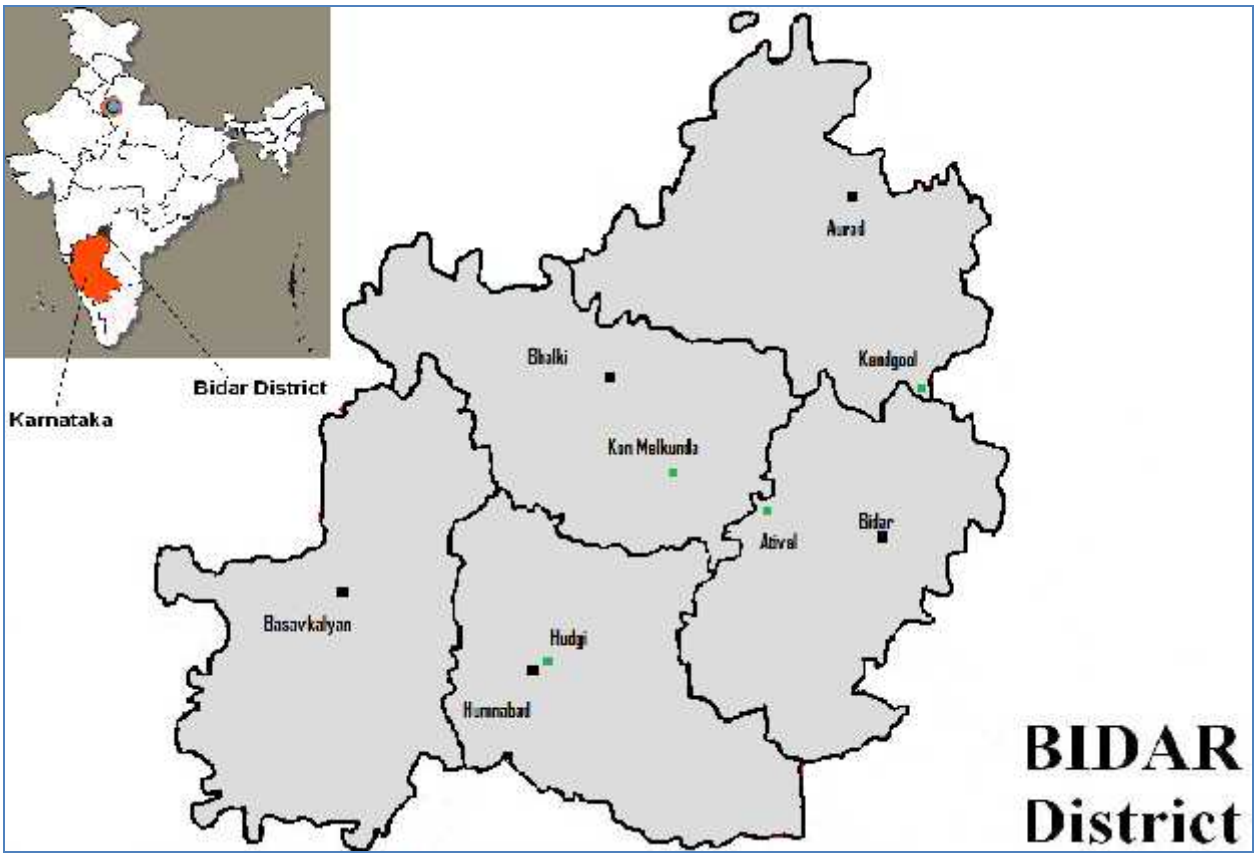
Under Karnataka Government's Organic Farming Mission, one village in each Taluka was selected for introducing organic farming. While organic farming of high value crops such as spices and plantation crops have been successful as they are mainly exported, instances of field crops such as cereals and pulses that form the bulk of the agricultural production in India and primarily meet the domestic markets requirements, being successful have been very few. We

have selected pulses as they are mainly produced in large areas in the dry regions in the country and are produced mainly for the purpose of selling, unlike cereal crops that are mainly used for home consumption particularly by the small farmers. The Bidar district in Karnataka is well known for the cultivation of pulses such as Red gram and Bengal gram. In Bidar District, four out of a total of five Talukas (namely, Bidar, Aurad, Bhalki and Humnabad) have one organic village each. A brief profile of the talukas is presented in Table 1 and the location map of Bidar district and the relevant taluks is presented in Figure 3.

Table 1: Profile of the taluks in Bidar District

S No.	Taluka	Area (km^2)	Population (2001 Census)	Organic Farming Village	Major Crops
1.	Aurad	1,227.2	2,45,739	Kandgool	---
3.	Bhalki	1,117.2	2,57,042	Kon Melkunda	Red Gram, Bengal Gram
4.	Bidar	925.19	4,05,540	Atival	Red Gram, Sugarcane, Jowar
5.	Humnabad	987.66	2,94,587	Hudgi	Red Gram, Sugarcane, Vegetables

Figure 3: Map of study area



Sample Profile

Responses from farmers in three of these villages Kon Melkonda, Atiwal and Hudgi, were collected through a structured questionnaire. Data on costs of cultivation and marketing, certification costs, yield and prices for the year 2008-09 were collected for two major pulse crops grown in these villages, Red gram and Bengal gram. The sample consisted of 38 farmers who were cultivating red gram under organic farming cluster and ten farmers outside the cluster, and eight farmers cultivating Bengal gram within the clusters and five farmers outside the clusters. It was difficult to get a large number of samples because of the non-availability of sufficient numbers especially those outside the clusters. The sample profile for the selected farmers is presented in Tables 2 and 3.

Table 2: Educational background of sample farmers

		Organic Farming clusters		Total
		No	Yes	
Education	Illiterate	0.00%	20.00%	10.00%
	Primary	20.00%	6.67%	13.33%
	SSLC	13.33%	23.33%	18.33%
	PUC	43.33%	10.00%	26.67%
	Degree	16.67%	30.00%	23.33%
	Post Grad	6.67%	10.00%	8.33%
Total		100.00%	100.00%	100.00%

Around 40 percent of the farmers who are adopting organic farming are either graduates or post graduates. On the other hand, the corresponding percentage for the non-adopters is only 23 percent. At the same time 20 percent of the adopters are illiterates whereas none of the non-adopters are illiterate. The educational background does not appear to influence the adoption. It appears that the other farmers within the cluster are likely to be a major influencing factor for illiterate farmers.

The average holding size is presented in Table 3. The average holding size for the organic farmers is only 7.46 acres as compared to 13.70 acres for the other farmers. The difference is much more pronounced in the case of dry land. The holding size of the organic farmers is only 2.59 acres where as that of the other farmers is 7.35 acres. This indicates that clusters helps small farmers to adopt organic farming whereas outside the clusters only larger farmers will be afford to go for it.

Table 3: Average holding size of sample farmers (in acres)

	Dry Land		Wet Land		Total Land	
	Clusters		Clusters		Clusters	
	No	Yes	No	Yes	No	Yes
Mean	7.35	2.59	6.35	4.95	13.70	7.46
Std. Deviation	11.03	3.73	4.98	4.60	11.82	6.16

The farmers in the cluster have adopted organic production for an average of 5.30 whereas the number of years that the other farmers have been practicing organic cultivation was 6.03 years. Both the categories of farmers have adopted organic cultivation for more than three years. Therefore, the sample has adequate number of years for the organic farming to become effective. When the farmers switch to organic farming methods, the yield levels drop in the first year. But, subsequently, the yields increase owing to the gradual enrichment of the soil and reach the original yield by the third year. With the development of clusters with organic farming, the costs associated with certification and other processing activities will be spread across the farmers in the cluster. As all the farmers in the cluster adopt organic farming practices, the quantum of inorganic chemical residues decrease and over time completely disappear, leading to realization of higher prices for the organically produced output.

Results and analysis

Data was collected on various aspects of cultivation from the sample farmers. The expenses on various items of cultivation are collected and the average expenses for each item are presented in Table 4. Since the clusters that are being studied refer to the cultivation of Red gram and Bengal gram, the data with respect to only these two crops is presented in the analysis.

Table 4: Significance tests between farmers practicing organic farming and others

Village	Taluka	Cluster	Sample no. of farmers	Sample Crop	Cost of Production (Rs./acre)	Yield (Qtl./acre)	Price Received (Rs./Qtl.)	Gross Return (Rs./acre)	Net Return (Rs./acre)
Atival	Bidar	Yes	15	Red Gram	5070*	5.5	2787*	15243*	10173*
Hudgi	Humnabad	Yes	15	Red Gram	6006*	4.2	2593	10885	4879
Kon Melkunda	Bhalki	Yes	8	Red Gram	6825*	6.0	3475*	20187*	13362*
Without Cluster	__	No	10	Red Gram	8792	5.2	2340	12660	3868
Kon Melkunda	Bhalki	Yes	7	Bengal Gram	8244*	6.6	2657*	17443*	9199*
Without Cluster	__	No	5	Bengal Gram	9215	6.2	2000	12080	2865

*Significantly different from those without cluster at 5 per cent level.

As expected, the cost of production is much lower in clusters compared to outside clusters in both the crops. Farmers within cluster had lower costs of inputs due to efficient construction of compost pits and had an advantage of being persistently introduced to the new and more efficient methods of organic agriculture through training programs arranged by organizations such as Eco Friendly Organic Farmer Association (EFOFA) in Kon Melkunda village or Shantishwari NGO in all the organic villages. Organic farmers associated with the clusters get the group certification for which the amount of Rs. 30,000 was be paid by the State government whereas an individual organic certification costs Rs. 5,000 and therefore no farmer outside the clusters had crops certified. Yield difference is also observed between farmers in the clusters and outside the clusters except in the case of Hudgi village cluster. In Hudgi village, the cluster advatanges were not exploited. Yield difference is also due to the fact that organic farmers are required to maintain a buffer region around their cultivating field in order to protect their organic crops from the adjacent inorganic field. Such buffer fields are used to grow Jatropa plants or Neem trees or any crop which will serve the purpose. In case of clusters, there is no need to waste even a small area of cultivable field since adjacent field would be organic too.

However, in the three villages, not all of the farmers had their field adjacent to another organic field. Except in Hudgi village, the other village clusters had organic certification which helped receiving better prices for their crops. Farmers within cluster are also making efforts for the better marketing of their crops. EFOFA is having talks with the Big Bazaar while Shantishwari NGO is also making arrangements for the collective marketing with the ISKCON group and Javik Krishi Society. Therefore the net returns are higher in organic farming clusters compared to outside the clusters.

Net returns was regressed on farmers, specific practice (reflected by total cost), crops (red gram=1; Bengal gram=0), village dummy variables and presence of cluster. The estimated result is as follows.

Net Returns = 4659.38 – 0.314 Total cost + 2385.32 Crop + 4630.17 Cluster – 4980.27 Hudgi
(0.86) (-0.56) (1.56) (1.86) (-3.3)

+ 3110.38 Kon Melkunda
(1.65)

$R^2 = 0.48$ Adj $R^2 = 0.43$

The regression results indicate that 43 per cent of the variations in net returns received by the sample farmers are explained by the variables included in the model. Hudgi village has significant lower returns due to poor practices such as low seed rate, absence of certification, etc. We also observe that variable cluster is significant at 10 per cent indicating that cluster helps in obtaining higher net returns to the extent of Rs 4630.

Conclusions

Cluster theory has been well accepted for the development of regions through industrial development. This approach also has significance for agriculture development especially where there are economies of scale in markets for inputs and output. In certain cases like organic agriculture, quality maintenance as well as cost reduction for certification requires cluster

approach. It helps to create markets through enhancement of both supply and demand. The empirical evidence of organic production of pulse crops in Karnataka presented here supports the advantages of cluster approach, namely cost reduction, high prices realization and high net returns.

End Notes

1. Authors acknowledge the assistance of Mr. Ravinder Kumar while conducting the study.

2. Porter, E .Michael, "Competitive Advantage of Nations", *Free Press*. 1990,

3. Smith, R.V. "Industry Clusters Analysis: Inspiring a Common Strategy for Community Development." Central Pennsylvania Workforce Development Corporation, Lewisburg, PA. 2003, p.1. [Electronic Version]. Retrieved July 1, 2004 from http://www.extension.psu.edu/workforce/Briefs/INDclustAnal.pdf.

4. Herr, Andrew. "Industry Cluster Analysis of Westmoreland and Fayette Counties addressing Workforce Development Needs." Prepared for the Westmoreland-Fayette Workforce, p.iii. Investment Board. 2003. [Electronic Version]. Retrieved July 1, 2004 from http://www.pittsburghregion.org/public/cfm/library/reports/Westmorelandfayettecluster.pdf. IFOAM, http://www.ifoam.org/about_ifoam/inside_ifoam/history.html

5. Naik, G. and K. R. Babu. 1993. "Demand and Supply Prospects for High Quality Silk". New Delhi, *Oxford and IBH Publishing Company*.

6, 7. Eades, Daniel and Cheryl Brown, "Identifying Spatial Clusters within U.S. Organic Agriculture", Research Paper 2006-10, Regional Research Institute, West Virginia University, Morgantown, WV 26506-6825 USA.

8. Goetz, Stephan J., and Martin Shields, "Agricultural and Food Industry Clusters in the Northeast U.S.: Technical Report", Regional Rural Development Paper No. 26, November 2004, The Northeast Regional Center for Rural Development, College of Agricultural Sciences, The Pennsylvania State University, USA.

9. Although the term 'organic farming' is getting popularity in recent times, it has been there since cultivation of crops started 10000 years ago. There is brief mention of several

organic inputs in ancient Indian literatures like Rigveda, Ramayana, Mahabharata, Kautilya's Arthasashthra etc[9a]. Until the green revolution technology arrived in the 1960s, Indian agriculture practice was largely organic.

9a., 11, 19. Bhattacharya, P. and G. Chakraborty, "Current Status of Organic Farming in India and Other Countries", *Indian Journal of Fertilizers*, Vol. 1 (9), December 2005, pp 111-123

10. Arnold, David, 2000 "Science, Technology and Medicine in Colonial India", Cambridge University Press, Cambridge, UK, p152.

12. Fukuoka, Masanobu, 1992."One straw revolution - An Introduction to Natural Farming", Other India Press, Mapusa, Goa, India,

13, 16. WHO," Organically Produced Foods"**,** Third edition, Food and Agricultural Organisation of the United Nations, Rome, 2007, available at ftp://ftp.fao.org/docrep/fao/010/a1385e/a1385e00.pdf

14. Goswami N. N., and Rattan R. K. "Organic farming as viewed by soil scientists", In *Organic Farming***.** ISSS Bulletin No**.** 22, Eds., Singh A.K., Narayanasamy G., Rattan R.K., Goswami N.N., 2004, pp42-49.

15. Lampkin, Nicholas, C. Foster, S. Padel and P. Midmore. (1999). "The policy and Regulatory Environment for organic Farming in Europe". *Organic Farming in Europe: Economics and Policy. VoL2*, Dabbert, Haring, Zano, H (eds.) London: Zed Book

17. (www.codexalimentarius.net/download/standards/37/CXG_020e.pdf)

18. Gouri, P.Y.S.M., National Programme for organic production. *Bulletin of Indian Society of Soil Science*. No.22, 61-64 (2004).

References

Porter, Michael E., "Location, Competition, and Economic Development: Local Clusters in a Global Economy", *Economic Development Quarterly*, v.14, n.1, pp. 15-34, 2000.