Ind. Jn. of Agri. Econ.
Vol. 60, No. 2, April-June 2005

Organic Farming for Sustainable Agriculture and Meeting the Challenges of Food Security in 21st Century: An Economic Analysis

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I

INTRODUCTION

India will be the world's most populous country of more than 1.4 billion people by the mid-twenty-first century (Dyson *et al.*, 2004). In this context, agriculture and food security are the most important concerns of the 21st century.

With the greying of Green Revolution, the Punjab agriculture as well as the overall Indian agriculture is now in crisis (Swaminathan, 1990, 1996; Jaisingh, 2000; Dahiya, 2001; Menon, 1997; Devasahayam, 2001; Ray, 2001) as the growth rate of agricultural production is losing momentum. If at this stage of globalisation and "WTO" regime, Indian agriculture must become efficient, competitive, low-cost and sustainable.

Therefore, it is essential to critically analyse and examine the major farming systems in their proper perspectives to make pertinent recommendations to the policy makers and farmers in order to ensure food security and low-cost sustainable agriculture in 21st century.

Agriculture is carried out mainly through three types of farming systems, namely, Natural Farming System (NFS), Inorganic Farming System (IFS) and Organic Farming System (OFS) characterised by the different types of inputs and agricultural management practices used for cultivation of land and production of crops. The NFS is considered a primitive and extensive farming system giving low production and income in the short-run. Therefore, the Chemical or the Inorganic Farming System (IFS) based on hi-tech advances in agriculture has been developed and implemented; this is embodied in the Green Revolution's strategy of external, purchased, costly high-yielding varieties (HYVs) and hybrid seeds of crops, high doses of chemical fertilisers, pesticides, energy intensive costly farm machinery, energised well irrigation, etc., all of which boost-up production and income of the farmers substantially in the short-run. Agricultural growth and development under IFS in the

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The study has been carried out at the instance of the Indian Council of Agricultural Research (ICAR), New Delhi, with financial assistance from the Council. The authors are thankful to the anonymous referee of the Journal for guidance and valuable comments.

form of Green Revolution during the sixties and seventies till the 1990s has been quite remarkable to move and push the country from severe food shortages and crisis of the past to self-sufficiency, to food surpluses and food security for the time being. However, the success story of agriculture under IFS has come to be regarded as one that began and ended with the Green Revolution (Rajagopalan, 1995; Kanwar, 1995; Jaisingh, 2000).

It is found that the IFS over the years burns the Soil Organic Matter (SOM) and soil micro-organisms rendering soil lifeless and infertile spoiling the soil structure and soil health, depleting soil of the micronutrients and its natural fertility; this has resulted in stagnant and declining yield, production and income of crops (Sharma, 1991; Pretty *et al.*, 1996 and Ray, 2001). The chemical inputs used in IFS are costly and lead to contamination and pollution of soil, water, air, atmosphere, plants and crops. The damage caused through agro-chemical pollution to environment and human health, directly and through the human food-chain and sustainable agriculture and food security is irreparable (Guan Soon, 1998; Thakur *et al.*, 2003; Vepa *et al.*, 2004). In many cases, over 90 per cent of the inorganic produce of vegetables, foodgrains, fruits, milk, etc., produced under IFS contain poisonous agro-chemicals residues harmful and unsuitable for consumption (Paroda, 2001).

As such, there is a strong feeling world-over that the solution of this problem and ills of IFS now lies in organic farming. Organic or biological farming or the Organic Farming System (OFS) is a modified form of NFS and IFS. The OFS is carried out through internal farm and home produced, low-cost, natural organic, biological inputs and cultural and mechanical methods and agricultural practices to increase agricultural production in place of the inorganic or chemical inputs used under IFS. The OFS has been designed for creating eco-friendly and pollution-free environment, ecological-balance and micro-environment suitable for sound health and growth of soil micro-flora, plants, animals and the vast human race who consume the farm products (Fukuoka, 1985; Thakur, 1997;Youngberg and Buttel, 1985; Weerakkody, 1999). OFS has become important and necessary in the context of agricultural problems of high-costs, environmental pollution, the need for improving public health, food quality and food safety (Parr *et al*, 1985; Dahama, 1997; Singh, 2002; Vidal, 1998; Veeresh, 1998).

India backed by a legacy of organic farming has a great potential to make a mark in the international and national markets and there is an urgent need to promote organic farming in order to increase exports. However, there is no pertinent research work done and knowledge available on economics of production and marketing of organic produce or OFS vis-à-vis inorganic produce or IFS in general and for the produce of hills in particular.

Therefore, ICAR sanctioned this research project with a view to working out the comparative economics of production of organic produce (OFS) vis-à-vis inorganic produce (IFS) in the context of sustainable agriculture and food security, to investigate and analyse the marketing pattern, preferences and problems of organic

products, the extent of demand and the growth of "niche market" for organic food in India and abroad, and to make policy recommendations for encouraging and developing organic farming in India on a large scale.

II

DATA AND RESEARCH METHODOLOGY

The study was conducted in the most progressive hill state of India, namely, Himachal Pradesh. The data from farmers have been generated and collected in the form of an Operational Research Project (ORP) in backward tehsil Chopal of district Shimla and tribal tehsils Nichar and Sangla of tribal Kinnaur district to work out the economics of production and marketing of crops grown under OFS vis-à-vis IFS, and to demonstrate the impact of hi-tech agriculture to the farmers of these poor, backward and tribal areas where organic farming is in vogue since centuries. In all, 100 farmers for ORP and 20 for on-farm experimental research work were selected from four villages in Chopal (Shimla) and 5 villages in Sangla-Nichar (Kinnaur) by the random sampling technique with probability proportion to the total households.

The crops were grown both under OFS and IFS with recommended package of practices. The data and information of other important commodities have also been collected, analysed and presented. Besides, in order to examine the marketing constraints, problems and pattern of marketing organic produce, a sample of 100, i.e., 50 traders and 50 consumers buying organic produce in the local (Shimla, Kullu and Chandigarh) as well as national terminal markets (Delhi, Mumbai, Bangalore and Chennai) have been interviewed at random. This information has also been compiled and presented with respect to important developed countries of the world, the impact of WTO and the globalisation of trade.

The study was carried out for a period of five years during 1998-99 through 2002-03. The OFS study and experiments consisted of completely stopping the use of chemical fertilisers, pesticides and other inorganic inputs and shifting to organic inputs. To analyse and interpret the data and information, tabular and budgeting techniques as well as statistical methods have been used.

In order to work out the economics of OFS vis-à-vis IFS, the cost of production of different crops have been worked out by using the standard cost concepts as follows:

Cost A_1 = Cost of seed and seedlings, value of farm yard manure (FYM), compost, fertilisers, pesticides, other chemicals used, bullock labour, hired human labour, hired machinery, interest on working capital @ 12 per cent for the half growing period of the crop, depreciation and repairs of farm tools and machinery (computed through apportioning method based on crop hacterage).

Cost A_2 = Cost A_1 + rent paid on leased in land.

Cost B = Cost A_2 + imputed rental value of owned land less rent paid on leased in land + interest on fixed capital.

Cost C = Cost B + imputed value of family labour.

Cost D = Cost C + management cost @ 10 per cent of Cost C.

The computation of cost of production was done on the basis of the input and output prices prevailing in the study area during the period of the study.

The linear production function has been fitted to the primary data on the basis of the goodness of fit (R^2). The effect of the factors affecting the quantity of FYM, the most important factor of production in organic farming has been examined by fitting the following linear regression model.

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + U$$

where Y : Quantity of FYM in quintal per farm,

X_1 : Family labour engaged in farming (No.of persons),

X_2 : Standard animal (cow) units on the farm by taking cattle as a unit (buffalo 1.5, sheep and goat 0.5, horses and mules1.2 cow units),

X_3 : Availability of dry fodder (qtl/farm),

X_5 : Collection of organic flora used for pan making in livestock sheds (qtl/farm),

U : Random or error term,

b_o : Intercept,

b_1 to b_5 : Regression coefficients.

The linear regression model was also employed to quantify the technical relationship of farm income with size of holding, farm labour, organic manures and other parameters. However, only the most related explanatory variables or parameters were retained in the model on the basis of the goodness of fit (R^2) in the following form.

$$I = a_o + a_1X_1 + a_2X_2 + a_3X_3 + U$$

where I = Annual farm income in Rs. per farm,

X_1 = Size of holding in ha,

X_2 = Family labour engaged in farming (No. of persons,)

X_3 = Quantity of FYM and other organic manures used in quintal per farm,

U = Random or error term,

a_o = Intercept

a_1 to a_3 : Regression coefficients.

The significance of regression coefficients has been tested by using the student's "t" test.

The qualitative differences in different parameters, significance of production and marketing problems and dimensions of OFS and IFS have been tested through the Chi Square (χ^2) Test.

III

RESULTS AND DISCUSSION

Comparative Economics of Production of Crops under OFS vis-à-vis IFS

Maize in *kharif* (Summer) and wheat in *rabi* (Winter) are the most important crops grown by the farmers in the hills. Therefore, these two crops were grown on the

selected farmers' fields under research supervision. Maize and wheat cultivation was followed by the cultivation of peas and rajmash (beans) as well as intercropping of rajmash and peas, respectively, for fixation of atmospheric nitrogen through these leguminous crops under OFS along with other recommended organic inputs to supply the required nutrients to crops and to improve the soil structure and health. In addition of these crops, vegetable crops were also grown to study their marketing aspects and problems.

The economic analysis and sustainability of these crops both under OFS vis-à-vis IFS has been carried out and the results are presented in Table 1.

TABLE 1. COMPARATIVE ECONOMICS AND SUSTAINABILITY OF MAIZE AND WHEAT PRODUCTION UNDER 'OFS' VIS-À-VIS 'IFS' OVER THE YEARS

(Rs. per ha and Rs. per qtl)

Particulars	1998-99		2000-01		2001-02	
	OFS	IFS	OFS	IFS	OFS	IFS
(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Maize			
Cost A	8,327.85	10,284.81	8,371.82	10,343.09	8,657.09	10,451.00
Cost B_1	8,827.52	10,901.89	8,874.12	10,963.67	9,176.51	11,078.06
Cost B_2	11,881.52	14,069.89	12,138.12	14,233.67	12,546.51	14,358.06
Cost C	14,686.52	16,627.89	15,045.12	17,344.67	15,708.51	17,622.06
Yield (qtl/ha)						
Grains	41.8	99.6	56.4	46.4	58.0	45.2
Straw	80.3	96.6	109.3	85.5	109.8	88.7
Price obtained by the farmers (Rs./qtl)						
Grain	840.00	4 80.00	910.00	550.00	950.00	610.00
Straw	140.00	120.00	140.00	120.00	150.00	130.00
Gross income	46,354.00	35,400.00	66,626.00	35,780.00	71,570.00	39,103.00
Net income or profit (Rs./ha)	31,667.48	18,772.11	51,580.88	18,435.33	55,861.49	21,480.94
Total cost/ha	14,686.52	16,627.89	15,045.12	17,344.67	15,708.51	17,622.06
Total cost/qtl	351.35	335.23	266.75	373.80	270.83	389.86
			Wheat			
Cost A	8,995.95	10,543.84	9,138.08	10,776.97	9,841.77	11,633.62
Cost B_1	9,535.70	11,176.47	9,686.36	11,423.58	10,432.27	12,331.64
Cost B_2	13,149.62	14,861.33	13,540.60	15,476.30	14,505.79	16,596.02
Cost C	15,495.62	17,309.33	16,039.60	18,128.30	17,463.79	19,758.02
Yield (qtl/ha)						
Grains	15.7	20.0	34.5	34.0	38.6	32.4
Straw	30.0	48.0	65.4	65.0	75.2	61.7
Price obtained by the farmers (Rs./qtl)						
Grain	1,000.00	580.00	1,150.00	650.00	1,200.00	680.00
Straw	150.00	150.00	150.00	150.00	180.00	180.00
Gross income	20,200.00	18,800.00	49,485.00	31,850.00	59,856.00	33,138.00
Net income or profit (Rs./ha)	4,704.38	1,490.67	33,445.40	13,721.70	42,392.21	13,380.00
Total cost/ha	15,495.62	17,309.33	16,039.60	18,128.30	17,463.79	19,758.00
Total cost/qtl	986.98	865.46	964.91	533.18	452.42	609.81
			Rajmash			
Cost A	9,336.44	12,226.48	9,585.93	12,423.37	10,243.61	13,129.10
Cost B_1	9,896.62	12,960.06	10,161.08	13,168.77	10,858.22	13,916.84
Cost B_2	13,061.15	16,264.44	13,444.52	16,736.05	14,214.93	17,604.04
Cost C	15,611.15	19,120.44	16,096.52	19,694.05	17,121.93	20,460.04

(Contd.)

TABLE 1 (CONCLD.) *(Rs. per ha and Rs. per qtl)*

Particulars	1998-99		2000-01		2001-02	
	OFS	IFS	OFS	IFS	OFS	IFS
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Yield (qtl/ha)						
Grains	9.2	14.2	23.2	20.8	24.4	26.6
Straw	18.00	30.00	47.4	43.2	45.8	38.5
Price obtained by the farmers (Rs./qtl)						
Grain	3,800.00	2,800.00	4,300.00	3,200.00	4,600.00	3,500.00
Straw	100.00	100.00	100.00	100.00	120.00	120.00
Gross Income	36,760.00	42,760.00	1,04,500.00	70,880.00	1,16,820.00	97,720.00
Net income or profit (Rs./ha)	21,148.85	23,639.56	88,403.48	5,186.00	99,698.07	77,260.00
Total cost/ha	15,611.15	19,120.44	16,096.52	19,694.00	17,121.93	20,460.00
Total cost/qtl.	1,696.86	1,346.50	693.81	946.82	701.71	769.17
			Peas			
Cost A	10,810.89	13,759.94	11,518.49	14,477.44	13,070.82	16,019.71
Cost B_1	11,459.54	14,585.53	12,209.59	15,346.08	13,855.06	16,980.89
Cost B_2	13,583.97	17,063.87	14,695.07	18,230.08	17,179.49	20,823.73
Cost C	15,215.97	18,746.87	16,430.07	20,066.08	19,219.49	22,761.73
Yield (qtl./ha)						
Grains	5.8	5.8	13.2	12.2	15.5	12.0
Straw	9.4	9.4	22.3	20.5	28.3	20.0
Price obtained by the farmers (Rs./qtl)						
Grain	6,000.00	4,700.00	6,300.00	5,200.00	6,550.00	5,500.00
Straw	100.00	100.00	100.00	100.00	120.00	120.00
Gross Income	3,5740.00	28,200.00	85,390.00	65,490.00	1,04,355.00	68,000.00
Net income or profit (Rs./ha)	20,524.03	9,453.13	68,960.00	45,424.00	85,135.51	45,238.27
Total cost/ha	15,215.97	18,746.87	16,430.00	20,066.00	19,219.49	22,761.73
Total cost/ qtl	2,623.44	3,232.21	1,246.69	1,644.75	1,239.96	1,896.81

It is found that the yield, total production, income and profit of crops increased under OFS as compared to IFS over the years. The economics of production of maize, wheat, rajmash and peas worked out for the years 1998-1999 through 2001-2002 are a clear pointer in this regard. The gross as well as net income or profit of different crops increased significantly by two to three times under OFS whereas they remained stagnant and even declined under IFS over the years. The costs of production of crops per ha as well as per quintal are also low under OFS in comparison to IFS due to higher cost of outside purchased inorganic inputs under IFS. Furthermore, organic products fetch very high premium prices in the market from the consumers, which are often as high as 2 to 3 times more than that of the inorganic produce which makes organic farming a highly profitable enterprise.

Organic Inputs for Organic Farming and Sustainable Agriculture System

In India, at present, in addition to foodgrains' output of above 200 million tonnes, more than 350 million tonnes of organic matter in the form of biological wastes of cereal and legume plants such as straw and stubbles and another more than one billion tonnes of annual and perennial crop plants are produced per annum. These biological wastes considered as a bane can be a boon to increase soil fertility for sustainable agriculture. This plant biomass may be utilised as such or after proper

bio-conversion through the low-cost bio-conversion plants into organic manures. The left-over of biogas production using animal, poultry and other excreta and organic or biological wastes is another rich resource for enhancement of soil productivity and soil health. In addition to this, there is a very large area under forests, other tree plantations and grasslands in India. The forest litter, twigs and leaves of trees and green and dry grass from this huge land mass, aquatic and other weeds, urban and rural solid wastes, agro-industries bio-products, etc., are also available for use as organic inputs. Some farmers in U.S.A. and other developed countries are following organic farming on their large farms by using various bacteria, fungi and parasites in place of labour intensive organic manures. Farmers in India can also use these organic inputs in addition to organic manures for OFS and sustainable agriculture.

Besides, there are many other important and common organic inputs rich in nutrition and readily available for soil, soil micro-organisms and crops which can be used in sufficient quantity for OFS and sustainable agriculture to ensure food security. These include organic FYM, rural compost, urban compost, other organic manures made by municipal corporations from domestic and industrial wastes, sewage and sludge, leguminous green manures and biological nitrogen fixation, concentrated organic manures like oil cakes, bloodmeal, meatmeal, horn, hoof and fish meals, vermicompost or vermiculture where earthworms the "Master Builders" of top soil are multiplied and used to make rich valuable organic manure, various types of biofertilisers and biopesticides available in the market.

Factors or Variables Affecting Organic Farming and Farm Income

As organic manures are the most important inputs or components of OFS, an attempt has been made to examine their role in terms of FYM, the most common and important manure, on agricultural production through correlation and regression analysis. The results are given in Tables 2 and 3.

TABLE 2. CORRELATION MATRIX SHOWING RELATIONSHIP BETWEEN PRODUCTION AND USE OF MANURE AND DIFFERENT VARIABLES OR FACTORS OF PRODUCTION

Sr. No.	Particulars	Variables specified	Y	X_1	X_2	X_3	X_4	X_5
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	FYM (qtl./year/farm)	Y	1.00	0.11	0.66**	0.57**	0.67**	0.79**
2.	Family labour in agriculture (No. of persons)	X_1		1.00	0.45**	0.13	0.14	0.30*
3.	Standard animal units (No./farm)	X_2			1.00	0.73**	0.76**	0.60**
4.	Availability of green fodder (qtl./farm)	X_3				1.00	0.87**	0.64**
5.	Availability of dry fodder (qtl./farm)	X_4					1.00	0.62**
6.	Availability and use of organic flora in cattle sheds	X_5						1.00

** and * Significant at 1 and 5 per cent level, respectively.

Data in Table 2 reveals that the production of organic manures on the farms is directly and significantly affected by the number of animals, availability of green and dry fodder and use of organic flora brought from forests and other sources. The family labour bears direct significant relationship with the number of animals reared on the farm and the collection of organic flora for the animals. The number of livestock units exhibits highly significant relationship with fodder availability and the use of organic flora. Similarly, availability of dry fodder has direct and significant relationship with the supply of green fodder and other organic flora. Thus, production and quantity of FYM depends not only on the number of livestock but also on fodder availability and use of organic flora for livestock and in the cattle sheds.

TABLE 3. REGRESSION ANALYSIS SHOWING ON-FARM PRODUCTION AND USE OF ORGANIC MANURE

(quintals per farm)

Sr. No. (1)	Particulars (2)	Variables (3)	Regression coefficients (4)
1.	Intercept	b_0	29.61
	Family labour in agriculture (No. of persons)	X_1	1.91
			(0.96)
3.	Standard animal units (No.)	X_2	10.74**
			(2.80)
4.	Dry fodder availability (qtl)	X_3	0.24
			(0.23)
5.	Green fodder availability (qtl.)	X_4	0.37*
			(0.14)
6.	Organic flora collected and used (qtl)	X_5	1.82*
			(0.77)
	Goodness of fit	R^2 (adjusted)	0.51**
		"F" value	55.01

** and * Significant at 1 and 5 per cent level, respectively.
Figures in parentheses show standard errors of estimates.

The quantitative relationship of production of FYM with different factors determining the same presented and elaborated in Table 3 shows that the quantity of FYM increased significantly by about 11 qtl with a unit increase in the standard animal unit. The green fodder and other organic flora also increase the quantity of FYM significantly. The dry fodder and family labour do not affect the quantity of FYM directly and significantly but indirectly through increase in the size of livestock. The variables included in the model explain 51 per cent of variation (R^2), which is significant at 1 per cent level.

Organic Farming for Increasing and Stabilisation of Farm Income for Sustainable Agriculture and Food Security

Organic farming may not lead to higher production and income in the short-run as its returns are of a long-term nature. OFS ensures in-built capacity to maintain and increase soil health and fertility leading to sustained increase in yield and production and low variability of crops; this results in stabilisation, and a high jump in incomes and sustainable agriculture for food security in the long run. The exact contribution

and relationship of more important indigenous factors in this regard have been worked out and the results are given in Table 4.

TABLE 4. RESULTS OF LINEAR REGRESSION ANALYSIS SHOWING INCREASE IN FARM INCCOME AND STABILISATION THROUGH ORGANIC MANURE

Sr. No. (1)	Particulars (2)	Variables (3)	Regression coefficients (4)
1.	Intercept	b_0	32267.10
2.	Size of holding (ha)	X_1	56,897.46**
			(21100.81)
3.	Family labour (No. of persons)	X_2	6041.30
			(8470.86)
4.	Quantity of FYM used (qtl)	X_3	536.33*
			(244.52)
	Goodness of fit	R^2 (adjusted)	0.125
		F value	NS

Note : ** and * Significant at 1and 5 per cent level of probability.

Table 4 depicts that with the use of organic inputs such as FYM, the marginal productivity of land becomes quite high and one additional ha of land could add substantially higher income to the tune of Rs. 56,897, which turns out to be significant. Again, organic manures including FYM are the significant contributors in enhancing farm income through sustainable agriculture to the extent of Rs. 536 per qtl. use of FYM. The marginal productivity of labour and its impact on farm income is also high at Rs. 6,041 with per unit increase of family member in agriculture but the same is not significant due to surplus availability of labour in the farm sector.

Constraints and Problems Experienced by Farmers in Organic Farming

There are some pertinent constraints and problems faced by the farmers (Table 5) which must be overcome and solved for the development of sustainable agriculture.

TABLE 5. MAIN PROBLEMS AND CONSTRAINTS ENUMERATED BY THE FARMERS 'OFS' VIS-À-VIS 'IFS'

(per cent of farmers)

Sr. No. (1)	Particulars (2)	OFS (3)	IFS (4)
1.	Knowledge of latest scientific management practices not available	52	35
2.	Lack of technical know-how of scientific soil management	45	35
3.	Lack of scientific nutrient management	50	45
4.	Problems in pests and disease control	20	40
5.	Seeds of good varieties and hybrids of crops not available	70	60
6.	Scarcity of FYM and other organic manures	40	50
7.	Lack of knowledge and availability of biofertilisers and biopesticides	80	100
8.	Extension service in the form of training and imparting knowledge of OFS not coming forward to remove fears of loss in organic farming and to break the past mindset	90	100
9.	Marketing problems like market intelligence, developing the right kind of marketing network, importance of going organic, ensure supply of organic food and to introduce the "organic way of life" to farmers, traders, consumer stores and consumers	95	90
χ^2		61.86**	

Note: ** denote significant difference at 1 per cent probability level.

These problems make adoption of scientific organic agriculture difficult, which is environment-friendly, more profitable and desirable. There is need for dissemination of the concept and knowledge of scientific organic agriculture and OFS to create more awareness among farmers of its success and all-round benefits. The non-availability and scarcity of organic inputs as pinpointed by the farmers must be overcome and solved.

The nature and magnitude of constraints and problems on OFS and IFS farms are quite different as revealed by high value of χ^2 (61.86), which is significant at 1 per cent of significance. Table 5 further reveals that marketing is more complex and difficult and the marketing problems are more severe for organic farmers. Keeping in view the prospects of organic farming the Government of Himachal Pradesh has recently taken some initiatives to promote organic agriculture in the state.[1]

Marketing Practices, Preferences and Demand for Organic Produce

There is an increasing awareness, preference and demand for organic foods from consumers and, as such, the organic produce is fetching much higher premium prices in the market as can be noted from Table 6.

Table 6 shows that organic produce fetches 3 to 4 times higher prices than those paid for inorganic produce. This is due to the rising preferences and demand for organic food in India and abroad.[2] There is an increasing awareness of the fact that 70 per cent of pesticides being used in India are prohibited in the West. Because of the intake of chemical or inorganic foods, perhaps the incidence of cancer is increasing in India. In 10 years from 1982 to 1992, the incidence of cancer rose by 7.39 per cent in Bangalore, 12.7 per cent in Mumbai and 12.8 per cent in Chennai. Furthermore, 50 per cent of the food samples in India are pesticide contaminated with 30 per cent exceeding the tolerance limit. The toxic elements of these chemicals in inorganic foods also cause blood pressure, heart and kidney troubles, mental disorders, other ailments and health problems. Therefore, health conscious people are showing preference for organic foods even though they have to pay higher prices for the same.

TABLE 6. PRICE DIFFERENTIALS OF ORGANIC VIS-À-VIS INORGANIC PRODUCE IN THE MARKETS OBTAINED BY THE FARMERS

(Rs. per kg)

Sr. No.	Particulars	Organic (*Desi*) produce	Inorganic or IFS produce
(1)	(2)	(3)	(4)
1.	Maize	11.25	6.00
2.	Unpolished basmati red rice	80.00	35.00
3.	Wheat	22.50	8.00
4.	Rajmash	48.00	24.00
5.	Unpolished pulses	41.20	22.00
6.	Cucumber	20.30	5.50
7.	Cauliflower	16.30	4.50
8.	Cabbage	12.50	4.00
9.	Bottlegourd	15.00	5.00
10.	Ghee	220.00	145.00

In view of this, traders, marketers and supermarkets as well as certain business houses and individuals are entering into business of organic food products and introducing the 'organic way of life' and turning into permanent 'tie-up' with the farmers to ensure a sustained supply of organic food to their customers. As the potential of organic food market has been assessed, there is a "price war" of sorts which has also been unleashed resulting in super-high prices for the organic products.

Burgeoning "Niche Market" for Organic Products

There is a big "niche market" burgeoning for organic products due to their unpolluted, environment-friendly, more tasty, highly nutritious, healthy, safe and fresh quality. It is a "niche market" because due to these qualities, there is no competition between the conventional and organic food markets. Organic foods are value-added products and can be marketed directly to the consumers through health food stores and specialty counters of food chain stores. In order to overcome the marketing problems, there are traders and buyers who are ready to pick up the organic produce right from the farmers' fields.

The preference of the traders and consumers in the markets was probed and the same has been ranked through rank score method as fair, good and very good. The weighted mean of rank score is presented in Table 7.

TABLE 7. RANKING OF ORGANIC PRODUCE WITH RESPECT TO PECULIAR TRAITS

Sr. No.	Commodities	Peculiar traits				
(1)	(2)	Freshness (3)	Taste (4)	Nutrition (5)	Attractiveness (6)	Chemical free (safe) (7)
1.	Wheat	2.8	3.0	2.4	2.2	2.6
2.	Rice	2.4	2.6	2.3	2.1	2.0
3.	Rajmash	1.5	2.8	1.8	2.0	2.5
4.	Pulses	1.4	2.6	1.9	2.4	1.8
5.	Cucumber	2.6	2.3	1.3	2.2	1.7
6.	Cauliflower	2.3	2.1	1.6	2.8	1.5
7.	Cabbage	2.4	2.1	1.5	2.6	1.6
8.	Bottlegourd	2.4	2.6	2.0	1.8	2.0
9.	Ghee	2.6	2.2	2.2	2.4	2.0

Note: Rank Score 1: Fair, 2: Good, 3: Very Good.

The weighted mean of rank score reveals that the taste, freshness, attractiveness and toxic chemical-free nature of organic produce are the most important traits in that order perceived by the consumers. This shows the need for imparting more knowledge and awareness of other useful traits and qualities of organic products to traders and consumers in marketing and sales promotion programmes to broaden the scope and volume of the niche market for organic produce in future for the benefit of both the farmers and consumers; this would also encourage the adoption of organic farming on large-scale.

There is a big local, national and international market growing for organic foods. Amongst the local markets, at present, traders and consumers are more conscious of

the benefits of organic foods in Chandigarh. Over the past two years, when the first food counter for organics was opened in the city by Manthan, a NGO, in Kalagram, the sale of chemical-free organic foods especially from Himachal Pradesh has more than doubled. Time is not far when the demand for organic products will outpace supply. Given the high potential of the organic food market, many business houses besides farmers are now promoting organic agriculture through their farms. Among the most organic foods in demand is the local (*desi*) wheat followed by unpolished red basmati rice, rajmash, unpolished pulses, organic jams, pickles, grapes, kinnows, apples and vegetables due to their chemical-free nature, bright shining colour, better quality, and taste compared to the ones grown under IFS.

The national terminal markets of Delhi, Mumbai, Chennai, Kolkatta, Bangalore, etc., are purchasing the organic produce in a big way and promoting the cause of organic farmers, organic farming and OFS by constantly enlarging the organic food "niche market". There are companies, traders, stores and even individuals tying-up with the farmers and NGOs working with the farmers for the purchase of organic produce. They have developed the right kind of network to ensure sustained supply for sale to the consumers and other buyers. They are dealing in organic wheat, wheat flour, rice, pulses, oils, sugar, vegetables, fruits, ghee, jams, pickles and in fact the entire range of organic products. The whole range of organic foodstuffs is now being marketed and sold in large quantity through the Health Food Stores, Specialty Counters of Large Food Chain Stores, Retailers Shops, Superbazars and the food counters of the so called Superhyper Markets and World Food Stores spread over in the consumption areas and through the wholesale foodgrains, fruits, vegetable and other markets.

Benefits from Globalisation of Trade, WTO and Export of Organic Produce

Globalisation of agricultural trade and signing by India of the WTO agreement have thrown open the international markets for the export of organic produce. Indian farmers can penetrate the growing global market for organic products. The International Trade Center has shown that due to globalisation of trade and WTO activities, demand for organics in the international market has gone up and over 100 countries including India are producing organic products and beverages in large commercial quantities. The organic food movement is gaining ground on a large scale due to the health consciousness of people in U.S.A. and Europe. In the U.S.A., the retail sales of organic produce have touched $ 7.8 billion during 2000 itself. Today one out of every four Americans buys organic food. Besides U.S.A., Japan, Australia, U.K., Switzerland, Sweden, Denmark, Austria, Scotland, Finland and many other nations are big buyers of organic products. At present, the world trade of organic food products is about US $ 25 billion. It is increasing at 10 per cent every year. The largest trader in the U.K. predicts that the organic market world over will increase from that of the present US $ 25 billion to more than US $ 100 billion over the next 10 years with the U.S.A., Japan and Europe leading the way (Geier, 1998).

The entire northern hemisphere is covered by snow in winter forcing these countries to import large quantities of foodstuff from other nations. India, having most suitable agro-climatic conditions for organic farming, can become a big producer and exporter of organic produce targeting these countries. People in some countries even want to wear clothes made from organic cotton. Therefore, several countries are interested in buying organic cotton, the annual demand for which is around more than 15 million bales. As the organically produced coloured cotton lint sells at premium prices, countries such as Egypt, Israel, Greece, Peru, Turkey, U.S.A., Australia, Latin American countries, India etc., have taken up its cultivation in a big way to conquer international markets. India in particular has the advantage in exporting organic pepper, sliced ginger, turmeric, basmati rice, lentil, gram, peas, sugar, fruits jams, pickles, fresh vegetables, etc., in the global markets.

However, buyers of organic products in the largest markets of U.S.A., Europe and such other countries are very much aware and conscious of purity and quality of organic produce. But our farmers can compete and export organic produce to the world markets only by producing quality organic products. International markets particularly the largest markets of U.S.A. and European Union (EU) accept organic products only if the farms have the required organics certification and the products meet their quality standards. The farmers have to submit their organic farm plans including abandoning of chemical fertilisers and pesticides for obtaining such certification to an accredited public or private agency like Agricultural and Processed Export Development Authority (APEDA), Spices Board, Agricultural Universities, etc., who will provide the guidelines and certification for exact and correct OFS. The U.S.A. and the EU have already developed the quality standards and norms for all products. India has at present evolved standards only for horticultural crops on the lines of the EU. These standards for other organic crops and products should also be developed to encourage organic farming.

IV

CONCLUSIONS, POLICY IMPLICATIONS AND RECOMMENDATIONS

The Inorganic Farming System (IFS) has made agriculture costly, risky, economically unviable and ecologically unsustainable. On the other hand, the Organic Farming System (OFS) has proved to be an effective cure for the ills and problems of IFS as it puts life into the soil through the addition of organic manure and promoting the activities of soil micro-organisms, improves soil structure, soil health and soil productivity to increase yields, production, income and profits of crops on sustainable basis.

The comparative economics of OFS vis-a-vis IFS is clearly in favour of OFS which is also necessary for sustainable agriculture. The yield and production of crops increase under OFS whereas the same decelerate under IFS in the long-run. The costs of production of crops per ha and per quintal under OFS are lower than under IFS.

Gross and net incomes or profits are nearly 2 to 3 times higher under OFS. Overall, OFS produces more and sustainable agricultural output with less energy, low cost and fewer resources.

Moreover, the organic produce and organic foods produced without the use of poisonous and toxic inorganic chemical inputs are best for health. Therefore, the quality and health conscious people world over are now buying and consuming organic products at the premium prices which are 3-4 times higher than the ordinary produce produced under IFS. The OFS is being followed by our farmers from centuries. The government policy in India should be aimed at boosting organic farming on a large scale for export of organic products. The potential of organic farming is very vast. The Government of India should set up an Organic Agricultural Research Institute (OARI) with its all India network and centers in different states. The proposed OARI should conduct research and provide extension services, training, extension skills, education, etc., with respect to organic farming, OFS, agro-ecosystem, biodiversity, methods of making improved FYM, compost, vermiculture, biological control of harmful insects and other pests, protected cultivation under polyhouses, site-specific technologies for precision organic farming management, processing and marketing to compete in the world markets for producing enough at low-cost in agriculture.

Received January 2005. *Revision accepted June 2005.*

NOTES

1. Government of Himachal Pradesh has signed a memorandum of understanding with Rajasthan based NGO, Rural Research Foundation (RRF) in 2003 for starting collaborative programme on promoting organic farming in the state. In this endeavour, a NGO named Himalayan Health Clinic Plant has been established at Rampur-Bushehar in Shimla district. This organisation is conducting training camps to educate the farmers about organic farming. The State Agricultural University, Palampur with the financial support from Directorate of Agriculture has initiated training on vermi-composting and organic farm management in 2004 to train resource personnel (farm scientists and agricultural officers) on different aspects of organic farming, certification and marketing. In addition there is another NGO named Pragya, a subsidiary of Himalayan Amchis Association (HAA) at Kaza (Spiti) for conservation, development and sharing knowledge on naturally growing medicinal plants and their use in health plant clinics to promote traditional system of medicines (www.dropka.org/haa/htm).

2. The organic products fetch higher prices as these have been found to have positive income elasticity of demand with special support from wealthier section of the population. In India too, organic prices are steeper because sellers are pitching against high income consumers willing to pay more for safe foods (Raman, 2005). There is ample evidence to show high price premium for organic basmati rice (Tandon, 2003) and organic wheat (Ahuja, 2001) in India. At the world level too, organic cereals, vegetables, fruits and even cotton fetched premium prices ranging from 20 percent to as high as 200 percent over conventional commodities in the world markets like San Francisco and Boston. For details, visit website, *www.ers.usda.gov/data/organicprices*.

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