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Socio-economic impact of organic farming with reference to vegetable crops in Haryana

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Abstract

According to Food and Agriculture Organization (FAO, 2008), organic agriculture promotes ecological resilience, improved biodiversity, healthy management, off-farms and the surrounding environment, and building on community knowledge and strength. Association between type of family and level of knowledge was found highly significant. More than sixty percent of the respondents who belonged to nuclear family had low level of knowledge about organic vegetable crops. On the other hand 44.4 percent of the respondents who belonged to joint family had high level of knowledge regarding organic vegetable crops. The association between annual family income and level of knowledge was found highly significant. The data revealed that the respondents who had annual income from organic vegetable crops i.e. up to Rs.50,000 had low level of knowledge and the respondents who had annual income above Rs.1,00,000 had high level of knowledge. Highly significant association was found between annual income from organic vegetable crops and level of knowledge. Association between social participation and level of adoption was found highly significant. It was found that 56.5 percent of the respondents who had low social participation had high level of adoption followed by 50.0 percent of the respondent who had nil level of social participation had medium level of adoption of organic crops. Highly significant association was found between mass media exposure and level of adoption. It was observed that 47.4 percent of the respondents who belonged to low mass media exposure had low level of adoption and 72.7 percent of the respondents who had high level of mass media exposure had high level adoption of organic crops.

Keywords: Organic, socio-economic impact, association

Introduction

Agriculture is the most important livelihood strategies in India, with two thirds of the country's workforce depend on farming. Organic farming can be seen as an approach to agriculture, where the aim is to create integrated, environmentally and economically sustainable agricultural production systems. Organic farming tends to conserve soil fertility and system stability. By conserving its soil fertility it will help the farmer to increase the humus content of the soil which will in turn improve the physical properties of the soil and support the life of micro-organism in the soil, which will help in increasing the pore spaces in the soil thereby improving drainage that aids to the stability of the soil structures and components. India is endowed with various types of naturally available organic form of nutrients in different parts of the country and it would substantially augment the organic cultivation. India has a lot of potential to produce all varieties of organic products due to its various agro-climatic regions. Organic farming is considered a systems approach, where interactions between components (crops, animals, insects, soil) are as important as the whole farm itself. Instead of using synthetic fertilizers, organic farmers use crop rotations, cover crops, and compost to maintain or enhance soil fertility. Also, instead of using synthetic pesticides, organic farmers employ biological, cultural, and physical methods to limit pest expansion and increase populations of beneficial insects. Organic farming is one among the broad spectrum of production methods that are supportive of the environment.⁴⁵ Organic farming has set out to be an alternative to conventional agriculture and food chains. It is based on principles and values.

In view of this the present study was designed with following specific objective

- To examine the socio-economic impact of organic farming along with constraints.

Materials and Methods

The study was conducted in Karnal and Sirsa districts of Haryana. One block was selected randomly from each district for the purpose of the study.

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From Karnal block villages namely Sangoha, Sangohi, Geer, Landora & Churni Jagir were selected and from Sirsa block villages namely Alipur Titu Khera, Alikan, Sikanderpur, Bhamboor, Madho Singhan were selected. Thirty respondents were surveyed from each block with the help of well-structured interview schedule as per objectives of the study. On the whole, a total of 60 respondents were selected randomly. Data was analyzed and tabulated to draw the inferences as per objectives of the study. The collected data were coded, tabulated, analyzed and interpreted according to the objective of the present study with the help of appropriate statistical techniques. The descriptive statistical tools such as frequency, and percentage and chi square test had been adopted to draw the inference from the study. In the end, the collected data from the field was analysed in term of identifying various specific objectives

Results and Discussion

Association between socio-economic variables and knowledge of organic vegetable farmers

Highly significant association was found between caste and level of knowledge of organic vegetable farmers 70.4 percent of the respondents who belonged to general caste had low level of knowledge about organic vegetable crops and 48.5 percent of the respondents who belonged to backward caste had medium level of knowledge about organic vegetable crops.

The analysis revealed that majority of the respondents who were having up to 1 ha and 4-10 ha of land holding had low and high level knowledge about organic vegetable crops was reported by 100 percent of respondents in each category.

Size of land holding and level of knowledge was found highly significantly associated. Highly significant association was found between size of organic land holding and level of knowledge. The respondents who had up to .2 ha had low level of knowledge and respondents who had above .4ha of organic land holding had high level of knowledge about organic vegetable crops.

Association between type of family and level of knowledge was found highly significant. More than sixty percent of the respondents who belonged to nuclear family had low level of knowledge about organic vegetable crops. On the other hand 44.4 percent of the respondents who belonged to joint family had high level of knowledge regarding organic vegetable crops.

The respondents who had up to 4 members and 5-8 members had low level of knowledge about organic vegetable crops. The respondents who had more than 8 members had high level of knowledge. Highly significant association was found between size of family and level of knowledge.

The respondents who had annual family income less than 1 lakh had low level of knowledge followed by the respondents who had more than 3 lakh annual income had high level of knowledge.

The association between annual family income and level of knowledge was found highly significant. The data revealed that the respondents who had annual income from organic vegetable crops i.e. up to Rs.50,000 had low level of knowledge and the respondents who had annual income above Rs.1,00,000 had high level of knowledge. Highly significant association was found between annual income from organic vegetable crops and level of knowledge.

About 50.00 percent of the respondents who had nil social participation had low level of knowledge followed by 40.00 percent who had medium level of social participation had high level of knowledge? Significant association was found between social participation and level of knowledge.

Highly significant association was observed between variables mass-media exposure and level of knowledge. Hameed *et al.*, (2016) also revealed in their research that the farmer's knowledge about the economic and production aspect of organic farming was medium-high. The results also showed that there was significant relationship between farmer's knowledge and variables like education level, age. The research also showed that there were no significant relationship between farmer's knowledge and variables like type of tenure, agricultural cultivated area, agricultural information source.

The analysis revealed that 63.2 percent of the respondents who had low mass-media exposure had low level of knowledge followed by 72.7 percent of the respondents who had high level of mass-media exposure had high level of knowledge. Singh *et al.* (2019) [5] revealed in their study that there was highly significant and positive correlation between training received, knowledge, mass media exposure, education, source of information, herd size, social participation, attitude, caste and occupation and adoption of organic farming technology. Analysis showed that the farmers with high level of training received, knowledge, mass media exposure, education, source of information, herd size, social participation, attitude, caste and occupation were found to be adopting more organic farming technology in comparison to those with lower level of above stated variables.

Highly significant association was found between socio-economic status and level of knowledge about organic vegetable crop. It was found that 92.9 percent of the respondents who had low socio economic status had low level of knowledge followed by 73.7 percent respondents who had high socio economic status had high level of knowledge. Riar *et al.*, (2017) also revealed that education was low in small and medium land holding farmers in both conventional and organic farms whereas only 38.3% of conventional farmers and 45.0% of organic farmers had more than 5 years of formal education. Level of education showed positive relationship with the land holding as within large land holding farmers, 61.1% of conventional farmers and 71.4% of organic farmers had more than 5 year of formal education.

Table 1: Association between socio-economic variables and knowledge of organic vegetable farmers

Socio-economic variables				
Age	Low (11-14)	Medium (15-18)	High (19-22)	Total
Up to 35 years age group	1 (20.0)	3 (60.0)	1 (20.0)	5 (8.3)
35-50 years age group	11 (31.4)	9 (25.7)	15 (42.9)	35 (58.3)
Above 50 years age group	11 (55.0)	7 (35.0)	2 (10.0)	20 (33.3)
Total	23 (38.3)	19 (31.7)	18 (30.0)	60 (100.0)
$\chi^2 = 8.814$				
Caste				

Backward caste	4 (12.1)	16 (48.5)	13 (39.4)	33 (55.0)
General caste	19 (70.4)	3 (11.1)	5 (18.5)	27 (45.0)
$\chi^2 = 21.851^*$				
Education				
Illiterate	1 (50.0)	1 (50.0)	0 (0.0)	2 (3.3)
Up to middle school level	4 (66.7)	2 (33.3)	0 (0.0)	6 (10.0)
Secondary School level	12 (48.0)	9 (36.0)	4 (16.0)	25 (41.70)
Senior secondary and above	6 (22.2)	7 (25.9)	14 (51.9)	27 (45.0)
$\chi^2 = 11.860$				
Size of land holding				
Marginal (up to 1 ha)	2 (100.0)	0 (0.0)	0 (0.0)	2 (3.3)
Small (1-2 ha)	20 (100.0)	0 (0.0)	0 (0.0)	20 (33.3)
Semi-medium (2-4 ha)	1 (4.3)	19 (82.6)	3 (13.0)	23 (38.3)
Medium (4-10 ha)	0 (0.0)	0 (0.0)	15 (100.0)	15 (25.0)
$\chi^2 = 95.157^*$				
Size of organic land holding				
Up to .2 ha	22 (100.0)	0 (0.0)	0 (0.0)	22 (36.7)
.2 to .4 ha	1 (4.3)	19 (82.6)	3 (13.0)	23 (38.3)
Above .4 ha	0 (0.0)	0 (0.0)	15 (100.0)	15 (25.0)
$\chi^2 = 98.374^*$				
Type of family				
Nuclear	16 (66.7)	6 (25.0)	2 (8.3)	24 (40.0)
Joint	7 (19.4)	13 (36.1)	16 (44.4)	36 (60.0)
$\chi^2 = 15.197^*$				
Size of family				
Up to 4 members	11 (57.9)	6 (31.6)	2 (10.5)	19 (31.7)
5-8 members	11 (57.9)	5 (26.3)	3 (15.8)	19 (31.7)
Above 8 members	1 (4.5)	8 (36.4)	13 (59.1)	22 (36.7)
$\chi^2 = 20.557^*$				
Annual family income				
Less than 1 lakh	19 (95.0)	1 (5.0)	0 (0.0)	20 (33.3)
2-3 lakh	4 (22.2)	14 (77.8)	0 (0.0)	18 (30.0)
More than 3 lakh	0 (0.0)	4 (18.2)	18 (81.8)	22 (36.7)
$\chi^2 = 75.337^*$				
Annual income from organic vegetable crops				
Up to Rs.50,000	23 (100.0)	0 (0.0)	0 (0.0)	23 (38.3)
Rs.50,000-1,00,000	0 (0.0)	19 (86.4)	3 (13.6)	22 (36.7)
Above Rs.1,00,000	0 (0.0)	0 (0.0)	15 (100.0)	15 (25.0)
$\chi^2 = 103.182^*$				
Animal possession				
Up to 2 animal	7 (63.6)	4 (36.4)	0 (0.0)	11 (18.3)
More than 2 animal	16 (32.7)	15 (30.6)	18 (36.7)	49 (81.7)
$\chi^2 = 6.384$				
Social participation				
Nil	16 (50.0)	12 (37.5)	4 (12.5)	32 (53.3)
Low (1-2)	5 (21.7)	6 (26.1)	12 (52.2)	23 (38.3)
Medium (3-4)	2 (40.0)	1 (20.0)	2 (40.0)	5 (8.3)
$\chi^2 = 10.780^*$				
Mass media exposure				
Low (up to 9)	12 (63.2)	6 (31.6)	1 (5.3)	19 (31.7)
Medium (10-17)	9 (30.0)	12 (40.0)	9 (30.0)	30 (50.0)
High (above 17)	2 (18.2)	1 (9.1)	8 (72.7)	11 (18.3)
$\chi^2 = 17.761^*$				
Socio-economic status				
Low (12-18)	13 (92.9)	1 (7.1)	0 (0.0)	14 (23.3)
Medium (19-24)	10 (37.0)	13 (48.1)	4 (14.8)	27 (45.0)
High (25-31)	0 (0.0)	5 (26.3)	14 (73.7)	19 (31.7)
$\chi^2 = 41.661^*$				

Figures in parentheses denote percentage, *Significant at 5% level of significance

Association between socio-economic variables and adoption of organic vegetable crops

Highly significant association was found between caste and level of adoption of organic vegetable crops. Likewise 66.7 percent of the respondents who belonged to general caste category had low level of adoption. All the respondents who had land holding up to 1 ha had low level of adoption of

organic crops followed by 90.00 per cent respondents who had 1-2 ha land holding also had low level of adoption. All the respondents 100.0 per cent who had organic land holding above .4 ha had high level of adoption followed by 90.9 percent of the respondents who had up to .2 ha had low level of adoption again followed by 87.0 percent who had .2-.4 ha land holding had medium level of adoption of organic

vegetable crops. Highly significant association was found between organic land holding and level of adoption. The data analysis revealed that 50.0 per cent of the respondents who belonged to joint family had high level of adoption.

The data revealed that 63.6 percent of the respondents who had above 8 members family size had high level of adoption of organic vegetable crops followed by 52.6 per cent respondents who had up to 4 members had low level of adoption. Size of family was highly significantly associated with the adoption level of organic vegetable crops.

It was found that 90.00 percent of the respondents who had less than 1 lakh annual family income had low level of adoption of organic crops followed by 77.8 per cent respondents who had annual family income up to 2-3 lakh had medium level of adoption. Highly significant association was found between annual family income and level of adoption of organic vegetable crops.

Highly significant association was found between income and level of adoption. The analysis revealed that 87.00 percent of the respondents who had annual organic vegetable crops income up to Rs.50,000 had low level of adoption. On the other hand the respondents who had above Rs.1,00,000 annual income had high level of adoption.

Association between social participation and level of adoption was found highly significant. It was found that 56.5 percent of the respondents who had low social participation had high level of adoption followed by 50.0 percent of the respondent who had nil level of social participation had medium level of adoption of organic crops.

Highly significant association was found between mass media exposure and level of adoption. It was observed that 47.4 percent of the respondents who belonged to low mass media exposure had low level of adoption and 72.7 percent of the respondents who had high level of mass media exposure had high level adoption of organic crops. Raghuwanshietal (2017)^[4]. The selected variables viz., education, land holding, annual income, socio-economic status, scientific orientation, extension contact showed significant relationship with adoption levels of organic farming practices by the farmers.

The analysis revealed that socio-economic status and level of adoption of organic vegetable crops was found highly significantly associated. The respondents 92.9 per cent who had low socio economic status had low level of adoption. On the other hand 63.2 per cent of the respondents who had high socio economic status had high level of adoption of organic crops.

Table 2: Association between socio-economic variables and adoption of organic vegetable crops

Socio-economic variables	Low (5-10)	Medium (10-15)	High (15-20)	Total
Age				
Up to 35 years age group	1 (20.0)	3 (60.0)	1 (20.0)	5 (8.3)
35-50 years age group	10 (28.6)	11 (31.4)	14 (40.0)	35 (58.3)
Above 50 years age group	9 (45.0)	8 (40.0)	3 (15.0)	20 (33.3)
Total	20 (33.3)	22 (36.7)	18 (30.0)	60 (100.0)
$\chi^2 = 5.220$				
Caste				
Backward caste	2 (6.1)	18 (54.5)	13 (39.4)	33 (55.0)
General caste	18 (66.7)	4 (14.8)	5 (18.5)	27 (45.0)
$\chi^2 = 24.914^*$				
Education				
Illiterate	1 (50.0)	1 (50.0)	0 (0.0)	2 (3.3)
Up to middle school level	3 (50.0)	2 (33.3)	1 (16.7)	6 (10.0)
Secondary School level	10 (40.0)	11 (44.0)	4 (16.0)	25 (41.7)
Senior secondary and above	6 (22.2)	8 (29.6)	13 (48.1)	27 (45.0)
$\chi^2 = 7.536$				
Size of land holding				
Marginal (up to 1 ha)	2 (100.0)	0 (0.0)	0 (0.0)	2 (3.3)
Small (1-2 ha)	18 (90.0)	2 (10.0)	0 (0.0)	20 (33.3)
Semi-medium (2-4 ha)	0 (0.0)	20 (87.0)	3 (13.0)	23 (38.3)
Medium (4-10 ha)	0 (0.0)	0 (0.0)	15 (100.0)	15 (25.0)
$\chi^2 = 89.881^*$				
Size of organic land holding				
Up to.2 ha	20 (90.9)	2 (9.1)	0 (0.0)	22 (36.7)
.2 to.4 ha	0 (0.0)	20 (87.0)	3 (13.0)	23 (38.3)
Above.4 ha	0 (0.0)	0 (0.0)	15 (100.0)	15 (25.0)
$\chi^2 = 93.777^*$				
Type of family				
Nuclear	14 (58.3)	10 (41.7)	0 (0.0)	24 (40.0)
Joint	6 (16.7)	12 (33.3)	18 (50.0)	36 (60.0)
$\chi^2 = 19.773^*$				
Size of family				
Up to 4 members	10 (52.6)	9 (47.4)	0 (0.0)	19 (31.7)
5-8 members	10 (52.6)	5 (26.3)	4 (21.1)	19 (31.7)
Above 8 members	0 (0.0)	8 (36.4)	14 (63.6)	22 (36.7)
$\chi^2 = 27.232^*$				
Animal possession				
Up to 2 animal	5 (45.5)	6 (54.5)	0 (0.0)	11 (18.3)
More than 2 animal	15 (30.6)	16 (32.7)	18 (36.7)	49 (81.7)
$\chi^2 = 5.809$				

Annual family income				
Less than 1 lakh	18 (90.0)	2 (10.0)	0 (0.0)	20 (33.3)
2-3 lakh	2 (11.1)	14 (77.8)	2 (11.1)	18 (30.0)
More than 3 lakh	0 (0.0)	6 (27.3)	16 (72.7)	22 (36.7)
$\chi^2 = 63.501^*$				
Annual income from organic vegetable crops				
Up to Rs. 50,000	20 (87.0)	3 (13.0)	0 (0.0)	23 (38.3)
Rs.50,000-1,00000	0 (0.0)	19 (86.4)	3 (13.6)	22 (36.7)
Above Rs. 1,00000	0 (0.0)	0 (0.0)	15 (100.0)	15 (25.0)
$\chi^2 = 89.357^*$				
Social participation				
Nil	13 (40.6)	16 (50.0)	3 (9.4)	32 (53.3)
Low (1-2)	5 (21.7)	5 (21.7)	13 (56.5)	23 (38.3)
Medium (3-4)	2 (40.0)	1 (20.0)	2 (40.0)	5 (8.3)
$\chi^2 = 14.930^*$				
Mass media exposure				
Low (up to 9)	9 (47.4)	8 (42.1)	2 (10.5)	19 (31.7)
Medium (10-17)	9 (30.0)	13 (43.3)	8 (26.7)	30 (50.0)
High (above 17)	2 (18.2)	1 (9.1)	8 (72.7)	11 (18.3)
$\chi^2 = 13.985^*$				
Socio-economic status				
Low (12-18)	13 (92.9)	1 (7.1)	0 (0.0)	14 (23.3)
Medium (19-24)	7 (25.9)	14 (51.9)	6 (22.2)	27 (45.0)
High (25-31)	0 (0.0)	7 (36.8)	12 (63.2)	19 (31.7)
$\chi^2 = 38.393^*$				

Figures in parentheses denote percentage, *Significant at 5% level of significance

Constraints faced by the organic vegetable farmers

Regarding problem about human labour 40.00 percent of the respondents reported it as not so serious constraint followed by low production of organic vegetable crops 48.33 percent respondents who reported it as very serious constraint. Regarding lack of knowledge of recommended package of practices on organic farming 50.00 percent reported it as serious constraint. Regarding lack of proper trainings by govt. personnel/NGO/research institutes 45.00 percent respondents viewed it as very serious constraint. Regarding unavailability of organic inputs 53.33 percent respondents reported it as very serious constraint followed by predominance of the inorganic farmers in the locality 81.66 percent reported it as very

serious constraint. Regarding low premium prices for organic vegetables 51.66 percent respondents viewed it as very serious constraint. The respondents 55.00 percent viewed lack/poor cooperative societies at local level as very serious constraints. Regarding long process of organic manure preparation 51.66 percent respondents viewed it as serious constraint. Regarding costly manures and bio fertilizers 93.33 percent respondents viewed it as not so serious constraint. Regarding lack of agencies to purchase organic vegetables 80.00 percent respondents viewed it as very serious constraint followed by lack of storage facilities in which 60 percent respondents viewed it as very serious constraint.

Table 3: Constraints faced by the organic vegetable farmers

Sr. No.	Statement	Very serious (3)	Serious (2)	Not so serious (1)
1.	Problem about human labour	15 (25.00)	21 (35.00)	24 (40.00)
2	Low production of organic vegetable crops.	29 (48.33)	25 (41.66)	06 (10.00)
3	Lack of knowledge of recommended package of practices on organic farming.	23 (38.33)	30 (50.00)	07 (11.66)
4	Organic farming is a slow process	35 (58.33)	23 (38.33)	02 (3.33)
5	Lack of proper trainings by Govt. Personnel/NGOs/research institutes	27 (45.00)	31 (51.66)	02 (3.33)
6	Unavailability of organic inputs	32 (53.33)	24 (40.00)	04 (6.66)
7	Predominance of the inorganic farmers in the locality	49 (81.66)	11 (18.33)	00 (0.00)
8	Low premium prices for organic vegetables	31 (51.66)	24 (40.00)	05 (8.33)
9	Lack /poor cooperative societies at local level	33 (55.00)	23 (38.33)	04 (6.66)
10	Long process of organic manure preparation	20 (33.33)	31 (51.66)	09 (15.00)
11	Costly manures and bio fertilizers	00 (0.00)	04 (6.66)	56 (93.33)
12	Lack of agencies to purchase organic vegetables	48 (80.00)	12 (20.00)	00 (0.00)
13	Lack of storage facilities	36 (60.00)	20 (33.33)	04 (6.66)

Figure in parentheses denote percentage, responses were multiple

Conclusion

Pre-dominance of the inorganic farmers in the locality 81.66 per cent reported as very serious constraint. Regarding lack of agencies to purchase organic vegetables 80 per cent respondents viewed it as very serious constraint. It was also suggested that there is need for green channels that can speed up the marketing of organic vegetables and government to

announce premium prices for organic vegetable crops in advance. Raghuvanshi et al (2017) [4] revealed that major constraints expressed by the respondent in adoption of organic farming practices of soybean crop were lack of capital, lack of bulk local demand for organic soybean, long process of organic manure preparation, lack of knowledge about bio-pesticides, application time, method and proper dose, lack of

published information regarding various practices of organic soybean farming. Namdev *et al.* (2011) ^[3] reported the major constraints of organic farming included lower yield, organic farming was a slow process coupled with lack of knowledge about the recommended package of practices and lack of capital Mokhtariabkenari, Abbas (2014) ^[2] also concluded in his study that among market oriented constraints, insufficient marketing channels for organic produce (43.34%) were identified as the first major constraint by the certified organic farmers based on the rank and transport facilities (30.00%) were identified as the second major constraint.

References

1. Amritbir R, Lokendra SM, Randhir SP, Monika MM, Bhullar GS. A Diagnosis of Biophysical and Socio-Economic Factors Influencing Farmers' Choice to Adopt Organic or Conventional Farming Systems for Cotton Production 2017.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5515906>
2. Mokhtariabkenari Abbas, Sharma Jai Narain. Organic farming and sustainable rural development a study with special reference to district Shimla H.P. Department of Gandhian and Peace Studies, Punjab University, Chandigarh 2014.
<https://shodhganga.inflibnet.ac.in/handle/10603/90630>
3. Namdev GP, Shrivastava A, Awasthi PK. Constraints and opportunity for organic paddy production in Jabalpur district of Madhya Pradesh. Indian Journal of Fundamental and Applied Life Sciences 2011;1 (3):141-145.
4. Raghuvanshi V, Mazhar HS. Study of constraint's faced by the farmers in adoption of organic farming practices of soybean crop under ATMA programme. Journal of Pharmacognosy and Phytochemistry 2017;6 (4):1779-1781.
5. Singh B, Sharma AK. Factors Affecting Adoption of Organic Farming Technology in Arid Zone. Annals of Arid Zone 2019;58 (3&4):1-5.
6. Talal SH, Barbara Sawicka. Farmer's knowledge about the economic and production aspect of organic farming 2016.
<https://www.researchgate.net/publication/310461057>