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Resource use Efficiency of Various Factors Affecting Productivity of Organic Farming Practice in Bikaner District of Rajasthan

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ABSTRACT: India has shown interest on the Genetically Modified Crops (GM Crops) like Bacillus Thurungensis (Bt) cotton and also high used of chemical, fertilizer and pesticide etc. which are highly hazardous to the environment. Organic farming has the potential to provide benefits in terms of environmental protection, conservation of non-renewable resources and improved food quality. The fundamental purpose of this paper is to evaluate the economic facets of the small and marginal farmers to speculate solutions on how farmers will manage enhance their income with organic farming. The important reasons which emphasis the need for organic farming in the country are the fact that majority of the farming community is resource poor and purchase of fertilizers and chemicals in adequate quantities is beyond their capacity Bikaner district was selected purposively as it has large area under rainfed farming and mostly fertilizers and pesticides are not being used in this area. To study the resources use efficiency of various key factors affecting production of selected crops on both organic and inorganic farms, the simple multiple regression function were used. The analysis of resource use pattern revealed that no major difference was in utilization of machine labour in per farming various of pertains of organic and inorganic bajra. However, more family labour were employed in production of inorganic bajra crop. In respect of seed quantity, more seed 7.50 kg used in organic bajra against 5.34 kg seed in inorganic bajra crop, but more number (2.61) of irrigation applied in case of inorganic bajra against 1.45 inflation in organic bajra. In case of wheat crop more (6.55) machine hrs. were used in inorganic wheat in comparison of 5.64 to organic wheat . Similarly higher human labour were utilized cultivation of inorganic wheat in comparison of organic wheat it was (173.430 and (137.72) hrs respectively, but in case of seed more quantity was used in organic wheat crop then inorganic wheat crop. FYM was used by the farmer in both type of farming but about 5 time more organic manure was supplied in the field of organic wheat in comparison of inorgaic wheat, no chemical fertilizer and plant protection material was used by the farmer in the field of organic wheat crop.

Keywords: Resource use pattern, Resource use efficiency, Organic farming, Inorganic farming.

INTRODUCTION

Organic products are grown under a system of agriculture without the use of chemical fertilizers and pesticides with an environmentally and socially responsible approach. This is a method of farming that works at grass root level preserving the reproductive and regenerative capacity of the soil, good plant nutrition, and sound soil management, produces nutritious food rich in vitality which has resistance to diseases. The negative consequences of higher use of chemical fertilizers and pesticides are reduction in crop productivity and deterioration in the quality of natural resources. India is bestowed with lot of potential to produce all varieties of organic products due to its various agro-climatic regions. In several parts of the country, the inherited tradition of organic farming is an added advantage which resulted in making the country to stand number one in terms of number of organic farm producers and eight in terms of percentage of the of area under organic farming practice to its total area under farming. This holds promise for the organic producers to tap the market which is growing steadily in the domestic and export sector. (www.organicworld.net/yearbook/yearbook-2020.html.). As per the available statistics, India's rank 8th in terms of World's Organic Agricultural land and

1st in terms of total number of producers as per 2020 data (Source: FIBL & IFOAM Year Book, 2020). Among all the states, Madhya Pradesh has covered largest area under organic certification followed by Rajasthan, Maharashtra, Chhattisgarh, Himachal Pradesh, Jammu & Kashmir and Karnataka. During 2016, Sikkim has achieved a remarkable distinction of converting its entire cultivable land (more than 75000 ha) under organic certification. India produced around 3496800.34 MT (2020-21) of certified organic products which includes all varieties of food products namely Oil Seeds, fibre, Sugar cane, Cereals & Millets, Cotton, Pulses, Aromatic & Medicinal Plants, Tea, Coffee, Fruits, Spices, Dry Fruits, Vegetables, Processed foods etc. The production is not limited to the edible sector but also produces organic cotton fiber, functional food products etc. Among different states Madhya Pradesh is the largest producer followed by Maharashtra, Karnataka, Rajasthan and Uttar Pradesh. In terms of commodities Oil seeds are the single largest category followed by Sugar crops, Cereals and Millets, Tea & Coffee, Fiber crops, fodder, Pulses, Medicinal/ Herbal and Aromatic plants and Spices & Condiments. The total volume of export during 2020-21 was 888179.68 MT. The organic food export realization was around INR 707849.52 Lakhs (1040.95 million USD). Organic products are exported to USA, European Union, Canada, Great Britain, Korea Republic, Israel, Switzerland, Ecuador, Vietnam, Australia etc. In terms of export value realization Processed foods including soya meal (57%) lead among the products followed by Oilseeds (9%), Cereals and millets (7%), Plantation crop products such as Tea and Coffee (6%), Spices and condiments (5%), Medicinal plants(5%), Dry fruits (3%), Sugar(3%), and others. It is highly gratifying that India achieved self-reliance in food production in the shortest span of time in the world, but despite everything, her traditional agro-system suffered a great setback, especially owing to the indiscriminate use of chemical fertilizers, insecticides, fungicides and herbicides. This has also led to erosion of soil fertility, contamination of water resources, and chemical contamination of food grain. In addition to this, India has shown interest on the Genetically Modified Crops (GM Crops) like Bacillus Thurungensis (Bt) cotton etc. which are highly hazardous to the environment and also increased her dependence on the foreign seed companies like Monsanto. The negative consequences of higher use of chemical fertilizers and pesticides are reduction in crop productivity and deterioration in the quality of natural resources. Veeresh (1999) have pointed out that the environment will be affected by the carbon emission of the agricultural system through: a) Direct use of fossil fuel in farm operations, b) Indirect use of embodied energy for producing agricultural inputs and c) Loss of soil organic matter during cultivation of soils. Reddy (2010) have observed that agriculture releases about 10-12 percent of the total green house gasses emissions which is accounted for about 5.1 to 6.1 Gt CO_2. Patil and Pawar (2012) has also pointed out that intensive agriculture and excessive use of external inputs are leading to degradation of soil, water and genetic resources and negatively affecting agricultural production. Kaushik (1997); Kumar *et al.* (2016); Ashraf *et al.* (2021), basing on the long term agrarian studies and experiments conducted in EU and North America have concluded that significant quantity of organic matter and soil carbon has been lost due to intensive cultivation. As a result of these changes in the agricultural sector, intellectual's world-over started searching for the ways to come out of the problem of heavy usage of chemical fertilizers and pesticides and finally arrived at to know that organic farming is the only remedy of the problem and also for sustainability of the agricultural sector in the long run. In this regard, Satpute *et al.* (2009) pointed out that agriculture has the potential to reduce the emission of green house gasses by crop management agronomic practices. They pointed out that Nitrogen application rates in organic farming are 62-70 per cent lower than conventional agriculture due to recycling of organic crop produce and use of manure. Bera *et al.* (2017) have found that the growth of organic farming in India is comparatively slower cause of numerous constrain like inaccessible organic supplements, organic fertilizers, market opportunities etc. The effects can be mostly seen in the small farm holder adopting organic farming. Seal *et al.* (2016), organic farming plays as a input output function envisaged a natural process. The present status of organic farming in India is in a emerging uniqueness as it attempts to produce products ranging from edible to organic cotton and fiber etc. a case study with IRF organic package of practice has been conducted to overcome the technological breakthrough and provide an accessible and better future of organic farming in India. Looking to the importance of organic farming, farmers should be motivated to adopt it. Farmer in always concerned with net profits and therefore, there is need to do comparative studies for crops in different areas for organic and inorganic production.

METHODOLOGY

Bikaner district was selected purposively as it has large area under rainfed farming and mostly fertilizers and pesticides are not being used in this area. Looking to the virginity of land government is also taking initiatives to bring much area under organic farming under Paramparagat Krishi Vikas Yojana (PKVY) in this region. Paramparagat Krishi Vikas Yojana (PKVY) scheme was started mainly in Nokha tehsil of Bikaner district in which two *panchayat samities viz.*, Nokha and Panchu were having maximum number of farmers adopting organic farming therefore, these two Villages selected from each selected *panchayat samities*. For the study 30 farmers for organic farming and 30 Farmers inorganic were selected from two

potential villages. The study was done for two crops viz., Wheat and Bajra. The status of organic farming shows that an area of 1494 acre is actually being undertaken under PKVY scheme. For studying the economics of organic cost of cultivation, income measures and economic feasibility measures were calculated.

Analytical tools

Resource use efficiency. To study the resources use efficiency of various key factors affecting production of selected crops on both organic and inorganic farms, the simple multiple regression function of following form was used:

$$Y = A + b_1 x_1 + b_2 x_2 + \ldots\ldots\ldots\ldots + b_n x_n + u \quad (1)$$

For inorganic crop the variables were:

Y = Productivity of inorganic crop (kg/ha)
X_1= Machine labour(hrs)
X_2 = Family labour(hrs)
X_3= Casual hired (hrs)
X_4 = Seed (kg/ha)
X_5 = FYM (tones)
X_6 = Urea (kg/ha)
X_7 = DAP (kg/ha
X_8 = Irrigation (No.)
X_9 = Plant protection chemicals (kg/ha)
u = Error-term.

For organic crop the variables were:

Y = Productivity of organic(kg/ha)
X_1= Machine labour (hrs)
X_2 = Family labour (hrs)
X_3= Casual hired labour(hrs)
X_4 = Seed (kg/ha)
X_5 = Organic manures (tones)
X_6 = Irrigation (No.),
u = Error-term.

Resource use pattern. The use of inputs and the adoption of various cultural practices in the cultivation of selected crops (bajra and wheat) on the sample farms, cultivated under organic and inorganic practices have been presented in this section.

Resource use pattern in cultivation of bajra on sample farms. Generally bajra is grown in the month of July. The input use pattern and cultural practices followed in the cultivation of bajra crop on sample farms under organic and inorganic farming are presented in Table 1 and 2. The description about resources used in inorganic and organic cultivation of bajra and Wheat is given together in following section. On an average, 5.62 and 5.42 machine hours per hectare were used for preparation of field and sowing on organic and inorganic farms, respectively. The overall human (both family and casual labour) labour used in bajra form field preparation to harvesting and threshing was 196.30 and 217.20 hrs for organic farms and inorganic farms, respectively. It was due to more operational practices such as application for fertilizers and other input. Sowing of seed is done in the month of July. On the overall basis, the seed rate used about 7.50 kg by the farmers using organic method and about 5.34 kg in inorganic farming. However, the overall seed rate per hectare was higher on organic farms as compare to inorganic farms. The organic manure applied to the field on organic farms was in the form of farm yard manure and vermi compost. The overall average organic manure was used 8.53 tons per hectare by the sample farms in organic bajra crop. However a small quantity of organic manure was applied in form of FYM by the farmers is inorganic bajra crop also. On an average about 2.21 tonns farm yard manure was applied in inorganic bajra crop.

RESULT AND DISCUSSION

Table 1 : Resource use pattern in bajra cultivation in organic and inorganic farming (Per ha).

Sr. No.	Input	Selected Farms	
		Organic	Inorganic
1.	Machine labour (hrs)	5.62	5.42
2.	Family labour (hrs)	97.31	105.97
3.	Casual hired labour (hrs)	98.99	111.23
4.	Seed (kg)	7.50	5.34
5.	FYM (tones)	8.53	2.21
6.	Fertilizers		
	Urea (kg)		22.90
	DAP (kg)		44.35
7.	Irrigation (Numbers)	1.45	2.61
8.	Plant protection chemicals (No. of sprays)		1.42

In case of chemical fertilizers used in inorganic bajra crop. In case of chemical fertilizers used in inorganic bajra crop, urea and DAP was used by the sample farmers. The average quantity of urea and DAP applied to the inorganic bajra crop, was 22.90 and 44.35 kg per, hectare, respectively. No plant protection material was used by the farmers in case of organic bajra crop. The average number of sprays done on inorganic farms was 1.42 per hectare. On an average, 1.45 irrigations were given to the bajra crop under organic farms while it was 2.61 on inorganic farms. Thus, the overall number of

irrigations on inorganic farms was higher than on organic farms.

Resource use pattern in cultivation of wheat on sample farms. The field preparation for growing of wheat crop in the study area starts in the month of November. On an average, 5.64 and 6.66 hrs machine power was used on organic and inorganic farms, respectively. The overall human (both family and casual hired labour) labour used in wheat crop cultivation from field preparation to harvesting was 137.74 and 173.63 hrs for organic farms and inorganic farms, respectively. The average quantity of seed used was 87.25 kg per hectare by the sample farms. The average quantity of seed used on inorganic farms was 77.41 kg per hectare by the sample farms. Thus, the overall seed rate used per hectare on organic farms was higher than on inorganic farms. The average quantity of organic manure used was 14.64 tonnes per hectare by the sample farms. On organic farms no chemical fertilizer was used in wheat by the sample farms .On the other hand FYM was used by the sample farms @ of 5.77 tonnes per hectare in inorganic wheat farms. The average quantity of urea and DAP applied to the inorganic wheat crop was 118.56 and 44.22 kg per hectare, respectively. No plant protection material was used by the farms in case of organic wheat crop, but on inorganic wheat crop average number of sprays done on inorganic wheat farms was 1.85 per hectare. On an average, 5 irrigations were given to the wheat crop, grown under organic farms while in case of inorganic farming it was 8 irrigation. Thus, the overall number of irrigations on inorganic farms was higher than on organic farms.

Resource use efficiency in bajra organic production. Simple multiple regression was run with machine labour, family labour, casaul hired labour, seed, organic manures and irrigation resources used in production of bajra organic. No resource was found significant

Table 2: Resource use pattern in wheat cultivation under Organic and inorganic farms (Per ha).

Sr. No.	Input	Size of holdings	
		Organic	Inorganic
1.	Machine labour (hrs)	5.64	6.55
2.	Family labour (hrs)	80.06	94.78
3.	Casual hired labour (hrs)	57.68	78.85
4.	Seed (kg)	87.25	77.41
5.	FYM (tones)	14.64	5.77
6.	Fertilizers		
	Urea (kg)		118.56
	DAP (kg)		44.22
7.	Irrigation (Numbers)	4.72	7.44
8.	Plant protection chemicals (No. of sprays)		1.85

Table 3: Resource use efficiency in bajra organic production.

Sr. No.	Resources	B Coefficient	Significance
1.	Machine labour (hrs)	0.713	0.685
2.	Family labour (hrs)	0.027	0.439
3.	Casual hired labour (hrs)	-0.066	0.549
4.	Seed (kg)	-0.092	0.911
5.	Organic manures (tones)	1.052	0.099
6.	Irrigation (Numbers)	0.612	0.649

Adjusted R Square= 0.078

Resource use efficiency in bajra inorganic production. Simple multiple regression was run with machine labour, family labour, urea, casual hired labour, seed, organic manures, urea, DAP, irrigation and plant protection chemicals resources used in production of bajra inorganic. Machine labour, seed and urea were found significantly contributing to -.668, -.450 and .293 unit of contribution in output with one unit increase in resource. Respectively (Table 4). Similar results were found in Sharma *et al.* (2012) in cotton crop in Hanumangarh district.

Resource use efficiency in wheat organic production. Simple multiple regression was run with machine labour, family labour, casual hired labour, seed, organic manures and irrigation resources used in production of wheat (organic). As shown in table 5, family labour and casual hired labour resources were found significant with 0.194 kg and 0.125 kg contribution in yield with one unit of application of resource.

Table 4: Resource use efficiency in bajra inorganic production.

Sr. No.	Resources	B Coefficient	Significance
1.	Machine labour (hrs)	-0.668	.038*
2.	Family labour (hrs)	.081	.130
3.	Casual hired labour(hrs)	.111	.090
4.	Seed (kg)	-.450	.051*
5.	Organic manures (tones)	.666	.723
6.	Urea (kg)	.293	.053*
7.	DAP(kg)	-.108	.318
8.	Irrigation (Numbers)	1.187	.172
9.	Plant protection chemicals(No. of sprays)	-.384	.560

Adjusted R Square= 0.400

Table 5: Resource use efficiency in wheat organic production.

Sr. No.	Resources	B Coefficient	Significance
1.	Machine labour(hrs)	-.299	.526
2.	Family labour(hrs)	.191*	.048*
3.	Casual hired labour(hrs)	.124*	0.010*
4.	Seed(kg)	.132	0.365
5.	Organic manures(tones)	.195	0.491
6.	Irrigation(No.)	.404	0.600

Adjusted R Square= 0.654

Resource use efficiency in wheat inorganic production. Simple multiple regression was run with machine labour, family labour, casual hired labour, seed, organic manures, urea, DAP, irrigation and plant protection chemicals resources used in production of wheat (inorganic). No factor was found significant in contributing to the yield of inorganic wheat production (Table 6).

Table 6: Resource use efficiency in wheat inorganic production.

Sr. No.	Resources	B Coefficient	Significance
1.	Machine labour(hrs)	-298	.842
2.	Family labour(hrs)	.027	.938
3.	Casual hired labour(hrs)	-.015	.928
4.	Seed(kg)	.401	.470
5.	Organic manures(tones)	1.551	.438
6.	Urea(kg)	-.078	.745
7.	DAP(kg)	.382	.412
8.	Irrigation(No.)	1.222	.544
9.	Plant protection chemicals(No. of sprays)	2.437	.344

Adjusted R Square= 0.381

CONCLUSION

The analysis of resource use pattern revealed that no major difference was in utilization of machine labour in per farming various of pertains of organic and inorganic bajra. However, more family labour were employed in production of inorganic bajra crop. In respect of seed quantity, more seed 7.50 kg used in organic bajra against 5.34 kg seed in inorganic bajra crop, but more number (2.61) of irrigation applied in case of inorganic bajra against 1.45 inflation in organic bajra. In case of wheat crop more (6.55) machine hrs. were used in inorganic wheat in comparison of 5.64 to organic wheat. Similarly higher human laboue were utilized cultivation of inorganic wheat in comparison of organic wheat it was (173.430 and (137.72) hrs respectively, but in case of seed more quantity was used in organic wheat crop then inorganic wheat crop. FYM was used by the farmer in both type of farming but about 5 time more organic manure was supplied in the field of organic wheat in comparison of inorganic wheat, no chemical fertilizer and plant protection material was used by the farmer in the field of organic wheat crop. Considering the increasing awareness about the safety and quality of foods, long term sustainability of the system and accumulating evidences of being equally productive, the organic farming has emerged as an alternative system of farming which can not only address the quality and sustainability concerns, but also ensure a debt free, profitable livelihood option.

FUTURE SCOPE

Organic food is in high demand with rising domestic market; India is set for faster growth. The growth of India's domestic markets is crucial to the organic movement's success. Organic farming is appropriate for

small farmers in developing countries like India. According to the available evidence, Organic agriculture helps to poverty reduction and food security through a variety of factors.

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Conflict of Interest. None.

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