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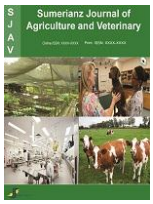

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Compost Adoption Impact on Vegetables Production in District Chakwal Pakistan: A Smallholders Perspective

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Abstract

Composting is one of the most ecological technologies for the management of the bio-waste now a days. The present study was conducted to identify the perception of the farmers regarding adoption of composting technique for vegetables production promoted by USDA/USAID supported project in Chakwal, Punjab, Pakistan. It was based on primary data collected through a field survey conducted in March, 2018 by assessing the benefit-cost analysis (BCA), broader feasibility and future potential of compost technology. During survey 40 sample respondents were interviewed out of this 30 (75%) of the sample respondents were female and 10 (25%) of the sample respondents were male. The results revealed that out the total 40 respondents, 35 percent respondents perceived on the decrease of cost for vegetable production. About 5 percent respondents consider this intervention helpful in food security and 15 percent consider this as secure their crops. The results point out that overall awareness trend was positive with in the area and adoption trend was progressing but with very slow trend. Some of the fellow farmers had adopted making compost at their own. Among 40 only 12 respondents were actually adopting the technology this shows their lesser interest in the technology due to many constraints such as lack of experience, awareness and poor financial resources. The findings bring in that enhancing the awareness about the need for protection of soil, water and the environment though involvement of the media (newspapers, radio programs, television show, dramas, etc.) may be effect farmers significantly.

Keywords: Compost adoption; Growers perception; Vegetables production; Soil fertility (SF); Soil health (SH).

1. Introduction

In Pakistan, several government-sectors, agriculture research institutes/centers and universities are working on various issues of agriculture. The Agricultural Extension department is also helping farmers to solve their problems. There exists a well-developed private-sector that supplies agriculture inputs to the farmers. However, provision of technical training and follow-up services are limited. The country also possesses printed media and a variety of electronic media reaching out to the most parts of the country that can be utilized to disseminate useful information. However, none of these resources are fully utilized leaving Pakistan's agricultural potential to a great extent under-utilized, particularly challenges in declining soil fertility.

For high yield of any crop, fruit and vegetable the soil condition must be in good condition and farmers know their field soil very well and they examine and evaluate their local soil experience for making everyday land management decisions according to indigenous understanding [1, 2]. In this way, the compost produced on-farm could contribute to solve the problem of disposing agricultural biomasses and vegetable feedstock and at the same time, to provide for the farmer a self-supply of quality compost for the improvement of soil quality [3]. Composting is refers to the biological decomposition of organic materials through microorganisms under controlled conditions. Composting is one of the most ecological technologies for the management of the bio-waste in many different ways using a variety of materials, methods, equipment, and scales of operation. In context of agriculture, this process is carried out by using common materials or feed stocks that are composted by livestock manures, bedding and various residual plant materials (straw, culls, on-farm processing wastes, etc) or waste and turned them into nature's best plant food [4, 5]. Integrating local knowledge helps match extension workers efforts with local needs and may achieve improved adoption of co-produced technology [6]. In this connection, On-farm composting can be a good option to industrial composting in intensive agricultural areas where a large investment in to dispose green waste, is required [3].

The success of sustainable agriculture needs to improve the capacity of the farmers for the adoption of sustainable agriculture practices at farm level. The purpose of this study was to identify the perception of the farmers

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regarding adoption of composting technique for sustainable agriculture practices in Chakwal, Punjab province of Pakistan. This study was therefore, planned to identify the farmers' perceptions about the adoption of compost for vegetables production.

2. Material and Methods

This study was conducted to assess the benefit-cost analysis (BCA), broader feasibility and future potential of compost technology promoted by USDA/USAID supported project[1] in District Chakwal. A list of 72 adopters has been obtained from the project implementing institute; Soil and Water Conservation Research Institute (SAWCRI), Chakwal. Out of 72 almost 80 percent respondents were interviewed and visited in mentioned locations[2] of District Chakwal. However to manage the balance some non-adopters were also interviewed purposively to find out difference among their income level and further analysis (Table 1).

Table-1. Distribution of sample respondents

Location	Adopter	Non-adopter	Total
Wallana	4	8	12
Narvey	4	2	6
Marri	4	10	14
Nara Mughlan	-	8	8
Total	12	28	40
Percent	30	70	100

Regarding the compost adoption status of the beneficiary sample respondents, the famers were re-arranged in two categories, Early-Adopter[3] and Late-Adopter[4].

Table 2 showed that the total eight host farmers were interviewed, only two of the host farmers were in the group of Early-Adopter, six host farmers were in the Late-Adopter category. Four of the adopters were categorized in Early-Adopter. These four respondents were adopting this technology by taking training from Green Hill organization not from SACRI or ICARDA related activities. At the same time 28 non-adopters were also surveyed as control group for comparison purposes.

Table-2. Frequency distribution by adoption status

Category	Early-Adopter	Late-Adopter	Non-Adopter
Host farmer	2	6	0
Adopter	4	0	0
Non-Adopter	0	0	28
Total	6	6	28

3. Results and Discussion

3.1. Socio-Economic Characteristics

Socio-economic is the most important determinant of the livelihoods as it influences levels of knowledge, skill and income conditions which mean for their living. Besides this, socio-economic characteristic of the respondents are important for effective planning, designing and implementing any interventions in agriculture. According to Somda, *et al.* [7] farmers' socio-economic characteristics and their agro-ecological location significantly affect their adoption decisions.

3.2. Descriptive Results of the Sample Respondents

During survey 40 sample respondents were interviewed out of this 30 (75%) of the sample respondents were female and 10 (25%) of the sample respondents were male. According to table 3 the average age of the sample respondents from adopter was 39.5 whole for non-adopter was 43 years. The average experience of farming was 14 years for adopters and for non-adopters it was 21 years working experience in the fields. However, in literacy adopters were with good literacy rate which is 10 classes on average while no-adopter average education was 7.5 years of schooling in the sample respondents. It indicated that higher the education level it will increase the chances of adoption for compost. The sample respondents were also asked about their farm distance from the major entities. The mean distance of major output market such as Chakwal was 37km for adopters and 38.5 Km was for non-adopters. The average distance of output minor market and input market was 6 kms. The main government Agriculture Extension office and Agriculture Research station distance from the respondents' farms were 12kms and 35 kms respectively. It is also observed that source of family income for adopters were crops, livestock, non-farm and remittances with 40, 11.75, 30 and 23.25 percent respectively. However for non-adopters share of crops,

[1] "*Dissemination, diffusion and adoption of the best soil fertility and soil health management practices and Technologies for the Farmers of Pakistan Phase-II"*

[2] Wallana, Narvey, Marri and Nara Mughlan

[3] Early-Adopters were those respondents that adopted the compost technology and applied to vegetables and obtained at-least one produce.

[4] Late-Adopters were those respondents that they adopted the compost technology late then early adopter and their compost were in preparation stage and were not applied to any crop during survey period.

livestock, non-farm and remittances in their household income were with 45, 15, 31.75 and 8.25 percent respectively. Irrigation major source was depending upon rain and in terms of family set up majority of the sample respondents mentioned that they lived in joint family system almost 90 percent agreed with joint family system.

Table-3. Farmer age, experience, house size, and distance from important places (Averages)

Farmer ID Analysis		**Adopter**	**Non-Adopter**
Age (years)		39.5	43
Farming experience (years)		14	21
Education (years)		10	7.5
Distance from (KM)	Output Market Major	37	38.5
	Output Market Minor	6	6
	Input Market	6	6
	Agric Exten. Office	12	12
	Agric Res. Station	35	35
Source of income (percent)	Crops	40	45
	Livestock	11.75	15
	Non-Farm	30	31.75
	Remittances	23.25	8.25
Irrigation source (percent)	Rainfed	76	92
	Canal	-	-
	Turbine	24	8
	T.Well	-	-
Type of family (percent)	Joint	83	90
	Single	17	10
Gender Involvement (no.)	Male	4	6
	Female	8	22

3.3. Change in Soil Productivity Overtime

Table 4 revealed that majority 65% (26 farmers) of the sample respondents viewed that the soil productivity over time decreased while 35% (14 farmers) viewed that the soil productivity remained un-change. The reason of reducing soil productivity perceived by majority 26 sample respondents were usage of more in-organic fertilizers while 16 sample respondents, perceived that the main reason behind reducing soil productivity was the soil type in their area. In light of literature, study conducted by Sharma, *et al.* [8] in India also support that organic farming is a modern, sustaining and close to nature farming system, which maintains the long-term fertility of the soil and uses less of the earth's finite resources to produce high quality nutritious food grains/vegetables/fruits. Quality of compost could further be enhanced with the addition of yard waste or cow and poultry manure etc. For land reclamation or plant productions the use of compost may be supportive not only increase moisture holding capacity but also help to sustain soil conditioning [9].

Table-4. Farmer's perception regarding soil less productivity and its reasons

Category	**Total**	**No**	**Yes**	**If yes, reasons**	
				Usage of more in-organic Fertilizers	**Soil Type**
Adopters	12	4	8	10	2
Non-Adopter	28	10	18	16	14
Total	40	14	26	26	16
Percent	100	35	65	65	40

3.4. Degradation of Water Resources

Table 5 depicted that majority 80% of the sample respondents viewed that the resources of water in the study area was reduced while the rest 20% of the sample respondents perceived that the water resources did not decreased in the study area. By digging out the reason of water degradation in the study area it had been observed that it was perceived by the sample respondents that the rainfall during was minimum, irregular and water table goes down due that the water quantity reduced in the study area.

Table-5. Farmer's perception regarding degradation of water resources

Category	**Total**	**No**	**Yes**	**If Yes, reason**
				Decreased water quantity
Adopter	12	2	10	10
Non-Adopter	28	6	22	26
Total	40	8	32	36
Percent	100	20	80	90

3.5. Enabling Institutions

The results indicated that about 15 agricultural service providers, agricultural services providers were providing services like mechanical (tractor, thresher etc), input facilities for agricultural production in the area. However, none of them provide organic fertilizer (compost technology) facility in the study area. The sample respondents perceived that none the agricultural service providers were working in the area and not sufficient for them. 20 % of the sample respondents perceived that the agriculture departments, institutes and NGOs worked on composting technology to promote in the study area while 10% of them viewed in opposition. When the sample respondents were asked whether they will buy the compost from the market if available, majority (90%) of them viewed that they were willing to buy from the market for more production from their filed and 10% were refused to buy it due to their financial status. In a study by Somda, *et al.* [7] also find out that the institutional factors, which are represented by the farmers' participation in extension workshops. In the study area they were of the view that the compost technology adoption had a potential to make place and compete with inorganic fertilizer in the study area (Table 6).

Table-6. Farmer's perception regarding role of enabling institutions

		Adopter	Non-Adopter	Total	Percent
How many Agricultural Service Providers ASPs in area	No.	2	1	3	15
Are ASPs sufficient?	Yes	0	0	0	00
	No	12	28	40	100
Other institute/ projects/ NGO promoting Compost usage	Yes	4	0	4	10
	No	4	4	8	20
	No response	6	22	28	70
Willing to buy compost technology	Yes	12	24	36	90
	Not willing	0	4	4	10
Future Prospects of the technology	Less Adoption	0	8	8	20
	More Adoption	8	6	14	35
	No response	4	14	18	45

3.6. Technology Assessment by Adopters

3.6.1. Hearing, Adopting and Area under Compost Technology

Following table revealed that the sample respondents heard first time about compost in year 2015, in 2016 only 2 farmers learned about compost, during 2017 number was 6 and in year 2018 almost all the respondents were well aware about compost technology (Table 7). However in adoption of the technology among sample respondents only 2 adopted this technology in year 2017 and currently 6 adopters were identified who were adopting this compost technology for their vegetables production (Table 7). Area under compost first time was used 13 Kanal, however respondents mentioned that there is potential for this about 150 Kanal of their lands (Table 7).

Table-7. First year heard about use of compost technology

Year	No.	Total
2015	1	1
2016	2	2
2017	6	6
2018	16	16
What was the first year you adopted use of Compost for vegetables production		
Year	Adopter	Total
2017	2	2
2018	6	6

3.6.2. Impact of Compost Use

Table 8 revealed the farmer's perceptions regarding impact of compost usage on vegetable production in the study area. The perception of adopters was based on their experience as they already use compost on vegetables and obtained vegetable produce. Of the total 40 respondents, 35 percent respondents perceived on the decrease of cost for vegetable production. About 5 percent respondents consider this intervention helpful in food security and 15 percent consider this as secure their crops. Studies conducted by Sarwar, *et al.* [10] and Qazi, *et al.* [11] showed that composts prepared will not only supplement the chemical fertilizers but also reduce the environmental pollution. In this strategy, the cost of production is also reduced. Hence, higher yield with resultantly more income is expected for the farming community in this system of farming.

The results revealed that access to information, more awareness about Soil Fertility (SF) and Soil Health (SH), Improvement in quality of crop, improvement in quantity, involvement of women, increased role of women, soil health, soil fertility and more social links with in community increased while duration of crop decreased. However they also indicated that size of the grain has not been affected by compost yet. Moreover, the results also revealed that duration of crops, more link with NGO/institutions and incidence of pest and insect were also constant which mean compost has no effect on these attributes neither in positive nor in negative side (Table 8).

Table-8. Frequency distribution of sample respondents by impact of compost usage on vegetables production

Category	Improved	Decr/ Wors	No Eff	Percent
Cost of Production	0	7	0	35.00
Food Security	1	0	0	5.00
Crop Security	3	0	0	15.00
Access to information	13	—	0	65.00
More Awareness about SF and SH	4	—	0	20.00
Improvement in quality of crop	13	—	0	65.00
Produce good quality horticulture	17	—	1	85.00
Improvement in qty Size of grain	0	—	5	25.00
Duration of Crop	0	—	5	25.00
Involvement of Women	7	—	0	35.00
Increased role of women	5	—	0	25.00
Soil Health	13	—	0	65.00
Soil Fertility	13	—	0	65.00
More Social links with in community	3	—	1	15.00
More Links with institutions/NGOs	0	—	2	10.00
Incidence of insects	0	0	1	5.00
Incidence of Pests	0	—	1	5.00

Note: Imp: Improved; Decr/ Wors: Decreased/worsened; No Eff: No effect

3.6.3. Perceptions Regarding Use of Compost Technology for Vegetable Production

Farmer's perception regarding compost use in vegetables has been recorded and ranked. The results were presented in Table 9. The results revealed that overall, the sample respondents viewed that compost application in vegetables will increase yield followed by increased in organic matter, reduce usage of chemical fertilizers, increased soil fertility and soil health as top five ranks respectively. Further adopters also mentioned that it improves water holding capacity, reduced environment pollution, easy to use this technology, environment friendly and cost effective for farmers. They also revealed that it is beneficial in terms of moisture conservation and water saving for the crops. On-farm composting could be an efficient, cost-effective and environmentally safe biological process for the recycling of residual agricultural biomasses [12].

Table-9. Ranking of Farmers' perceptions regarding Compost Use for Vegetables Production

Perception	Rank
More yield	I
Increased Organic matter	II
Reduced used of chemical fertilizer	III
Increased Soil fertility	IV
Improve soil health order	V
Saving of cultivation cost	VI
Improves soil water holding capacity	VII
Reduce environment pollution	VIII
Easy to use this technology	IX
Environment friendly	X
Cost Effective	XI
Moisture conservation and saving irrigation	XII

4. Conclusions and Recommendations

Overall awareness trend was positive with in the area and adoption trend was progressing but with very slow trend. Some of the fellow farmers had adopted making compost at their own. Among 40 only 12 respondents were actually adopting the technology this shows their lesser interest in the technology due to many constraints such as lack of experience, awareness and poor financial resources. Technology is labor intensive farmers considered it not suitable for small holders' families. Finally it was a great limitation of the study that respondents were unable to provide information about cost benefit analysis of different vegetables with and without compost using. Without this analysis this study can't provide a quantitative benefit of the technology for future adopters, relevant stakeholders and policy makers. Based on the above discussion, some recommendations are given as under for wider adoption of the technology:

- There is a need to arrange frequent Farmer Field Days (FFDs) on one site and the same should be followed on the other sites as well for the awareness of people.
- There is a need to document some success stories and show it to them as sample, so it may encourage them to apply at their own farm.
- It is recommended that procedure of compost making should be performed practically before participants of any activity, so they could understand the technology easily.
- Enhancing the awareness about the need for protection of soil, water and the environment though involvement of the media (newspapers, radio programs, television show, dramas, etc.)

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