Original Research Article

EFFECTS OF FERMENTER TECHNOLOGY ON THE YIELD OF VARIOUS CROPS IN KHYBER PAKHTUNKHWA PAKISTAN

Abstract: The principle objective of this research was to investigate the effects of fermenter technology on yield of various cash crops grown in Malakand division of Khyber Pakhtunkhwa Pakistan. A total of 128 farmers using fermenter technology in six districts of Malakand division were the universes of the study. 50.8% of the farmers using fermenter were holding a land between the groups of 1.6 to 2.5 hectares. Majority of the farmer's 84.4% source of awareness about the fermenter technology were extension worker. Major cash crops grown by the respondents in the study area were tomato, onion and wheat. T-test results reveal a highly significant (P=0.000) increase in yield of tomato, onion and wheat. On average 1668.868 kg ha^{-1} increased were recorded in tomato, 1293.478 kg ha^{-1} increased in onion and 98.791 kg ha^{-1} in wheat crop. The finding of study suggests that various crops yield were increased with adopting fermenter technology. So the fermenter technology should be promoted and imparted to the entire farming community to meet with the increasing demand.

Key words: Fermenter technology, Organic farming, Extension role, Tomato yield, Khyber Pakhtunkhwa

Introduction

The improper and unnecessary use of chemical fertilizers has led to consider the use of organic matters for sustainable production. Therefore, to maintain the soil charchteristics and to gain increased production of crops, carefull practice of organic manures and their scientific management is necessary (Channabasanagowda *et al.,* 2008). Fermenter technology is a method of using farm yard manure (FYM) fermented by beneficial microorganism (BM) or effective microorganism (EM) in a fermenter tank that is added to the field through irrigation water. Beneficial microorganisms increase the microbial multiplicity of soil which increases crop yield and growth (Higa, 2000). The application of organic matter alone can't meet with the demand of nutrient required to plant growth so the incorporation of BM/EM with organic/inorganic materials (Hussain *et al*., 1999). It is the need of the country to increase production per hectare

because the average production of the country is not meeting the required demand, even by excessive application of chemical fertilizers (Ali, 2000). Higher yield can be gained with optimal use of inorganic fertilizer, but it has proved that fertility can be increased and maintained with the application of organic matter. EM application in combination with organic or inorganic matter increased yield (Khaliq *et al*., 2006). EM incorporation with both organic manures and chemical fertilizers increase yield and growth of plant (Javaid and Bajwa, 2010). Organic farming have a significant effect on cost and productivity of farmers. Adopting organic farming not only increase their income but also it protect environment from pollution by escaping chemical fertilizer (Ullah *et al*., 2015). In the present study efforts was made to evaluate the effects of fermenter technology on the yield of different crops.

Objectives

1- To identify the farmer's source of awareness about fermenter technology in the study area.
2- To study the effect of fermenter on differnet crops.
3- To formulate suggestion for future.

Materials and Methods

The study was carried out in Malakand division of Khyber Pakhtunkhwa. Six districts out of total seven districts were purposively selected because these districts were easily accessible for the researcher to collect data for this study. In six districts of Malakand division 128 fermenters were installed by agricultural extension department. All of 128 fermenter having farmers were interviewed. A well developed and pretested interview schedule was used to collect the data. The data was analayzed using SPSS and the results were presented as counts and percentages. To compare the yield before and after fermenter a paired sample t-test was used as (Alam *et al*., 2004) determined the significance of the difference in yield by using t-test.

$$t = \frac{\Sigma d}{\sqrt{\frac{n\left(\Sigma d^2\right)-\left(\Sigma d\right)^2}{n-1}}}$$

Results and Discussion

Size of Land

Information regarding farmers land holding size is given in Table-1. Data shows that 60 (46.9%) of the farmers using fermenter were having size of land holding from 0.50 to 1.5 hectares, 65 (50.8) of the farmers were 1.6 to 2.5 hectares while only 3 (2.3%) of farmers were in category of 2.6 to 3.5 hectares of land.

Table 1 Distribution of Respondents regarding Size of Land

Districts	Size of Land (in hectares)			Total (%)
	0.50 to 1.5 (%)	1.6 to 2.5 (%)	2.6 to 3.5 (%)	
Swat	12 (9.4)	14 (10.9)	1 (.8)	27 (21.1)
Malakand	10 (7.8)	19 (14.8)	1 (.8)	30 (23.4)
Lower Dir	11 (8.6)	12 (9.4)	1 (.8)	24 (18.8)
Upper Dir	11 (8.6)	2 (1.6)	0 (0)	13 (10.2)
Buner	10 (7.8)	14 (10.9)	0 (0)	24 (18.8)
Shangla	6 (4.7)	4 (3.1)	0 (0)	10 (7.8)
Total	60 (46.9)	65 (50.8)	3 (2.3)	128 (100)

Source: Field Survey, 2016

Source of Awareness about Fermenter Technology

Respondents were asked about the source of awareness about fermenter technology and their response are presented in Table 2. The results showed that out of total 128, 108 (84.4%) of the respondents become aware about fermenter technology from the extension worker of their area, while 20 (15.6%) of the farmers source of knowledge about the fermenter technology has their fellow farmers. This result is similar to that of Khan (2012), who also reported that fellow farmers were one of the major source of information in the study area.

Table 2 Distribution of Respondents on the Basis of Source of Awareness about Fermenter Technology

Districts	Source of Awareness about Fermenter Technology		Total (%)
	Extension Worker (%)	Fellow Farmer (%)	
Swat	20 (15.6)	7 (5.5)	27 (21.1)
Malakand	28 (21.9)	2 (1.6)	30 (23.4)
Lower Dir	21 (16.4)	3 (2.3)	24 (18.8)
Upper Dir	11 (8.6)	2 (1.6)	13 (10.2)
Buner	19 (14.8)	5 (3.9)	24 (18.8)
Shangla	9 (7)	1 (.8)	10 (7.8)
Total	108 (84.4)	20 (15.6)	128 (100)

Source: Field Survey, 2016

Major Crops Grown

The cash crop of the farmer is the major crop which farmers grow on commercial level for income generation. Major crop grown by the farmers is presented in Table 3. The data revealed the categories of crop grown by the respondents in the study area. Tomato and wheat were grown by 14 (10.9%) of the respondents, 55 (43%) were onion and tomato growers, 24 (18.8%) were tomato, onion and wheat growers, 13 (10.2%) were tomato, onion and peach growers and the remaining 22 (17.2%) of the farmers were growing other vegetables and wheat. Overall, 106 farmers were growing tomato on large scale, 92 of the farmers were growing onion, and 60 were growing wheat as major crop while 13 and 22 grow peaches and other vegetables, respectively.

Table 3 Distribution of Respondents Regarding Major Crop Grown

Districts	Major Crop Grown					Total (%)
	Tomato + wheat (%)	Onion + Tomato (%)	Tomato + Onion + wheat (%)	Tomato + Onion + Peaches (%)	Other Vegetables + Wheat (%)	
Swat	0 (0)	14 (10.9)	0 (0)	13 (10.2)	0 (0)	27 (21.1)
Malakand	7 (5.5)	16 (12.5)	7 (5.5)	0 (0)	0 (0)	30 (23.4)
Lower Dir	4 (3.1)	14 (10.9)	6 (4.7)	0 (0)	0 (0)	24 (18.8)
Upper Dir	0 (0)	2 (1.6)	4 (3.1)	0 (0)	7 (5.5)	13 (10.2)
Buner	0 (0)	9 (7)	6 (4.7)	0 (0)	9 (7.0)	24 (18.8)
Shangla	3 (2.3)	0 (0)	1 (.8)	0 (0)	6 (4.7)	10 (7.8)
Total	14 (10.9)	55 (43)	24 (18.8)	13 (10.2)	22 (17.2)	128 (100)

Source: Field Survey, 2016

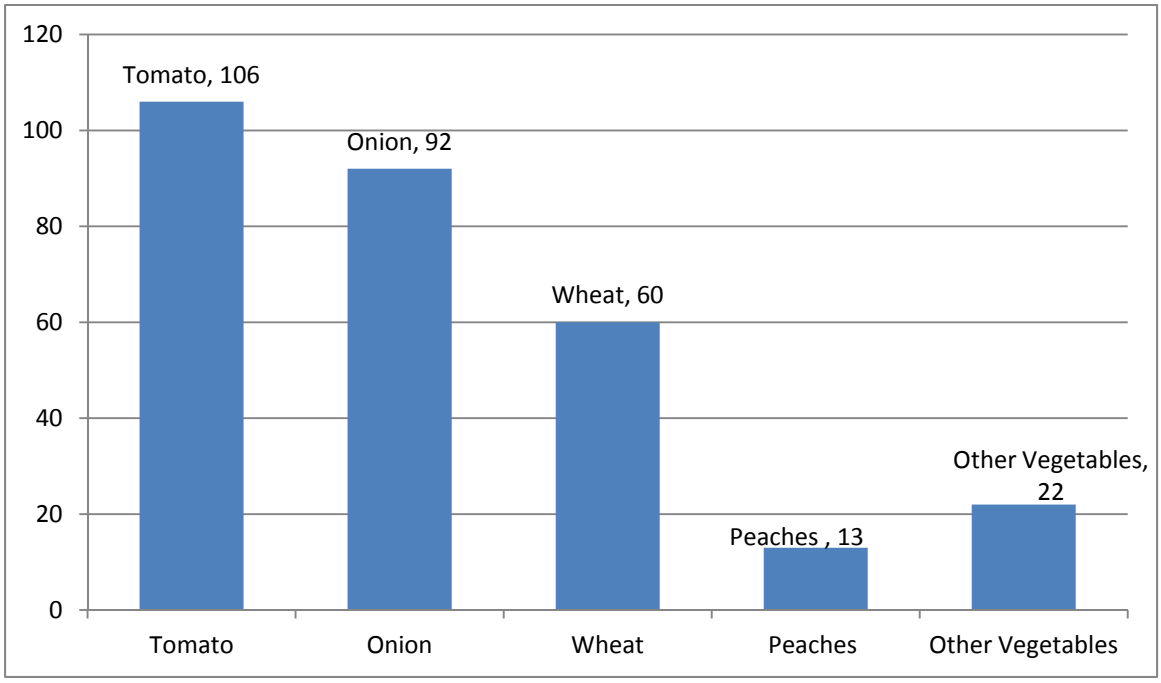

Fig. Grhapical Representation of Major Cash Crops

Yield of Different Crops, Before and After Fermenter Installation

To check the differences in yield of tomato, onion and wheat before and after application of fermenter technology t-test was applied.

Hypothesis for T-Test and its Result

To identify the association between yield of different crops before and after fermenter installation the paired sample t-test is used. The research hypothesis with the respective results are discussed below in Table 4.

Hypothesis - 1

Ho = Fermenter technology has no effects on yield of tomato crop

H1 = Fermenter technology has effects on yield of tomato crop

As revealed in Table 4 a highly significant (P= 0.000) difference in tomato yield before and after fermenter installation was found. As the value is less than 0.05 for 95% confidence level thus the null hypothesis is rejected and established relationship is confirmed between increases in yield of tomato after fermenter installation. A mean difference value of -1668.868 suggests increase in average yield of tomato before and after fermenter installation.

Hypothesis - 2

Ho = Fermenter technology has no effects on yield of onion crop

H1 = Fermenter technology has effects on yield of onion crop

As revealed in Table 4 a highly significant (P= 0.000) difference in onion yield before and after fermenter installation was found. As the value is less than 0.05 for 95% confidence level thus the null hypothesis is rejected and established relationship is confirmed between increases in yield of onion after fermenter installation. A mean difference value of -1293.478 suggests increase in average yield of onion before and after fermenter installation.

Hypothesis - 3

Ho = Fermenter technology has no effects on yield of wheat crop

H1 = Fermenter technology has effects on yield of wheat crop

As revealed in Table 4 a highly significant (P= 0.000) difference in wheat yield before and after fermenter installation was found. As the value is less than 0.05 for 95% confidence level thus the null hypothesis is rejected and established relationship is confirmed between increases in yield of wheat after fermenter

installation. A mean difference value of -98.791 suggests increase in average yield of wheat before and after fermenter installation.

Table 4 Paired Sample t-test Distribution

Crops	Before Fermenter Yield		After Fermenter Yield		Mean Differences	t-value	(P Value)
	Mean	Standard Error	Mean	Standard Error			
Tomato	7221.70	129.842	8890.57	144.709	-1668.868	-30.299	.000
Onion	12869.57	270.026	14163.04	237.203	-1293.478	-30.999	.000
Wheat	1455.85	47.358	1554.64	47.063	-98.791	-9.742	.000

Source: Calculated by Author, 2016

Conclusion and Recommendation

The main objective of the study was to find out the effect of fermenter technology on yield of different crops in the study area. It is concluded that the extension worker played an efficient role in creating awareness about fermenter technology and motivated farmers to adopt it. Hypothesis testing of fermenter effects on yield were accepted that after fermenter installation the yield were increased of various crops. The inoculation of BM/EM with organic manures and inorganic chemical fertilizers increased yield of different crops. Addition of fermented organic manures incorporation with BM/EM through fermenter technology can be used to increase yield of different crops. It is recommended that the extension department should motivate others farmers of the province to adopt fermenter technology to increase the yield of crops and meet the future demands of supply.

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