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Perceptions of Farmers on Compost and Chemical Fertilizers in Soil Fertility Improvement in Hawela Tula in Southern Ethiopia

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ABSTRACT

The present study was conducted to assess farmer's perceptions and attitudes on compost and chemical fertilizers to soil fertility improvement at Hawela Tula in South Ethiopia. Total of 65 farmers/respondents were selected for the study. In the present study, farmer perceptions were identified in the usage of compost and chemical fertilizers. Therefore, farmers have given less attention to compost either for the fertility of the soil or the yield of crops. In contrast, they gave great/more attention towards the usage of chemical fertilizers. Factors decreasing the usage of compost were identified: lack of knowledge, labor force requirement and lack of training. For the most part, the present examination demonstrated that farmerss did not give enough consideration regarding manure as contrasted and substance composts. Principally, they favored composts for the creation of yields and soil fruitfulness. The recommendation was given as creating awareness among farmers about the importance of compost to soil fertility while compared with chemical fertilizers.

Keywords: Chemical fertilizer, Compost fertilize, Farmers perceptions, Soil.

INTRODUCTION

During the green revolution, chemical fertilizer use in the world increased from 27.4 million tons in 1959/60 to 143.6 million tons in 1989/90 [1]. In relation to total world consumption, Asia's share of fertilizer use increased from 14% in 1965-66 to 47% in 1992-93 [2]. In recent years, the amount consumed increased from 3.4 million tons in 1996 to 3.65 million tons in 2003, making Asia the world's largest user of chemical fertilizers [3]. In Ethiopia, agriculture history is not a recent phenomenon in the history of agriculture development. From the total population of the country, 85% are dependent on agriculture. It is also the leading economic policy of the federal democratic republic of Ethiopia government [4]. However, in the agriculture sector, there are a lot of problems, to increase and get good agricultural productivity. In spite of the fact that its ranchers are poor, horticultural sources of info are more often than not outside innovation subordinate particularly synthetic manures like Urea and DAP which are bought with on expanding cost from year to year. In addition to high cost, it has a potential effect or influence on microorganism of the soil and it can deteriorate our natural ecosystem and decrease sustainable agriculture by disturbing soil microorganisms [4]. Farmers use soil amendments such as manure and compost to improve soil fertility and soil quality and to enhance populations of beneficial microorganisms in the soil. Sustainable and organic producers, in particular, rely on manure and compost instead of synthetic chemicals to add fertility of their fields. In this case, farmers used compost made from locally available materials with low cost without disturbing the natural ecosystem for sustainable agriculture [5].

Fertilizer is returned innovation that has recently been advocated as a viable option of improving soil fertility and it is a natural way of recycling, composting biodegrades organic waste, i.e. food waste, manure, leaves, grass trimming, paper, wood, features, and crop residue etc. and turns it in to a valuable organic fertilizer. Composting is a natural

biological process, carried out under controlled aerobic conditions (requires oxygen). In this process, various microorganisms, including bacteria and fungi, break down organic matter into simpler substances. The effectiveness of the composting process depends upon the environmental conditions present within the composting system i.e. oxygen, temperature, moisture, organic matter and the site and activity of microbial populations [6].

Composting is not a mysterious or complicated process, natural recycling (composting) occurs on a continuous basis in the natural environment. Organic matter is metabolized by microorganisms and consumed by invertebrates. The resulting nutrients are returned to the soil to support plant and crop growth and it is relatively simple to manage and can be carried out on a wide range of scales in almost in any geographic location, it is made of locally available material without incurring high cost and without disturbing or affecting our natural and man-made environment compared with that of chemical fertilizers with high cost and low environmental soundness by deteriorating soil microorganisms and facilitate soil erosion by disturbing soil structure. Generally, compost is important for the development of soil structure to enhance porosity, water holding capacity, infiltration capacity, movement of air and water and can sustain agricultural productivity and protect soil fertility [7].

In order to get good agriculture products; it is obligatory to provide plant nutrients as input it's obvious that the main source of plant nutrient is soil, and soil fertility is developed by the addition of organic matters of compost and chemical fertilizers. Because of the increasing cost of chemical fertilizers and different components, the main arrangement is to deliver manure needing numerous impacts. Compost is prepared from the decomposition of plants and animal residues like leaves, weeds, animal dung, bush, and other non-allopathic organic matters, generally, there are two types of compost preparation, above ground and underground compost preparation. Underground compost preparation requires three pits of size, 4 m length, 2 m width and 1.5 m depth in average and its dimension may vary depending on the amount of compost required and availability of raw materials for compost making. By doing this the full time required for scientific compost making is three month by remixing it within 21 days and recycle the process until we get the required amount of composts [8].

The significance of fertilizing the soil developed in open cognizance as of late, as it is eco-accommodating and deal approach to make cultivators prosper with lovely veggies and healthy, flavorful fruits. In short composting is simply the process turning organic matter that is ready for disposal into something beneficial. Basically, organic materials like vegetable matter, coffee grinds, tea bags (anything that is not animal based) is placed in sustainable container or pile to decompose overtime, these materials turn into a rich form of soil that is absolutely chockfull of vitamins and can help you grow amazing plants in any space in addition to this, compost can also have the power to off harmful pests and weeds [9]. By compost application, you can also help to reduce the amount of waste that is being directed into our landfills this means a reduction of concentrated, toxic leachates and methane gas that is being released into the atmosphere, which equates to a decreased in overall pollution. In addition, composting can save money not only for a household but it can also help to balance cities and eventually a countries budget. For instance, essentially by treating the soil a family unit cuts down its financial plan by developing substance free organic products and vegetables while eliminating the need to spend money on chemical fertilizers [10]. Also means a reduction in waste management costs for your city.

Statement of the problem

Chemical fertilizers, i.e. inorganic fertilizers like urea and DAP have many effects on the economy and soil microorganisms which have a natural capacity to fertilize the soil to increase productivity. And also those fertilizers not only nourish plants and microbes but also have harmful effects on the soil and its life, especially when they are very concentrated and water soluble. Acidification, as well as neutralization of the soil, may be very harmful to microbes, which often depend on a sole enzyme there are also several harmful effects of chemical fertilizers, some of the harmful chemical fertilizers may cause include waterway pollution, chemical burn to crop, increase air pollution, acidification of the soil and mineral depletion of the soil. These problems can be solved by compost application which is produced from locally available and cheapest materials or farmers use composted manure and other natural materials as well as crop rotation to improve soil fertility, rather than chemical fertilizers that can result in an abundance of nutrients.

Specific objectives

To identify the level of awareness of farmers on compost application for soil fertility improvement and to identify the farmer's attitude in compost application for soil fertility improvement.

The significance of the study

Even if it is cheapest and it is easy to prepare compost from locally available materials, in Ethiopia farmers of Hawela Tula have lone awareness and practice in compost application for the improvement of their soil fertility.

Their knowledge and perception on compost use is scanty from this, the study will design to fill this gap of knowledge and perception. The study will help to identify the attitude and perception of farmers on compost application for soil fertility improvement which is made from locally available materials and which is not expensive as chemical fertilizers such as Urea and DAP which are costly and have effects on the environment, soil microorganisms which have the capability of fertilizing soil naturally.

MATERIALS AND METHODS

Description of study area

Geographically, Hawela Tula located at Hawassa city of southern Ethiopia. The place found a few km away from Hawassa University and 275 km from the capital city of Ethiopia (Addis Ababa). The study area is situated with 1694 m above the mean sea level, and it has a 27.40°C annual temperature. The annual rainfall is 978.9 mm. The total populations found in the study area are 15972, from this 7653 are males and 8259 are females. Out of these populations, 1274 were farmers. The land that is used for agriculture practice is 300.25 ha. And the type of soil is sandy soil.

Design of the study

This study was conducted to assess the farmer's perception and attitude on compost application for soil fertility improvement in Hawela Tula.

Study population

The sources of the population for this study are farmers of Hawela Tula.

Sample and sampling technique

The sampling frame was the list that contains the total population of the study out of which the sample was going to be selected. The sampling frame of this study was the list of farmers in Hawela Tula.

To determine sample size Daniel formula is taken [11],

$$n = \frac{Nz^2pq}{d^2(N-1) + z^2pq}$$

Where n = sample size, N = total population of the area (farmers), P=population proportion=0.5, q=p+q=1, q=1-p=1-0.5=0.5, d=margin of error=0.1, z=normal distribution=1.96

From this, we can determine sample size "n" from the total population or farmer N,=1274

$$n = \frac{Nz^2pq}{d^2(N-1) + z^2pq} = \frac{1274(1.96)^2 \times 0.5 \times 0.5}{(0.1)^2(1273) + (1.96)^2 \times 0.5 \times 0.5}$$

$$= \frac{1274 \times 3.8416 \times 0.25}{0.01 \times 1273 + 3.8416 \times 0.25}$$

$$= \frac{1223.5496}{13.6904} = 65$$

Methods of data collection

The methodology used for this research was questionnaires which are prepared directly for the farmers. The data were collected from farmer's response directly moving to their house to house.

Data analysis and interpretation method

The data were analyzed by quantitative means, using chart, percentage, and table that information was gained from farmers or respondents.

Ethical consideration

As ethics are very important to practice or get necessary information for data collection, consent was asked from the department of biology. That is a formal letter to the manager of Hawela Tula.

RESULTS

Based on the finding of the study area the following analyzed data are observed.

Even though the sample sizes of the total farmers/respondents are 65, it was very difficult to get information from all of them.

Table 1: Respondents farming type.

Respondents			
No	**Type of farming**	**Frequency**	**Percentage**
1	Crop production farming	25	38.46
2	Irrigation farming	10	15.38
3	Livestock breeding only	0	0
4	Both crop production forming and livestock bleeding	30	46.15

As Table 1 indicated that, most of the farmers about 30 (46.15%) of the total sample were dependent on both crop production and livestock breeding types of farming.

From the general overview of the study area, about 25 (38.46%) and 10 (15.38%) of farmers depended on crop production farming and irrigation farming, respectively. From the total of samples, there were no farmers to practice on livestock breeding only.

Generally, the majority of the Hawela Tula farmers depended on both crop production and livestock breeding.

Table 2: Respondents response on what type of fertilizer they use for soil fertility improvement for crop production farming in most.

Respondent			
No	**Type of fertilizer used by the farmer**	**Frequency**	**Percentage**
1	In organic chemical fertilizer	35	53.84
2	Compost	10	15.38
3	Both compost and inorganic chemical fertilizer	20	30.75

As observed from Table 2, the majority of the Hawela Tula farmers used chemical fertilizers for the fertility of the soil. Around 35 (53.84%) of them used inorganic chemical fertilizers such as urea and DAP and 20 (30.75%) of the farmers used both inorganic chemical fertilizers and compost as fertilizing agents, from these only a few numbers, 10 (15.35%) of them depend on compost for soil fertility improvement.

As Figure 1 showed that most of the farmers of the Hawela Tula have weak perception on compost usage as fertilizer for the increment of soil fertility in order to get good harvest, around 28 (43.07%) farmers have weak perception on compost usage, and 8 (12.30%) farmers have very weak perception on compost usage, and a few farmers 11 (16.92%) have very strong perception on compost usage for soil fertility improvement.

As shown from Table 3, most of the farmers of Hawela Tula around 38 (58.46%) replied that compost preparation requires labor force. They also said that it requires digging pits in which locally available materials such as leaf of tree, cow dugs, waste from hens should be collected and long lasted until it is used as fertilizers and 17 (26.15%) farmers replied that compost preparation take much time, 6 (9.23%) farmers replied that lack of knowledge how to prepare compost. A few farmers replied that lack of motivation from concerned bodies such as developmental Agents (DA) to prepare and use compost.

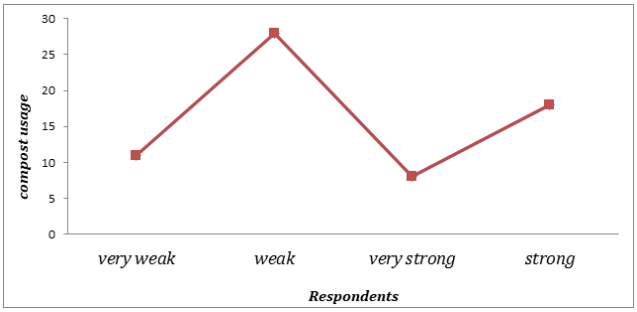

Figure 1: Result of respondents reply about their perception of compost usage for soil fertility improvement in order to get high yield.

Table 3: Respondents reply on the factors that hinder them not to use compost for soil fertility improvement.

Respondents			
No.	**Factors**	**Frequency**	**Percentage**
1	It requires labor force to prepare compost	38	58.46
2	It takes time to prepare compost	17	26.15
3	Lack of knowledge of how to prepare compost	6	9.23
4	Lack of motivation from the concerned body such as developmental agents (DA)	4	6.15

Figure 2 below showed farmers' perceptions of inorganic fertilizers. The respondent's feedback for questionnaires were collected and estimated as a percentage by using comparison phrases like weak, very weak, strong and very strong. Majority of respondents/farmers had good perceptions for the usage of inorganic fertilizers while compared with organic fertilizers and a few of the farmers had negative perceptions to inorganic fertilizers, in contrast, they had positive perceptions to organic fertilizers (compost). Some of the farmers also had good perceptions of inorganic fertilizers.

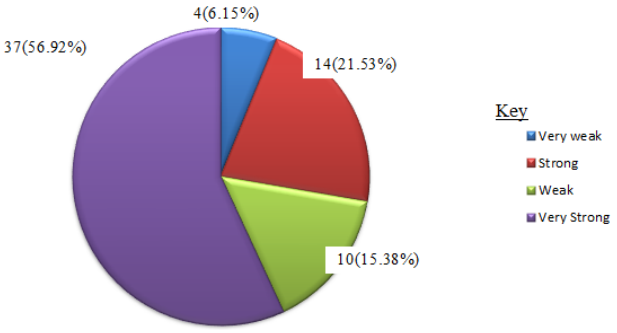

Figure 2: Respondent's reply about their perception of inorganic chemical fertilizer usage for their soil fertility improvement.

Majority of the farmers around 37 (56.92%) replied that they perceive in using inorganic chemical fertilizers very strongly and around 14 (21.53%) have a strong perception on using inorganic chemical fertilizer, and farmers around 10 (15.38%) have a weak perception on using inorganic chemical fertilizer, from those there are fewer about 4 (6.15%) have a very weak perception on using chemical fertilizers for this they do have their own response like, the cost of chemical fertilizer is high i.e. the input and output is not balanced and if it doesn't rain seasonally, inorganic chemical fertilizer is going to burn the crops.

Table 4: Respondents response to the level of the yield of crops per year by using compost and inorganic chemical fertilizer, as a comparison.

Respondent			
	Level of the yield of the crop	**Frequency**	**Percentage**
Type of fertilizer compost	Very high	26	40
	High	30	46.15
	Medium	7	10.76
	Low	2	3.07
Inorganic chemical fertilizer	Very high	34	52.30
	High	18	27.69
	Medium	9	13.84
	Low	4	6.15

As shown in the Table 4, very few farmers 2 (3.07%) of Hawela Tula replied that the level of yield of crops per year by using compost as fertilizer is low, and most of the farmers 30 (46.15%) replied that their level of yield of crops per year by using compost is high. From those 26 (40%) replied that their level of the yield of crops per year is very high and around 7 (10.76%) of crop yield is medium.

As compared to that of inorganic chemical fertilizer with the usage of compost most of the farmers around 34 (52.30%) replied that their level of yield of crops per year by inorganic chemical fertilizer is very high, 18 (27.69%) indicated a high yield, 9 (13.84%) said a medium yield was obtained and the others few in numbers 4 (6.15%) replied that the level of yield of crops per year by using inorganic chemical fertilizers is low.

DISCUSSION

As indicated in Table 1 there were farm types recognized in the study area. According to questioners 65 respondents were classified as per their undertaking farm types, such as crop production farming, irrigation farming, both crop production farming and livestock breeding. In the present study, majority of respondents/farmers had carried out both crop production farming and livestock breeding 30 (46.15%). From Total of populations sample about 25 (38.46%) respondents/farmers were only practicing crop production farming and there were no farmers practicing livestock breeding. Additionally, minority of respondents/farmers had practiced Irrigation farming.

Table 2 showed that the usage of fertilizers for the production of crops and from the sample populations, majority of farmers/respondents 35 (53.84%) had adopted practices on the usage of inorganic chemical fertilizer for crop production. Minority of respondents/farmers 10 (15.38%) had been practicing on compost application for soil fertility. Moreover, there were 20 (30.78%) farmers who used both compost and inorganic chemical fertilizer for production of crops. Therefore, the present study revealed that compost was not much preferred by majority of farmers, more of them were attracted by chemical fertilizers for their farming types.

Figure 1 showed that the perceptions of farmers on ability of compost in the fertility of soil and therefore majority of farmers respond that compost was weak to the fertility of soil while compared with chemical fertilizers. For instance, farmers revealed their perceptions on ability of compost in soil fertility as weak 28 (43.07%), very weak 8 (12.30%), strong 18 (27.6%) and very strong 11 (16.92%) for the capability of compost to the fertility of soil. The study indicated that compost fertilizer was not broadly accepted by farmers. On the other hand, farmers had great perceptions on chemical fertilizers as compared with compost.

As showed in Table 3, farmers have given variables which add to impacts that they didn't utilize manure as a compost, for example, labor force to prepare compost was the major factor mentioned by respondents 38 (58.46%) and secondly, time taken to prepare compost 17 (26.15%), additional less factors were mentioned by farmers/ respondents such as Lack of knowledge how to prepare compost 6 (9.23%) and lack of motivation/training 4 (6.15%).

The present examination distinguished the farmer discernments in yield of harvests according to manure types. Therefore, chemical fertilizers the most preferable one to the yield of crops while compared with compost fertilizers.

Previous studies revealed that fertilizers are in the forms of inorganic and organic. Inorganic (chemical) fertilizers are very expensive and beyond the reach of resource-poor farmers and not readily available when needed by the

resource-poor farmers according to Emuh F.N. [12], which is agreement with current study. In addition to this, another research done by Bello W.B. [13] was proven to have negative consequences on the environment and health aspect. Human survival demands that environmental considerations should underpin all aspects of development whether physical or social aspects.

In the present study, farmers perceptions on organic fertilizers (compost) was not totally ignored. This is because of usage of either inorganic or organic fertilizers varied in estimated percentage. For example, from the total of 65 respondents, 35%, 20%, 10% used inorganic fertilizer, mixed of compost with inorganic fertilizer and compost, respectively. Compost is one of the less concentrated organic manures, but it is extremely valuable in adding extra body to soils especially the sandy ones. Compost can also help to lighten heavy clay soils.

The present study has agreement with previously reported by Emuh F.N. [12]. The negative perceptions of farmers imply that a unit increase in age and distance of the farm from homestead of the farmers decreases the probability to the use of organic manure. The more the farmers develop arable harvests near their homes the more they utilize natural excrement and furthermore in view of mind-boggling expense of transporting of natural compost to the homesteads. Additionally, this study agreed with the finding reported by Nabifo P.P. [14]. As indicated by Farmers' view of an innovation was a key determinant in the choice to utilize. On the off chance that ranchers' discernments are that the innovation isn't gainful, there will be low interest in the innovation. In the assessment of farmer perceptions in organic manure, so many factors should be considered and examined. These factors include: farmers' characteristics such as education, experience, age, household size; farm structure such as farm size, distance of farm from homestead; and institutional factors such as contact with extension agents and access to credit facilities [15]. Another finding [16] also revealed that training provides more knowledge and will presumably change the perception of the farmers towards new technologies and the awareness of positive effects of compost utilization. Although the intensive use of chemical fertilizers has brought about a dramatic increase in crop production it has somehow resulted in a negative impact on the chemical, physical and biological properties of the soils which has led to a gradual decline in crop productivity [17].

CONCLUSION

From the finding of this study, results of the following conclusions were included. At most majority of the Hawela Tula farmers were depend on both crop production farming and livestock breeding type of farming next to crop production farming only. Very small numbers of farmers were depending on irrigation farming, which includes the production of vegetable, such as onions, cabbage, carrots and tomato. There were no farmers who were depending on livestock breeding type of farming. The study revealed that farmers perception on compost application for soil fertility improvement in Hawela Tula was very good because, most of the total respondents stated that compost is advantageous over chemical fertilizers, because it has multiple advantages, i.e. low cost and easy to prepare from locally available materials such as cow dung, leave from tree and waste from hens. However, almost all of them were not well skilled, they stated the reason why they were not using compost on large scale was lack of knowledge how to prepare compost, it require labor force, and takes time to prepare compost. Moreover, lack of motivation from organization such as developmental agents (DA) on how to prepare the exact compost. Most of the farmers of Hawela Tula use only inorganic chemical fertilizer for the improvement of their soil fertility, and only a few numbers of farmers use only compost for soil fertility.

Generally, farmers have used chemical fertilizers than compost as fertilizers for the improvement of their soil fertility. Most of the respondent of Hawela Tula perceived very strongly on in organic chemical fertilizer. In some extent, the farmers used both compost and inorganic chemical fertilizer to improve soil fertility. Finally, we conclude that if training is provided to the farmers, it would solve the problems that hinder them to use of compost for soil fertility improvement.

RECOMMENDATION

Based on the finding of the study which was conducted at Hawela Tula regarding to assessment of farmers' perception on compost application for soil fertility improvement, the following recommendations were forwarded.

Farmers of the study area should be well trained on the method of preparation of compost and its application. Farmers should be educated about inorganic chemical fertilizers disadvantage in spite of its advantage, since it decreases the number of microorganisms in the soil which have the capability of increasing soil fertility naturally. Governmental and non-governmental organizations, environmentalists, food and nutritional organizations, agricultural sectors and other related stake holders and donors should provide their effort to educate, and aware

farmers and through education and training. Attention should be given to motivate and support individual and groups of farmers to prepare compost and apply it to improve the soil fertility without incurring high cost through their own effort.

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