Original Research Article

Use Levels of Organic Fertilizers in Subsistence Food Production in Vihiga County, Kenya

ABSTRACT

In the face of skyrocketing prices of inorganic fertilizers, organic materials are considered the alternative sources of fertilizers. Most Farmers in Vihiga County have adopted use of organic manures. Research institutions have over the years succeeded in demonstrating high yield responses to use of recommended levels of organic fertilizers. Despite this, crop yields remain low in farmers' fields due to low soil fertility and inability of farmers to use optimal levels of organic fertilizers. Researchers often use optimal levels of organic materials recording high yields in experimental and farm demonstration fields. Little or no research has been done to determine why farmers still record low yields despite a lot of extension outreaches to promote available organic matter technology packages in the study area. This paper reports findings of a study carried out to determine factors affecting use levels by farmers of farmyard manure in Vihiga County, Kenya. The objective of the study was to compare farmyard manure use levels in farmers' field with optimal (recommended) levels to determine if the level of use were significantly different. This was aimed at providing advice based on empirical evidence to farmers on whether there is need to improve use levels of farmyard manure and to determine if low intensity of farmyard manure was a possible cause of recorded low yields in farmers' fields. Purposive sampling was used to select farmers who were using farmyard manure for soil fertility. A total of 120 farmers were selected to provide data needed for the study. Primary data was collected using questionnaires and data was analyzed using descriptive statistic (t-test). The results of the analysis indicated a significant difference in use level between what farmers applied and what was recommended by research. Use levels of farmyard manure among the sampled farmers were much lower than the recommended levels explaining the low maize yields among farmers in the study area. The study rejected the hypothesis that the farmers' use levels of farmyard manure was not statistically significant different from that recommended by research institutions. This is because average use levels of manure of 320.4 kg/ha was significantly below those recommended by researcher of 5ton/ha (at 99% level. Farmers must follow appropriate promoted technology use recommendations. The study recommended promotion of organic manure. Farmers should be sensitized on the need bridge the gap between the current use level and the recommended levels for them to realize the benefits of organic fertilizer.

Keywords: Use Levels, Organic Fertilizers, Subsistence Food Production, Kenya

1. INTRODUCTION

Declining soil fertility is the fundermental biophysical root cause for the declining percapita food production in Kenya (Jayne Mugwe, Daniel Mugendi, James Kungu, Monica Mucheru-Muna and Andre Bationo, 2012) Organic fertilizers, if used in the right amounts can be as effective as chemical fertilizers**.** They are required in large amounts (5 tons/ha) to meet plant nutrient requirements (Palm, 1995).

Farmyard manure is often applied by broadcasting and hoeing or raking it into the top soil. Chemical fertilizers contain soluble mineral salts that plant roots can absorb quickly explaining why they are needed in small amounts (50 kg/ha). High chemical fertilizer prices however have resulted in many farmers not adopting recommendations for major soil types and individual crops in Kenya's representative soils in Kenya (GoK, 1996; Jen-Hshuan Chen, 2006).

Small scale farmers in Kenya often apply suboptimal levels of inorganic fertilizers making it hard for farmers to achieve potential yields of hybrid crop varieties (Woomer *et al*., 1997 & Muturi, 1989). Muturi (1989) noted chemical fertilizer use as low as 5% of recommended levels. Maritim (1991) proposed that other forms of solving food insecurity problems other than exclusive use of chemical fertilizers be put in place. According to Sanchez (1995) fertilizers are a recurring cost of production that must be paid for by increased crop yields. Lampkin (1990) noted that non-conventional fertilizer use in soil fertility management ought to be promoted since it is environmentally friendly and more cost effective than conventional fertilizers. Reijntejees *et al*. (1992) advocated exclusive use of organic inputs for soil fertility as a logical alternative to expensive fertilizers in Africa. Organic matter rich in carbon and poor in N enriches soil in humus and are applied in substantial amounts of up to 5.5 tons/ha (Reijntejees *et al.,* 1992).

Feeding over 6 billion people-and over 9 billion by 2050-will require a wide range of creative, sustainable agricultural systems which not only provide food, but also but also factor in the economic value of nature-based services such as organic fertilizer that underpin agriculture (UN-UNEP, 2008). Animal manure and plant materials are bulky and are needed in large amounts because of their low nutrient content, difficulties in preparation, lack of constant supply due to low livestock numbers and high labor demands for collection, storage, transportation and application in fields (Probert *et al.,* 1993, Brandt, K and Kidmose, U. 2018). They contain from 1- 4% N (10-40g N/kg) on a dry weight basis, while inorganic fertilizers contain from 20-46% N (200-460 g N/kg) (Palm, 1995). To haul 100 kg N needed for a 4 ton/ha maize crop, it would take 0.217 tons of urea or 20 tons of leaf biomass (Aderinoye-Abdulwahab, S.A and Salami, S.T, 2017; Palm *et al*., 1996). Organic inputs are low suppliers of P due to their low P concentration (Palm, 1995; Palm *et al*., 1997b). Technically feasible yields have been obtained under research conditions. However, crop yields are still low in farmers' fields. The purpose of this study was to compare use levels of farmyard manure with the recommended levels. The study postulated that use levels of farmyard manure were not significantly different from recommended levels.

2. METHODOLOGY

The study was carried out in Emuhaya, Sabatia and Luanda divisions of Vihiga County. The County's warm and humid climate supports growing of most crops. However, the soils are of low fertility, limited water-holding capacity and are prone to erosion due to their sandy texture, high land use intensity and heavy rainstorms. The low agricultural productivity in Vihiga County has resulted in food insecurity. Crop yields have continued to decline despite the existence of already developed technologies that farmers could use to improve soil fertility.

The population was divided into three sampling units represented by the three selected divisions, selected based on agro-ecological zonation. Purposive sampling was used to select respondents according to recommendations by Kothari, C.R. and Gaurav Garg (2014). Farmer's willingness to participate in the study determined whether the purposively selected farmers provided data or not. Data was collected from at least two farms from each sub-location in which a total of 80 respondents were interviewed. A household was the enumeration unit and was defined as a decision-making unit at farm level.

The target population sampled was the set of resource poor farmers who used farmyard manure in subsistence maize and bean production in the study area. This study recognized the role maize and bean production play in meeting food needs of residents in Vihiga County.

Ten trained agriculture staff/field extension workers familiar with the local language and customs served as enumerators, orally administering questionnaires during data collection exercise. Questionnaires were

pre-tested with a random sample of 8 farmers in Tiriki Division of Vihiga County. Information concerning households was provided by heads of selected household.

Primary data on use level of farmyard manure in sampled farms was obtained from selected farmers. Information on the recommended levels of farmyard manure that was needed for optimal crop yields was obtained from research publications in libraries of institutions such as KARI, ICRAF, KEFRI, UNEP, Moi University and NGOs such as ABLH.

Farmers' use level was postulated not to be statistically different from recommended use levels. Data collected was subjected to t-test to compare the difference between mean of use levels and that recommended by researchers.

3. RESULTS AND DISCUSSION

This chapter provides the analysis of use levels of farmyard manure on maize and bean intercrop production in the study area. The results of the analysis showed that a majority (76%) of the farmers interviewed in the study used farmyard manure for soil fertility improvement. When a random sample of farmers who had adopted use of farmyard manure for soil fertility in the study area was taken, it was shown that majority of them used sub optimal levels (less than 5 tons/ha) of the manure resulting in low crop yields. This could have been due to Offensive oduor and transportation problems as demonstrated by Aderinoye-Abdulwahab and Salami (2017). Applications of manure-based commercial organic fertilizers (COFs) which have been harmlessly disposed still resulted in general increases intercrop production. Table 1 shows summary statistics of results of the survey of farmyard manure use levels among farmers.

Table 1: Use Level Statistics of Farmyard in Farmers' Fields and Experimental Levels

Category of Farms	Mean	Standard error	Sample Variance	Standard Deviation	Kurtosis	Skewness
Farmers' Fields (kg/ha)	320.3	21.48	32303.9	179.73	1.466	1.085
Recommended Use Levels (kg/ha)	5000	130.33	1189050	1090.44	-0.144	-0.780

Source: Data Analysis in this Study (2016)

From the study, the average level of farmyard used by farmers was 0.32 tons/ha while recommended level was 5tons/ha. The high variances of means revealed the big gap between actual level of use of farmyard and that recommended by research for optimal crop yields. The actual distribution of level of use of farmyard among the farmers interviewed has positive skewness and is leptokurtic. This means that a majority of the sampled farmers used suboptimal levels of farmyard manure.

Table 2 shows the results of the t-test done to test the hypothesis that difference between the use levels of farmyard manure in farmers' fields and that recommended by research did not differ significantly from zero. The postulated hypothesis means that farmyard manure use levels by farmers did not differ significantly from that recommended by research institutions for optimal plant growth in the study area. As can be seen from table below the hypothesis was rejected.

Table 2: t-test Analysis of Recommended and Farmers' Use Levels of Farmyard Manure

Population Sample/ Statistic	Farmers' Use Levels of Farmyard Manure	Recommended Level of Farmyard Manure
Mean kg/ ha	320.28	5000.26

Known Variance	32303.95	1189050
7Hypothesized Mean Difference	0	
t-Statistics	-35.43	
P(T<=t) one tail	4.91E-48	
T Critical one-tail	1.666	

Source: Data Analysis in this Study (2016)

A test of difference of means showed that level of use of farmyard manure was significantly below 5 tons/ha recommended by research (KARI, 2009; Jayne *et al,* 2012; John Beeby, Steve Moore, Laura Taylor and Samuel Nderiti. 2020) at 99.9% confidence level (p<+4.91E-48). The conclusion is thus that farmers interviewed used levels of farmyard that were far below rates recommended by research as needed to get optimal crop yields. It was observed that farmers failed to gather enough manure, which affected amount used on crops. Offensive oduor and transportation problems were among the prominent limitations as suggested by Aderinoye-Abdulwahab, S.A and Salami, S.T (2017) and Mughivisha, Olowoyo and Mzimba (2017) This translated into poor crop yields in farmers' fields, explaining why there were low yields among farmers who were using farmyard manure. From study findings it was concluded that adoption of a technology should not in itself be used as a measure of success in helping farmers out of food insecurity**.**

4. CONCLUSION

The study rejected the hypothesis that the farmers' use levels of farmyard manure was not statistically significant different from that recommended by research institutions. This is because average use levels of manure of 320.4 kg/ha was significantly below those recommended by researcher of 5ton/ha (at 99% level.

Farmers must follow appropriate promoted technology use recommendations. From the findings it is recommended that extension agents should shift focus from promoting use of improved technologies to ensuring that the technologies are adopted in recommended levels or are used as recommended by research.

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