



## **Determinants for Application of Organic Manure in Maize Production in Kalambo District, Tanzania**

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### **Abstract**

*The study on determinants for application of organic manure in maize production was conducted at Kale village Rukwa region. The objectives of the study were to identify the factors for application of organic manure in maize production in the study area, determine the level of community awareness on the importance of applying organic manure in maize production and examine economic factors influencing application of organic manure. A sample of 75 respondents was used. Multiple linear regression analysis models were used to test the linear relationship of independent variables. Application of organic manure as a dependent variable was tested if it had relationship with traditional experiences on organic manure, community norms on application of organic manure, beliefs towards application of organic manure, and grazing practices. Descriptive statistics were also used for analysis. Results for t- test indicated that low application of organic manure was associated with traditional experiences on organic manure ( $t = 9.18, P < 0.001$ ), norms of the community on application of organic manure ( $t = 9.97, P < 0.01$ ), beliefs towards application of organic manure ( $t = 7.25, P < 0.05$ ) and grazing practices ( $t = 4.27, P < 0.05$ )*

**Keywords:** Farming practices, beliefs, socio-economic factors



## **1.0 Introduction**

Tanzania economy depends on agriculture, about 85% of the population of Tanzania lives in rural areas and their main economic activities are agriculture production (URT, 2003). The sector account for about half of GDP and exports, and its importance is amplified through backward and forward linkage effects. Sale of agriculture products accounts for 70 % of rural household incomes (URT, 2003). Statistics showed that Tanzania has had over 15 million smallholder farmers in the country by 2010 (Nyomora *et al.*, 2012). Most farmers in areas of high livestock number rarely use animal for crop production due to a variety of reasons including migration in search of good grazing land (Mgani, 2005). The animal manure has traditionally been used as a source of nutrients for both perennial and annual crop (Kashuliza, 1998). In some parts of southern highlands of Tanzania, mixed farming is commonly practiced. But the productivity of the soil declined due to continuous use of chemical fertilizer.

Maize is among the crop which is cultivated in different parts of Tanzania including Rukwa region. The cultivation of maize in Rukwa is accompanied with excessive application of chemical fertilizers (URT, 2008). However, the application of chemical fertilizer for maize production has caused the decrease in land productivity within the region, thus the land requires external support for crop growing (URT, 2008). Kalambo is among of the southern highland districts in Rukwa region considered as an active maize producer in the national maize program thus made the district a member of big maize producers (URT, 2008). The use of organic manure to increase land productivity for crop production is newly practical technology in some parts of the district.

The Tanzania government has put different efforts of improving agriculture through application of organic manure. Those efforts include: The recognition of organic agriculture in the national policy which has created an enabling environment for stakeholders to continue with organic production in the country (Alastair, 2006). Also the establishment of the Tanzania Organic Agriculture Movement (TOAM) in June 2005. The use of organic agriculture in Tanzania's rural areas is highly determined by availability of livestock producing manure for farm application. The total number of cattle in Ulumi ward is about 497 which generate 453.5 tons of organic manure per year (URT, 2014). While in Kale village where the study was conducted there were large number of cattle about 209 which generate a total of 190.7 tons of organic manure per year (URT, 2014).

In spite of government efforts and the community having large number of cattle and organic manure the application of organic manure in Kale village is still low. The use of organic manure for maize production in Kale village is ranking below 13% (URT 2008). Farmers prefer the use of chemical fertilizer which contributes to land pollution due to addition of acid on soil (Makokha, 2001). Statistics show that the population engaging in



maize production in the village was 268 households, among them only 12% were fully apply organic manure in maize production, 50 % apply chemical fertilizer while the remaining 38% do not apply any type of manure . The study, therefore, intended to find out determinants for application of organic manure in maize production in Kale village Kalambo district, to determine the level of community awareness on the importance of applying organic manure in maize production in the study area, to examine economic factors influencing application of organic manure in the study area.

## 2.0 Methodology

The study was conducted at Kale village Kalambo district. The area is mostly occupied by smallholder's farmers who are engaging in maize production and livestock keeping. The study was non experimental which used cross sectional design. A sample of 75 respondents was involved in the study.

The study used both primary and secondary data. Primary data were collected from relevant sources which included maize producers and extension officers, while secondary data were collected from various relevant documents from library, electronic sources and from different reports obtained from WEO's and VEO's offices. Observation and interview methods of data collection were employed which used questionnaires and checklist.

Multiple linear regression analysis models were used to test the linear relationship of four independent variables. Where application of organic manure in the study area (APPOM) as a dependent variable, was established to test if it had relationship with traditional experiences on organic manure (TRADEXP), norms of the community on application of organic manure (NORMCOM), beliefs towards application of organic manure (BELAPPORG), and grazing practices (GRAZING) as independent variables.

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_p X_{pi} + \varepsilon_i$$

Whereby;

$Y_i$  = A dependent variable

$X_{1i} \dots X_{pi}$  = Independent variables

$\alpha$  = a regression constant

$\beta_1 \dots \beta_p$  = regression coefficients

$\varepsilon_i$  = Error term

$$APPOM_i = \alpha + \beta_1 TRADEX1_i + \beta_2 NORMCOM2_i + \beta_3 BELAPPOM3_i + \beta_4 GRAZING4_i + \varepsilon_i$$

APPOM1 = Application of organic manure

TRADEXP = Traditional experiences on organic manure



NORMCOM = Norms of the community on application of organic manure

BELAPPORG =Beliefs towards application of organic manure

GRAZING= Grazing practices

$\alpha$  = Regression constant

$\beta_1 \dots \beta_4$  = Regression coefficients

### **3.0 Results and Discussions**

#### **3.1 Community awareness on application of organic manure in maize production**

The study aimed to determine the level of community awareness on application of organic manure in maize production. Four variables were assessed: number of people with knowledge on application of organic manure, number of people with skills on applying organic manure, and number of people applying organic manure and attitudes of the community toward organic manure.

##### **Knowledge on application of organic manure in maize production**

Knowledge on the importance of applying organic manure in maize production was an important indicator for a respondent's decision making on the use of organic manure. In determining the number of people with knowledge on application of organic manure. The study revealed that 97.3% of respondents had knowledge on application of organic manure, most of these farmers acquired such knowledge through seminar, village meeting, and field farm education or through their own experience on organic manure application in maize production.

Data on the knowledge of respondents toward organic manure revealed majority of community members were aware with the benefits of using organic manure in maize production for improving productivity and welfare of their families. This implies that there was great opportunity for community to apply organic manure in maize production in the study area. Therefore, community members were willing to apply organic manure in maize production in study area since they had knowledge about organic manure. In analysing sources of knowledge a farmer accessed, it was found that among people with knowledge, 85.3% of respondents had acquired knowledge through experience, while 8% of respondents acquired from fellow farmers, and 4.0% from extension officer. This shows that experience in farming guaranteed awareness of community toward application of organic manure in maize production in the study area, since majority 85% of respondents had acquired knowledge through experience from fellow farmers.



### **Skills on applying organic manure**

Application of organic manure requires diverse skills on the methods of organic manure utilisation. The study results revealed that 86% of respondents have skills in organic manure application in maize production whereby 13.3% of respondents have no skills on application of organic manure in maize production in the study area. Data imply to large extent the study area had community with skills of application of organic manure in maize productions.

Although according to Ward Executive Officer there was increasing number of maize growers in the ward using organic manure from 70 households in 2005 to 200 households in 2013. As the result of education brought to the community by the Village extension officers. However, the application of organic manure in Kale village was still low, only 16% of respondents apply organic manure, 45% of the respondents do not apply organic manure at all, 35% of the respondents apply chemical fertilizer, 16% apply neither organic manure nor chemical fertilizer and 33% applies both. On time horizon for applying organic manure in maize production, there was variation between farmers, some organic manure applicants applied during planting; others applied after planting and others before planting. At all these season the skills for each season was required to ensure the effectiveness of the manure to the soil for reliable yields. The implication was that a significant number of farmers possess skills on organic manure application in maize production which could improve the status of organic manure application in maize. The study also identified the dominant methods used in organic manure application were banding, 41% of respondents use broadcasting, 8% of the respondents use banding method, 3% of the respondents use ringing method and another 3% of respondents use incorporation method. Methods determine the skills to be applied in the process of organic manure application, since each method must be applied with respective skills. This provided an implication that farmers in the study area had skills of applying organic manure in maize production.

### **3.2 Social factors affecting application of organic manure in the study area**

In determining social factors influencing the application of organic manure. The study used four variables: traditional experiences on organic manure, the norms of the community on application of organic manure, beliefs towards application of organic manure, and grazing practices. Multiple linear regression analysis models were used to determine relationship between social factors and application of organic manure to determine whether they influence its application. Application of organic manure as dependent variable, established to find out whether it was influenced by traditional experiences on organic manure, norms of the community on application of organic manure, beliefs towards application of organic manure and grazing practices as independent variables. In analysing the effect of specific



independent variables it was possible to control the effect of other variables through multiple linear regression analysis.

**Table 1: Multiple linear regression analysis for social factors influencing application of organic manure in maize production in study area**

| Independent Variables | B       | Std error | t-value | sign |
|-----------------------|---------|-----------|---------|------|
| (Constant)            | -13.138 | 1.244     | -10.558 | .000 |
| TRADEXP               | 2.907   | .317      | 9.181   | .000 |
| NORMCOM               | 3.157   | .317      | 9.970   | .000 |
| BELAPPORG             | 1.907   | .263      | 7.253   | .000 |
| GRAZING               | 1.050   | .246      | 4.278   | .000 |

$R^2 = 0.75$ ;  $p < 0.001$

The finding indicated that traditional experiences on organic manure, norms of the community on application of organic manure, beliefs towards application of organic manure and grazing practices were good predictors of application of organic manure. About 75% of application of organic manure was due to variations in independent variables which indicates that independent variables collectively had a significant influence on application of organic manure. Results for t- test indicate that traditional experiences on organic manure ( $t = 9.18$ ,  $p < 0.001$ ), norms of the community on application of organic manure ( $t = 9.97$ ,  $p < 0.01$ ), beliefs towards application of organic manure ( $t = 7.25$ ,  $p < 0.05$ ) and grazing practices ( $t = 4.27$ ,  $p < 0.05$ ) had a significant relationship with application of organic manure. Data implies that norms of the community towards application of organic manure lead to low application of organic manure compared to other social factors (traditional experiences on organic manure, beliefs towards application of organic manure and grazing practices).

### 3.3 The influence of costs on application of organic manure

Application of organic manure is associated with various costs so that they can be of value to soil and, therefore, ensure high yields. In the study area findings revealed that there were costs involved in organic manure application. Costs that were identified were: manure purchasing costs, transport cost, and storage costs. These findings were similar to observations made by Brown (2013) who found that "Handling of organic manure is a cost associated with the livestock portion of the farm connected with it, including equipment purchase and maintenance, the opportunity cost of the time it takes to apply manure to fields, and the liability if something goes wrong and there is a spill, if land base is limited



and additional land must be rented, or in situations where manure agreements must be established”.

**(a) The purchasing costs**

The study revealed that majority of people in Kale village 68 (90.7%) of respondents are non-purchasers of organic manure, instead they depend from their own domestic livestock especially cattle. Further, 5.3% of respondents purchases between 25,000 - 39,000 Tsh. per ton, while 2 (2.7%) of respondents buy at a price of between 40,000-54,000 Tsh. per ton and only 1 (1.3%) of respondents buy at a price between 10,000- 24,000 Tsh. per ton. The study reveals that the price of organic manure is relatively cheap in the study area compared with non-organic fertilizers, whereby the price for one bag (50kg) of chemical fertilizer ranged from 50,000Tsh (with government subsidies) to 100,000Tsh without subsidies.

**Table 3: Responses on costs for getting organic manure**

| Amount in Tsh. Per ton | Frequency | Percent |
|------------------------|-----------|---------|
| 10,000-24,000          | 1         | 1.3     |
| 25,000-39,000          | 4         | 5.3     |
| 40,000-54,000          | 2         | 2.7     |
| Non Purchasers         | 68        | 9.7     |
| Total                  | 75        | 100     |

This implies that the organic manure is available at cheap price of Tsh. 25000 to 39000 per ton compared to chemical fertilizers. This situation could encourage the application of organic manure in the study area.

**(b) Transport costs of organic manure from source to farm plots**

The process of applying organic manure is accomplished after reaching at farm area. Transport cost is associated with all costs of removing organic manure from the source or storage areas to farm area. The findings revealed that cost for transporting organic manure hinders the effective utilization of organic manure in Kale village as 84% of respondents were discouraged by transport costs. Transportation of one tonne (1000kg) of organic manure from the storage place to the farm land ranged between Tsh. 40,000/= to Tsh. 60,000/=. Despite the use of draught power in the study area, transport of manure to the field was identified as a major problem affecting manure utilization. This was due to high demand of draught animals for cultivation that coincides with season of manure application.



Farmers use a lot of time to transport organic manure manually where they take small amount of organic manure per trip. This situation resulted to low application of organic manure in maize production. The study also found that most farmers (75%) do not own transport facilities this made them fail to transfer own organic manure to farms. The dominant identified transport facilities used by farmers were wheel barrow, head and bicycles. This situation caused most farmers in the study area fail to apply organic manure in maize production hence low application of organic manure. These findings are consistent with those of Defoer (1998) who reported that factors such as the distance of the crop fields from homestead, available means of transport and labour, influenced the extent of manure utilization.

**(c) Storage costs**

The construction of store is another great factor which limit effective utilization of organic manure. Storage room which can be used to accommodate 1000kg of organic manure costs between Tsh. 50,000 and 100,000 for its construction. The results have further revealed that only 30.7% of respondents had constructed organic manure stores mainly being due to high costs. .



**Plate 1: Wheel barrows as one of transport facilities for organic manure in Kale village**





**(d) Storage Facilities**

Storage facilities of sufficient capacity are needed to cover the closed periods and to provide the farmer with flexibility to continue storing manure outside the closed periods when conditions may be unsuitable for field applications especially waterlogged soil. The study results have shown that the organic manure storage facilities used in Kale village are folds, digging holes, houses, and farm itself. The respondents result on storage facility shows that 54.7% of respondents do not use any kind of facility as storage of organic manure, 40% use folds to store manure before transporting it to farm area and 5.3% of respondents dig holes and fill the manure waiting to be transported during the required season. Organic manure can be stored in a vessel, on an impermeable base with appropriate collection and containment of run-off, in a roofed building or in an appropriately located temporary field heap (Crown, 2009). However, in Kale village folds and hole were the only facilities used for organic manure storage which resulted to low application of organic manure in maize production.



**Plate 2: Fold used as storage facility for organic manure in Kale village**



#### **4.0 Conclusion**

Although the Tanzania government has put different efforts of improving agriculture through application of organic manure, through recognition of organic agriculture in the national policy and creating enabling environment for stakeholders to practice organic production in the country. The use of organic agriculture in Tanzania's rural areas in the study area was not promising. It can be generalized that there were large number of cattle owned by farmers hence producing large volume of manure in the study area. And communities' awareness on the important of applying organic manure in maize production was very high. Despite the promising situation, the study found that norms of the community towards application of organic manure lead to low application of organic manure in the study area compared to other social factors .Moreover, application of organic manure in the study area was very low constrained by high purchasing cost, high transport cost, high storage cost, absence of transport facilities and poor storage facilities.



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