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Research Article

# Use of Artificial Fertilizer's on Major Crops: The Case of Farta and Fogera Districts, South Gondar Zone, Ethiopia

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## ABSTRACT

The agriculture sector in Ethiopia is the most important sector for sustaining growth and reducing poverty. However, lack of adequate nutrient supply, depletion of soil organic matter, and soil erosion are major obstacles to sustained agricultural crop production. This study was conducted in Farta and Fogera districts of Amhara National Regional State with the objective of assessing fertilizer uses of farmers on their major crops. Six kebeles (three kebeles from Fogera and three kebeles from Farta) were first selected purposively. Formal survey was carried out using questionnaires on a total of 120 households' selected using stratified random sampling techniques proportional to the population. Descriptive and inferential statisticswere used to analyze the collected data. Tukey test was used to know the mean difference between the three wealth categories. The major income of household in the study areas were crop selling and selling of animals in both districts, while the annual expenditure of households was for household consumption (purchased of food items. Wealth status was the main factor for the amount of fertilizer use as there was a significant mean difference between the different wealth status categories on the rate of fertilizer. Generally farmers apply lower rates of fertilizer as compared to rates by the extension system although richer farmers apply more fertilizer amounts than the medium and poor. The broadcasting method of fertilizer application was practice in both districts and the timing of fertilizer did not used during the crop needs due to accessibility of fertilizer on time. The yield of major crops was declining due to soil erosion problems in Farta and poor crop rotation and weed problems in Fogera plains. Major constraints for development, management and utilization of fertilizer were low extension service, high cost of fertilizer lack of credit, lack of technical knowledge and not available on time. Wealth status has its own contribution for ample amount application on crop field of households' fertilizer application rate, timing and method was traditionally system. Therefore, this should be improved by adding value and transformed into modern production system in relation to the research recommendations.

**Keywords:** Rate; Timing; Method; Wealth status; Inorganic fertilizer; Organic fertilizer

## INTRODUCTION

Agriculture is the mainstay of the Ethiopian economy with its hefty contribution of about half of the GDP. Yet its growth rate over the past four decades had been quite low [1]. Per capital agricultural output in 2003 is not so much different from its level in 1961[2]. This is coupled with the dominance of smallholder farmers with land holding size of 0.96 hectare per household, and yield of 1,167 kg to 2,122 kg per hectare for the main cereal crops. The agriculture sector in Ethiopia is the most important sector for sustaining growth and reducing poverty. However, lack of adequate nutrient supply, the depletion of soil organic matter, and soil erosion are major obstacles to sustained agricultural crop production [3]. On average, agricultural crop productivity in Africa is lower than in other regions and available technologies that show great promise in research stations are not widely adopted (Figure 1). Consequently, the gains in rural income and the reduction in rural poverty that characterized Asia's Green Revolution have not reached Africa [4].

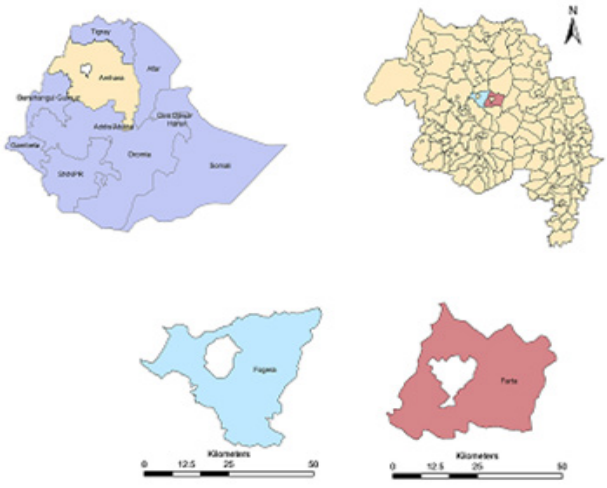

**Figure 1:** The map of the Farta and Fogera districts.

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Fertilizers are substances that add nutrients to the soil to correct the deficient nutrients. Plants absorb nutrients from the soil. If the soil is used consecutively without treatments, the soil will suffer from deficiencies of minerals and these makes the soil infertile [5]. To treat such soil, adding fertilizer is important. There are two types of fertilizers. These are chemical/artificial fertilizers and natural/organic fertilizers [6]. The overall fertilizer use is increasing from time to time. For instance, according to (IFPRI) the usage increased from 250,000 tons (21 kg/ha) in 1995 to 323,000 tones (32 kg/ha) in 2004 in Ethiopia, which is a more rapid growth than the average for Sub-Saharan Africa (SSA) over the same period. The gross growth in fertilizer usage is 29% from the year 1995 to 2004.

The fertilizer application amount used by Ethiopian farmers was so low or below the research recommendation because of lack of credit, poor marketing capabilities, high transport costs, lack of availability of fertilizer, inadequate demand to stimulate investment in production and distribution, lack of crop markets, devaluation of domestic currencies, and weak extension services constrain fertilizer use. Lack of credit has been identified as the major determinant of fertilizer use in Ethiopia and also the local price of fertilizer is two to four times the world price, due to high transportation costs and in efficient marketing systems.

There has been substantial growth in cereals, in terms of area cultivated, yields and production since 2000, but yields are still low by international standards and overall production is highly susceptible to weather shocks, particularly droughts. Thus, both raising production levels and reducing its variability are essential aspects of improving crop production in Ethiopia, both to help ensure adequate food availability, as well as to increase household incomes. Ethiopia's crop agriculture in general, and the cereals sub-sector in particular, face serious challenges including less shortage of land and soil degradation and soil compaction [7]. In this paper, we investigated farmers' fertilizer application practices, timing, method and rate on major crops in Fogera and Fartaworeda as compared to practices recommended by researchers. The research can help to identify technical, institutional and policies that facilitates or hinders use of fertilizer and encourage the adoption of fertilizer application mechanisms.

## METHODOLOGY

### Study design

The study area has tremendous potential for cultivation of cereal crops which play an important role in contributing to the household food security. In addition to the nutritional value, these crops generate employment opportunities for the poor households. In most fields, farmers achieved better income by improving the production of crops. Wheat, barley and teff in Fartaworeda and rice, finger millet and maize in Fogera are the major crops grown by farmers. But the productivity of these cereal crops per hectare is low as a result of overlooking to apply recommended technologies including fertilizer as compared to research recommendations.

The key to increase in agricultural production is to improve land productivity, which can be achieved through better use of technologies and efficiencies. Fertilizer remains the main yield-augmenting technology being aggressively promoted by the Ethiopian government and institutions. Despite of this, fertilizer adoption rates remain minimal. Until recently, only farmers used fertilizer and application rates remained at or below 16 kg/hectare of nutrients. In addition there is significant evidence suggesting a pull back from using fertilizer (Figure 2). Escalating prices and production and consumption risks have been cited as one of the factors limiting the use of fertilizers in Ethiopia [8]. These research efforts have been made to generate and release improved technologies for crop productivity and fertilizer application including, timing, rate and method. Farmers' are not always adopting the newly introduced technologies especially fertilizer recommendations that come to them through the extension system. However, the decision of fertilizer uses by farmers is reached based on their social, environment and economic circumstance. So this paper will be investigating the limiting or promoting factors to their fertilizer uses that would important for the different actors (researchers, extension experts, governmental and none governmental organizations and donors). Policy makers will also benefit from the research output since they require micro level information to formulate and revise policies and strategies.

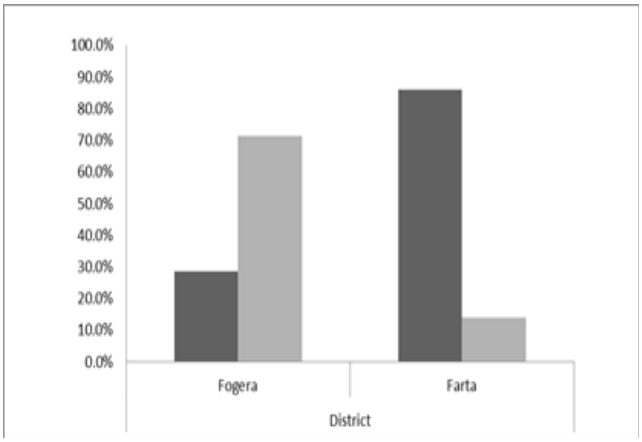


**Figure 2:** Farmers'practicing of crop rotation in two districts. Note: ( ■ ) yes; ( ■ ) no.

This study was conducted in two adjacent but contrasting woredas in south Gondar Zone of Amhra region; namely Fogera and Farta woredas.Farta woreda covers most of the Dega area of the South Gondar Zone including Guna Mountain with Afro- Alpine climatic condition, while Fogera woreda represents the foot hills of the Gumara and Rib Rivers as well as the extensive plain areas of the Lake Tana basin adjust to the Lake.

### Location

Fogera districtis one of the Amhara regional states found in South Gondar Zone. It is situated at 11°46 to 11°59 latitude North and 37°33 to 37°52 longitude East. Altitude ranges from 1774 to 2410 meters above sea level (m.a.sl).Woreta is the capital of the woredaand located 625 km northwest of Addis Ababa and 55 km from the regional capital, Bahir Dar. Woreta and Alember are two major towns in the woreda. The woreda is divided into 26 rural kebeles, and 5 urban kebeles and the total land area of the Woredais 117,405 ha of which flat lands account for 76% while mountains and hills and valley bottoms account for 11 and 13%, respectively (Figure 3). Farta district is one of the administrative divisions of South Gondar zone which is located in northern part of Ethiopia.It is situated at 11° 98 latitude North and 38° 03 longitude East. Northern by Ebinat worda, estern Laygaynt district, southern Estate district western Fogera district [9]. The district contained 41 rural kebele and 2 urban kebele with the problem of land escape social service like as road, transport, electricity and postal service are limited in the area this lack of sufficient cultivated land is rural area because high density of population and unemployment rate in urban center low availableability of basic education and primary health service.

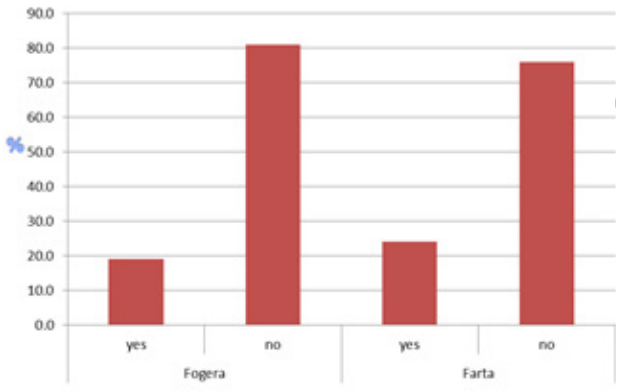


**Figure 3:** Number of farmers following research recommendation in applying fertilizers. **Note:** ( ■ ) percent

## Climate

Based on the existing data Fogera district, the mean annual rainfall is 1216 mm ranging from 1103 to 1336 mm from June to September long rains. An interesting characteristic of Fogera woredais the seasonal flooding of the six kebeles (Shaga, Shina, Nabega,Wagetera, Kidest Hana, Aboakokit) bordering Lake Tana because of over flow of the Lake . Rib and Gumeraare two major rivers that recharge Lake Tana. The minimum, maximum and average temperature of the woreda is 10.3, 27.2 and 18.75 respectively. The length of growing season highest of the woreda is June to September.

According to the traditional classification climate of the Farta districtranges from of Guna maintain (4235 m) to lowest (1920 m) above sea level and having three different climatic zones. Cool highlands, mild middle areas and warmer lower plains. The climatic condition highly indicated 75% weyna dega, 17% Dege and 8% kola (Figure 4). According to the Ethiopian agro-ecological zone the area is categorized under wonay Dega and rainfall of 1500 to 2300 mm. and is characterized by one rainy season (Uni-modal). The rainy season is from June to September and the average temperature is 170 with minimum 9 to maximum of 25 c.

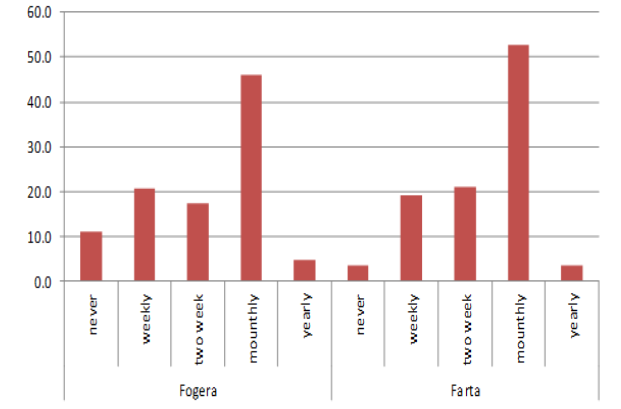


**Figure 4:** Farmers-extension contacts in the study areas.

## Topography and soil

The topography of the Fogera district is flat lands account for 76% while mountains and hills and valley bottoms account for 11 and 13%, respectively. The dominant soil type on the Fogera plains was black clay soil (ferric Vertisols), while the medium and high altitude areas were orthic Luvisols. The major crops to be grown were Rice, maize, millet and the woreda has good soil depth because of no more soil erosion.

Concerning the topographic distribution of the Farta district, about 45%is hilly, 26%is undulated and 29%is flat.According to the woreda Office of Agriculture, the dominant soil type on the red 30%, brown 50%, and black 20%.

## Farming system and cropping practice

Average land holding of the Fogera district was about 1.4 ha with a minimum and maximum area of 0.5 and 3.0 ha, respectively. Fogera woredawas endowed with diverse natural resources and can grow a number of annual and perennial crops. The woredawas one of the eight wored as bordering Lake Tana with estimated water body of 23,354 ha (IPMS) and also one of the surplus food producing woredain the region. Traditionally farmers with in the area with mono crop or single cropping i.e. early planting of rice, maize, barley and followed by grown barley with the residual moisture is also another cropping system under rain fed agriculture [10]. The flooded plains are the major rice production areas in the region and the country (Figure 5). In addition, two rivers of great economic importance (Gumara and Rib) to the woredaare found there and they are used for irrigating vegetables during the dry season. Both rivers cross many of thekebelesbefore entering in to Lake Tana.

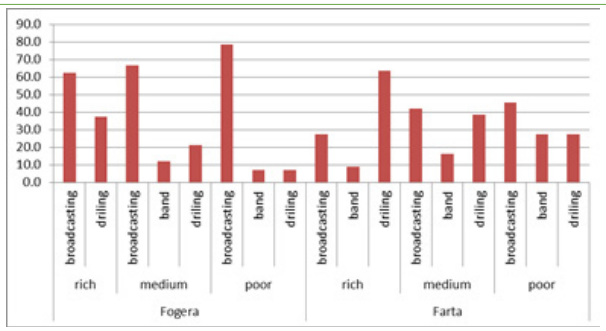


**Figure 5:** Methods of fertilizer application by wealth categories. **Note:** ( ■ ) percent

Farta woredais endowed with diverse natural resources and can grow a number of annual and perennial crops like apple and gesho. Crop production of the study area is almost totally dependent on the availability amount and distribution of rain fall and soil fertility. Traditionally farmers with in the area single cropping i.e. early planting of maize, barley and followed by grown barley with the residual moisture is also another cropping system under rain fed agriculture.

## Population

According to the woreda finance and economic office (2008) the total human population of the woredais 250,926. The proportion of male and female population is almost similar (male 128,000 and female 122,926. The number of agricultural households was 42,746.

According to the the Farta district finance office,the human population of the woredais 143440 male and 137840 female and the total of 281,280. The rural population was estimated at. The proportion of male and female population was almost similar in both rural and urban areas.

# RESULTS AND DISCUSSION

The survey showed that male-headed farmers accounted 97% of the respondents while the remaining 3.3% were female-headed farmers

within the age range of 18 and 25. The focus group discussion showed the age of the household head has been found to be a significant factor affecting the use of fertilizer, but of contradictory impact in some research; and even insignificant in others Kaliba et al. found that older heads of household were more likely to use fertilizer. The result also indicated that majority of the farmers (77%) were about within the aged of 26 to50, relatively young farmers. The majority of farmers (47.6%) in Fogera district was illiterate and 34.9% of them have primary education while in Farta district 47.4% of the respondents could read and write, 29.8% were illiterate and also 39% of the respondents in both districts were illiterate, 29% could read and write and the rest of 28% and 3% have visited primary and secondary school, respectively.

During key informant interview and focus group discussion, the level of educational attainment were important to support application of technology (fertilizer use) through information sharing and distribution and education was important to transfer and promotion of technologies meant to improve crop production which was in line with the findings of other authors (Lawal and Ayoola). The result indicates that the likelihood of the farmers to desire productivity-oriented information is high since majority of them were literate.

In the two districts the criteria used to group households in different wealth classes (rich, medium and poor farmers) were different. After listing of all households in the districts and documenting their assets using PRA techniques, ranking of households based on the wealth status has been conducted with the pre-agreed criteria during the focus group discussions and key informant interviews mainly based on ownership of different assets [2,4]. After an in-depth discussion with focus group members and community representatives, there was an agreement on the different criteria and the respondents were grouped into three categories (rich, medium, and poor). The wealth status criteria of the two districts were different because the sources of income of farmers in the two districts were somewhat different which were determining the wealth categories.

Farmers in the study area had different source of income like sells of crops, sells of animals, off-farm activities and wood selling. Asking farmers to rank their source of income is usually helpful to better understand the major contributors of livelihoods as farmers may be reluctant to tell the exact amount of their income source [3]. The major source of income in the study area were sells of crops (54%), sells of animals (22%) and sells of wood (10%) especially Eucalyptus both for fire wood and construction purposes and the remaining were from wadge and labour.

Farmers also had different source of expenditures in the study area including purchased of food item (69%) purchase of fertilizer (21%) and schooling expenditure for children education (10%) in Fogera district while in Farta distric 75% for purchasing of food items, 20% for purchasing of fertilizer and 5% for children education. In Farta more farmers purchased additional food items from the market due to less productivity of the soil through soil erosion. Generally farmers in the study area expended more for purchased of their own food items for their family rather than purchased of fertilizer in both districts (Figure 6).

The key informant and focus group discussion results showed that farmers' soil fertility perceptions were more holistic. It was confirmed that farmers use a variety of inter-related criteria to characterize their soils fertility status with soil color being the dominant one [9]. The discussion also indicated that combination of compost application and rotation of cereal with legume have been viewed as a good practice to give adequate amount of nitrogen to the growing crop and as a potential source of natural fertilizer to improve soil fertility. However, farmers in the study areas were not practiced all these due to labour problems and they used crop residues and animal dung for fuel purpose. Soil color was an important criterion for farmers, as it often reflected the soil's hidden parent material which determines the specific soil characteristics. The result is contradict with other findings of expressed by Corbeels et al. (2000) crop rotation, compost application and applying farm yard manure are the important soil fertility management practiced.

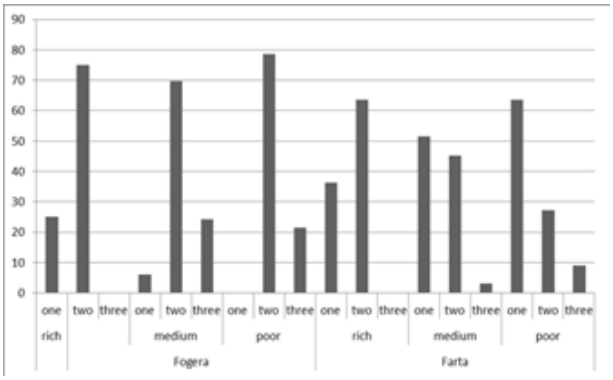


**Figure 6:** Split application nitrogen fertilizer on major crops by district and wealth categories. **Note:** ( ■ ) percent.

The common rotational practices in the two woredas were different. In Fogera woreda the common rotational practice was only rice rotates with grass pea (using residual moisture) while in Farta woreda barley with wheat followed by tomato and sometimes bean rotates with barley followed by teff. Crop residues and SWC practices were practiced mainly in Farta district as the area is undulating as compared to Fogera plains. Chemical fertilizers (urea and DAP) were also applied by the respondents in the two woredas.

Farmers felt that there is a reduction in crop yield at present as compared to in the past on their major crop when there is no any input used. During focus group discussion the main reasons given by respondents were poor crop rotation especially in Fogera plain of rice fields and invasive exotic weeds (e.g. parthenium) especially in kokit lower administrative areas while the reason given for Farta district was the reduction in soil fertility due to soil erosion. Crop rotation was practice by many farmers in Farta district as compared to Fogera because farmers have no much choice in Fogera area of water lodged plain.

## CONCLUSION

This study was undertaken to understand farmers soil fertility management practices in two contrasting districts. The study has the objectives of Farmers' fertilizer applications practices on major crops in Farta and Fogera districts.

Farmers applied lower amount of fertilizer as compared to the research recommendations. Wealth and educational status of households influenced amount of fertilizer uses (during key informant and focus group discussion. Statistically, there was a significant mean difference between the three wealth categories in urea fertilizer rate in both districts while DAP fertilizer rate had significant mean difference in Farta district only. Rich and medium farmers applied better amount of fertilizer as compared with poor farmers.

The application method and timing of fertilizer were not well developed in the study areas. Farmers applied broadcasting application method of fertilizers and some farmers practiced split application of nitrogen

especially in Fogera for maize crops. Farmers produced crops with and without fertilizer although they understand that fertilizer is the main yield augmenting input for increasing the likelihood of their income. Majority of farmers in the study area didn't practice the combined use of organic and in organic fertilizer. Farmers perceived that soil fertility is getting declined over the years. The main reasons for declining of soil fertility were soil erosion especially in Farta district. In Fogera district weed and non-crop rotation practices were seen the main factor for declining of rice yields.

## REFERENCES

1. Adeoti JO, Sinh BT. Technological constraint and farmers' vulnerability in selected developing countries (Nigeria and Vietnam). Georgia Institute of Technology.
2. Birhanu A. Environmental degradation and management in Ethiopian highlands: review of lessons learned. J Environ Prot Ecol. 2014;2(1):24-34.
3. Agwe J, Morris M, Fernabdes E. Africa's growing soil fertility crisis: What role for fertilizer?
4. Alem Y, Bezabih M, Kassie M, Zikhali P. Does fertilizer use respond to rainfall variability? Panel data evidence from Ethiopia. School of Business Economics and Law, University of Gothenburg. Working paper. 2008.
5. Alene AD, Hassan RM. The determinants of farm-level technical efficiency among adopters of improved maize production technology in western Ethiopia. Agrekon. 2003;42(1):1-4.
6. Anthony. Agroforestry for Soil Conservation. UK: CBA international. 1990.
7. Tesfa A, Mekuriaw S. The effect of land degradation on farm size dynamics and crop-livestock farming system in Ethiopia: a review. Open J Soil Sci. 2014.
8. Bacha D, Aboma G, Gemeda A, Groote HD. The determinants of fertilizer and manure use in maize production in Western Oromiya, Ethiopia. InSeventh Eastern and Southern Africa Regional Maize Conference Proceedings. 2001.
9. Barrios E, Delve RJ, Bekunda M, Mowo J, Agunda J, Ramisch J, et al. Indicators of soil quality: A South–South development of a methodological guide for linking local and technical knowledge. Geoderma. 2006;135:248-259.
10. Shiferaw B, Holden ST. Policy instruments for sustainable land management: the case of highland smallholders in Ethiopia. Agric Econ. 2000;22(3):217-232.