

Soil Test Based Fertilizer Recommendation for Wheat Production in Ethiopia: Review

Alemayehu Abdeta

Oromia Agricultural Research Institute, Bedele Agricultural Research Centre, Bedele, Ethiopia

Email address:

abdeta.alex35@gmail.com

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Abstract: Ethiopia is the second largest wheat producer, in Sub Saharan Africa (SSA). Ethiopia farmers are facing challenges on the price, amount and type of fertilizers to be applied on their land. Because in Ethiopia blanket fertilizer recommendation are the only practice that have been in use for the past four decades in the country. Many farmers were using blanket type of fertilizer application which is not recommended based on soil test crop nutrient requirements. This blanket recommendation often fails to take into consideration differences in resource endowment (soil type, labor capacity, climate risk) or make allowances for dramatic changes in input/output price ratio, thereby discouraging farmers from fertilizer application. The prevailing blanket fertilizer recommendation rate is unaffordable for most smallholder farmers. Thus review paper therefore focused on recommended to use the soil test based fertilizer recommendation for wheat in Ethiopia. Soil test is one of the most known and exact methods for fertilizer recommendations for plants. Soil test based fertilize application of essential plant nutrients and in optimum quantity for a specific soil crop condition in alleviating the yield, quality and its attributes of wheat production is important. Data of different paper show that yield and yield components of wheat in soil test based fertilizer recommendation were higher than the blanket type of application. The finding of this review indicated that there are viable potentials for increasing the current wheat productivity through soil test based fertilizer recommendation practices. This shows that it is recommended to use the soil test based fertilizer recommendation in Ethiopia.

Keywords: Soil Test, Fertilizer Recommendation, Wheat Production

1. Introduction

Wheat (*Triticum aestivum* L.) is one of the most important food grain crop grown in the world. It belongs to the grass family of Poaceae [1]. It is one of the major staple crops in Ethiopia next to maize [2]. The national average productivity is estimated to 2.4 tons/ha [3] which far below the world average of 3.27 tons/ha [4]. The low productivity is attributed to a number of factors including depletion of soil fertility due to continuous nutrient uptake of crops, low fertilizer use and insufficient organic matter application [5].

The popularization of blanket recommendation is increasing from time to time through the extension programs [6]. However, there is a major challenge facing the small holder farmers not only to find ways of making fertilizer available at affordable price but also recommendations on the amount and type of fertilizers to be applied for most crops and soil types [7].

Soil test based fertilizer recommendation as a tool for

judicious fertilizer use is a well-recognized practice all over the world which takes care of too little, too much or disproportionate applications of nutrients [8].

Therefore, by reviewing research achievements and possibly identifying research and development thrusts for future considerations. This review part was mainly focused on the Soil test based fertilizers response on the growth and crop yield of wheat crop in Ethiopia. Thus, the review writing was providing the role of developing soil test based fertilizer recommendation for wheat production in the Ethiopia. Therefore, the objective of this writing was to develop soil test based fertilizer recommendation for wheat in Ethiopia.

2. Literature Review

2.1. Production and Importance of Wheat in Ethiopia

Ethiopia is the second largest wheat producing in Africa.

Wheat in Ethiopia is grown over a large area occupying about 20% of the total cereal area but productivity is as low as 2.4 t/ha [9] which is lower than the world average (3.3 t/ha) [10]. The average cereal yields of 3 t/ha in the developing world and wheat yield of 6-7 t/ha in the developed country.

Bread wheat is a globally important crop, accounting for 20 percent of the calories consumed by humans [6]. The grain of bread wheat is used for bread, biscuits and cookies are some of the industrial products. It is mainly used to prepare traditional recipes such as 'dabo' (Ethiopian bread), 'injera' (thin, flattened bread), 'kolo' (roasted grain), 'nifro' (boiled whole grain, sometimes mixed with pulses) and 'kinche' (crushed kernels, cooked with water and mixed with spiced butter), 'ganfo' (wheat flour cooked with water and mixed with spiced butter) and other food types and beverages in Ethiopia. The straw is a good source of animal feed and it is also used for roof thatching.

2.2. Wheat Yield Constraints in Ethiopia

Wheat is believed to cover up to about 25% calorie requirements of the population in Ethiopia [11]. Despite its greater economic and nutritional contribution to our population, the national average does not exceed 2.2 t/ha. However, in Ethiopia current wheat production is insufficient to meet domestic needs, forcing the country to import 30 to 50% to fill the gap [12].

The low mean national yield for wheat is primarily due to depleted soil fertility, low fertilizer usage, limited information is available on various sources of fertilizers K, S, Zn and B and other micronutrients, and the unavailability of other improved crop management inputs such as improved seeds, diseases and weed control measures, and inaccessibility of farmers to finance, farm machinery and training [1].

2.3. Blanket Fertilizer Recommendation and Its Drawback

Several studies have reported that lack of considerations for soil and crop variability's were major shortcomings of the blanket fertilizer recommendation. Broad or blanket fertilizer recommendations that assume homogeneity of farming conditions have, thus, partly contributed to the low diffusion of fertilizer technologies within the small scale farm sector.

Blanket recommendation, soil test based nutrient management practices should be adopted for productivity, profitability, sustainability and environmental safety [5]. Traditionally, to determine the optimum fertilizer doses of most appropriate method is to apply fertilizer on the basis of soil test and crop response studies.

Improved crop management needs to be envisaged with adequate emphasis on balanced plant nutrition for stability in production, appropriate soil nutrient resilience. Concurrently, an escalating trend in fertilizer use is for seen, which in turn increases the unit cost of production. Fertilizer has been and will continue to be the key input for achieving the estimated food grain production goals of the country.

2.4. Importance of Soil Testing

Soil testing scientific tool to evaluate soil fertility by predicting the probability of getting profitable crop response to recommended fertilizer application crop condition. Sound soil test calibration is essential for successful fertilizer program and crop production. Soil testing is recognized as an important tool for judicious use of fertilizers which takes care of unbalanced application of nutrients [13].

Soil testing and fertility management programmers have been given adequate importance for sustaining crop production and balanced fertilization in Ethiopia. Also, soil testing is the first entry point to the farmers' field for extending agro technology transfer to the nutrient balances in the highlands of Ethiopia; typically the high potential areas for agricultural productions are currently exposed to severe nutrient depletion [11].

2.5. Site Specific Fertilizer Recommendation and Its Benefit

Fertilizer application recommendations are often based on crop response data averaged over large areas, though farmers' fields show large variability terms of nutrient supplying capacity and crop response to nutrients. The fertilizer application by the farmers in the field without knowledge of soil fertility status and nutrient requirement of different crops usually leads to adverse effect on soil as well as crops by way of nutrient deficiency or toxicity due to over use or inadequate use of fertilizers.

The role of soil test calibration is to obtain correlation between the contents of the available nutrients in the soil and the crop responses to applications of nutrients in selected areas [14]. Site and crop specific fertilizer recommendation is very useful for easy adoption of technologies as it better increases productivity as compared to the blanket recommendation. Site and crop specific recommendation is resulted from solving the real production constraints in the specific area.

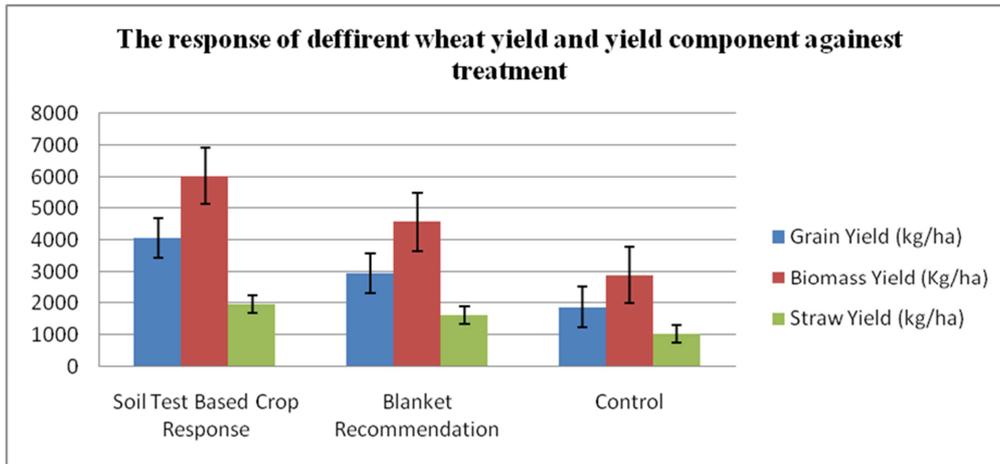
Introduction of farmers to site specific fertilizer recommendation will make fertilizer more affordable to them. An overestimation of the risk of failure to break even when applying fertilizer by farmers adds to the dilemma. Furthermore, fertilizer recommendations developed in the past often ignored differences between soils and are highly incompatible with smallholders' resource.

Blanket fertilizer recommendation (high rates of fertilizer input) was made for farmers for a long time to improve yields, but smallholder farmers could not afford such [7]. Site specific fertilizer recommendations also provide an avenue for profitability on farm and produces towards food security. Site specific nutrient management decreases the percentage of total nitrogen losses from applied fertilizers, thus reducing the nitrous oxide emissions and global warming [1].

2.6. Soil Test Based Fertilizer Recommendation for Wheat

Site and crop specific fertilizer recommendation is very useful for easy adoption of technologies as it better increases

productivity as compared to the blanket recommendation [6]. The site and crop specific recommendation is resulted from solving the real production constraints in the specific area.



Source Gebremedhin Gebremeskeletal [15].

Figure 1. Response of wheat Yield and Yield component Against Soil test based Fertilizer and Blanket Recommendation and Control.

The highest grain yield, Biomass yield and Straw was obtained in soil test based fertilizer recommendation and the minimum is gained in control [13]. This call for site specific recommendation that considers both the agronomic and environmental risks is to determine a rate of nutrient application that maximizes its beneficial use. The analysis of variance showed that the recorded biomass yield of bread

was significantly affected ($p < 0.001$) only by the application of soil test crop response-based phosphorus fertilizer application. The highest mean grain yield (2875 kg/ha) was recorded with the soil test crop response-based fertilizer recommendation treatment (table 1) which was significantly higher than the farmer practice (2119.4 kg/ha).

Table 1. Mean grain and biomass yield (kg/ha) of bread wheat as influenced by different fertilizer application at Horo district.

| Treatment | Grain Yield (kg/ha) | Biomass (kg/ha) |
|---|---------------------|-----------------|
| Soil test based Fertilizer Recommendation | 2873.0a | 8330.6a |
| Farmers practice | 2119.4b | 6625.0b |
| Control | 1647.2b | 6036.1b |
| LSD (0.50) | 536.03 | 1543.4 |
| CV (%) | 12.12 | 1.04 |

Source; Temesgen [16]

3. Conclusion and Recommendation

Low crop productivity and rapid population growth is the main problem facing sub Saharan Africa including Ethiopia. One of the reasons for lower production is imbalanced use of fertilizers by the farmers without knowing soil fertility status and nutrient requirement of crop causes adverse effects on soil and crop both in terms of nutrient toxicity and deficiency. Furthermore, yields have not increased as expected even when recommendation rates of N and P fertilizers applied. This is mainly due to use of blanket fertilizer (DAP and urea) alone and this may cause unbalanced fertilizers use.

To overcome the constraint soil test based fertilizer recommended for ameliorating site specific nutrient deficiencies and thereby increasing productivity. This review part was mainly focused on the newly blended fertilizers response on the growth and crop yield of different horticultural and field crops that was produced in the country. The findings of reviewed published and unpublished outputs

revealed that there are viable potentials for increasing the current wheat productivity through using of soil test based fertilizer recommendation practices.

Generally, soil test based recommended a fertilizer usage provides macro and micro nutrients that was needed by the crop to provide the maximum yield and which was economically feasible for the growers. Therefore, this paper provide information basis for fertilizer recommendations for a specific nutrient element and crop on specific soil type. Furthermore, it is also recommended to use the soil tesbased fertilizer recommendation rate calibrated could be best means to boost production and productivity of wheat in Ethiopia.

Future Perspectives

- 1) Further research is required in order to ascertain the precise outcomes and benefits of site specific Fertilizer Recommendation.
- 2) All national and Regional Research center should be re attention on Soil test based fertilizer recommendation for wheat Production.

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