

Evaluation of Balanced Fertilizer Types and Validation of Soil Fertility Map Based on Fertilizer Recommendation in South East Arsi, Ethiopia

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Abstract

A field experiment to evaluate blended fertilizer types and validation of soil fertility map based on fertilizer recommendation was conducted at 10 sites on-farmers' fields in Lemu Bilbilo and Asasa districts during 2014 and 2015 cropping seasons. The experiment was conducted to compare the effects of multi-nutrient blends that included macro- and micro-nutrients (N, P, K, S, B, and Zn) among each other and against the conventional N and P rate recommendation from Urea and DAP fertilizers. The experiment consisted of six treatments viz. recommended NP and five different types of blended fertilizers laid out in randomized complete block design (RCBD) with three replications. The P and S containing fertilizers were drilled along seed line at planting while N was split applied in such a way that half was applied at planting and the remaining half was applied at tillering stage. All management practices in respect of sowing, seed rate, weed control, pest and disease control were done according to agronomic best practices. Combined analysis over locations and years indicated that wheat grain yield, test weight and hectoliter weight were not significantly increased by blended fertilizer application at both Lemu Bilbilo and Asasa areas. The highest wheat grain yield of 4694 kg/ha and 4286 kg/ha were recorded from application of recommended rate of fertilizer at Lemu Bilbilo and Asasa, respectively.

Key Words: Bread wheat, blended fertilizer, grain yield

Introduction

Ethiopia is one of the largest producers of wheat in sub-Saharan Africa [1] with an estimated area of one million hectare under wheat production (CSA, 2000) and a projected potentially suitable area of 1.3 million hectare. Wheat grows in the Ethiopian highlands, at altitudes ranging from 1500 to 3000 m [2] and is produced exclusively under rainfed conditions.

The most suitable area, however, falls between 1900 and 2700 m [3]. Wheat is the second most important crop in area and third in total production in Ethiopia (CSA, 2000), and its production is increasing more rapidly than all other cereal crops in the country [4]; CSA, 2000.

Balance use of fertilizers and agronomic measures are needed to raise production of crop. The role of macro and micro nutrients is crucial in crop nutrition for achieving higher yields [5]. Balanced nutrition is an essential component of nutrient management and plays a significant role in increasing crop production and its quality.

For the major processes of plant development and yield formation the presence of nutrients like N, P, K, S and Mg etc in balance form is essential [6]. S deficiency in crops has only recently become widespread. Previously, sufficient S to meet crop requirements was obtained from the frequent incidental additions of S to soils when N and P fertilizers, such as ammonium sulphate and single superphosphate were applied. The experiment was conducted to compare the effects of multi-nutrient blends that included macro- and micro-nutrients (N, P, K, S, B, and Zn) among each other and against the conventional N and P rate recommendation from Urea and DAP fertilizers.

Materials and Methods

Description of the Study Site:

This Experiment was conducted on farmers field at Gedeb Asasa and Lemu-bilibilo district in Arsi zone of Ethiopia during 2014 and 2015. Experimental site is located in an altitude of 2340 meters above sea level (masl) and 2780 masl respectively. The long term average annual rainfall is 620mm and 1020 mm respectively and soil type is Gleysol and Nitosol respectively.

Experimental Treatments, Design and Procedures:

The experiment was conducted to compare the effects of multi-nutrient blends that include macro and micronutrients (N, P, K, S, B, Zn, etc) among each other and against the conventional N and P recommendations from Urea and DAP fertilizers.

The experiment consisted of six treatments viz. recommended NP and five different types of blended fertilizers laid out in randomized complete block design (RCBD) with three replications.

The seedbed plowed four times using traditional plough, locally called *maresha* drawn by ox before planting. The P and S containing fertilizers were drilled along seed line at planting while N was split applied in such a way that half was applied at planting and the remaining half was applied at tillering stage.

| Treatments | N | P ₂ O ₅ | K ₂ O | S | Zn | B |
|---|--------|-------------------------------|------------------|----------|----------|----------|
| T1= Recommended NP (150 kg/ha urea + 100 kg/ha DAP) | 8 8 | 38 | 0 | 7 | 0 | 0 |
| T2= Formula 1: 100 kg + 150 kg urea top dressed | 8 8 | 38 | 0 | 7 | 0 | 0 |
| T3=Formula 2: 100 kg/ha+ 155 kg/ha urea top dressed | 8 9 | 36 | 0 | 6.7 | 0 | 0.7 1 |
| T4= Formula 4: 100 kg/ha+ 155 kg/ha urea top dressed | 8 8 | 34 | 0 | 7.3 | 2.2 3 | 0.6 7 |
| T5 = Formula 6 : 150 kg/ha+ 134 kg √ha urea top dressed | 8 8 | 52 | 0 | 11. 4 | 3.3 5 | 0.3 8 |
| T6 = Formula 6 : 150 kg/ha+ 150 kg/ha urea top dressed | 8 8 | 39 | 21 | 7.3 | 3.3 5 | 0.3 8 |

Data Collection

Agronomic data on grain yield and yield components grain and biomass yields were collected at the recommended time. Analysis of variance was carried out for each of the measured or computed parameters following the method described by Gomez & Gomez (1984). All yield, yield component data were subjected to analysis of variance using PROC GLM of SAS version 9.0 (SAS Institute, 2008) statistical software.

Results and Discussion

It is evident from the data that the application of balanced fertilizer was a non-significant ($P > 0.05$) effect on Grain yield and biomass yield on bread wheat at Gedeb Asasa and Lemubilibilo (Table1). Thus, the highest grain yield was recorded with the conventional source of N and P from DAP and urea. The highest wheat grain yield was recorded from application of recommended rate of fertilizer at Lemu Bilbilo and Asasa. Based on this study there is general perception that the new fertilizer blends didn't bring better yield increment than the traditional fertilizer recommendation (urea and DAP) at Gedeb Asasa weredas of Arsi zone on bread wheat showed.

Table of means for the effects of balanced fertilizers on bread wheat grain and biomass yields at Gedeb Asasa and Lemu-Bilbilo weredas of Arsi Zone during.

| Treatments | Grain Yield (kg ha ⁻¹) 2014 | | Grain Yield (kg ha ⁻¹) 2015 | |
|---|---|-------|---|-------|
| | Lemu-Bilbilo | Asasa | Lemu-Bilbilo | Asasa |
| Recommended NP (150 kg DAP ha ⁻¹ + 100 kg urea ha ⁻¹ top dressed) | 4560 | 4860 | 4828 | 3714 |
| Formula 1 (100 kg ha ⁻¹ + 99 kg urea ha ⁻¹ top dressed) | 4601 | 4528 | 4666 | 3609 |

| | | | | |
|---|-------|-------|------|------|
| Formula 2 (95 kg ha ⁻¹ + 100 kg urea ha ⁻¹ top dressed) | 4408 | 4523 | 4607 | 3504 |
| Formula 4 (89 kg ha ⁻¹ + 102 kg urea ha ⁻¹ top dressed) | 4286 | 4455 | 4459 | 3580 |
| Formula 6 (138 kg ha ⁻¹ + 82 kg urea ha ⁻¹ top dressed) | 4632 | 4487 | 4663 | 3648 |
| Formula 7 (103 kg ha ⁻¹ + 97 kg urea ha ⁻¹ top dressed) | 4718 | 4423 | 4691 | 3547 |
| Mean | 4534 | 4546 | 4652 | 3600 |
| CV | 10.61 | 11.59 | 15.7 | 12.6 |
| Loc*Trt | *** | *** | ns | ns |

Conclusion

Blended fertilizer should be re - evaluated in different location with appropriate soil and methods of application fertilizers. Based on this study all parameters were occurred enhanced from traditional fertilizer sources of N and P with DAP and urea.

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