Evaluation of Yara Mila Cereal on Wheat (*Triticum aestivum*) and Teff (*Eragrostis tef*) Yield in Amhara Region

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Abstract

A field experiment was conducted in North Shewa, East and West Gojam, and South Wello to evaluate the effects of Yara Mila cereal fertilizer on yield of wheat and teff. The treatments were control without fertilizer, Urea and DAP at 100/100 kg ha^{-1} (as NP blanket Recommendation), Yara Mila at 150 kg ha^{-1}, Yara Mila at 200 kg ha^{-1}, and Yara Mila at 200 kg ha^{-1} + Adjusted NPK requirements. The wheat varieties used were Menzie for North Shewa, TAY for East and West Gojam and Dinknesh for South Wello while Kuncho teff variety was used for all sites. The seed rate was 175 kg ha^{-1} for wheat and 30 kg ha^{-1} for teff. All agronomic data were collected and subjected to statistical analysis using SAS version 9. The results showed significant differences in mean straw and grain yield for wheat and tef compared to the control (no fertilizer) treatment at all locations. But, application of Yara Mila at 200 kg ha^{-1} with and without adjusted NPK give additional yield in both crops compared to the blanket recommended NP fertilizers. This may be due to the fact that the NP content of fertilizer was low. Yara Mila at 200 kg ha^{-1} with adjusted NPK has no difference in yield be used as alternate fertilizer source due its bulkiness that adds about 100% of the blanket recommended NP.

Key word: teff, Yara Mila, wheat, NP, yield

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Introduction

Ethiopia is one of the sub-Saharan African countries where severe soil nutrient depletion restrains agricultural crop production and economic growth. The annual per-hectare net loss of nutrients is estimated to be at least 40 kg ha^{-1} N, 6.6 kg ha^{-1} P and 33.2 kg ha^{-1} K (Scoones and Toulmin, 1999). Continuous cropping, high proportions of cereals in the cropping system, and the application of suboptimal levels of mineral fertilizers aggravate the decline in soil fertility (Hailu *et al.,* 1991; Amsal *et al.,* 2000). Due to the presumed sufficiency of other nutrients in the past, more research emphasis was given to the replenishment of N and P. Other important major nutrients like K, and secondary nutrients like S and some important micronutrients like Zn and Cu received less attention. However, the importance of these nutrients in yield enhancement and quality improvement has been reported by few studies in the country. In addition to these factors that contributing to low productivity of cereals is low soil fertility through nutrient depletion by nutrient removal with harvest, tillage, weeding, and losses in runoff and soil erosion (Oldeman *et al.,* 1991; Gebregziabher *et al.,* 2006). Most of the time in cereals production areas of Ethiopia compensating of the loss of nutrients is not practiced to mitigate the negative nutrient balances (Stoorvogel *et al.,* 1991)

Low cereal productivity problem can be alleviated through the improvement of nutrient availability through the application of inorganic or organic fertilizer or their combination (Kaizzi *et al.,* 2007). Even though the great efforts had been done on the use on N and P sources fertilizers to improve the yield of tef and wheat by farmers, the non affordable cost of inorganic fertilizer and high risk in utilization of fertilizer technology is a major challenge

The identification of the proper fertilizer mix is beneficial at the macroeconomic level by improving the efficiency of fertilizer procurement and resource allocation. It is generally understood that crop response to fertilizer inevitably declines if nutrient applications are continually unbalanced. But if harvested nutrients are replaced, intensive agricultural systems can be sustained indefinitely, provided that measures are taken to halt soil erosion and to minimize detrimental changes in soil pH.

Based on this consensus, fertilizers containing different macro and micro nutrients have been evaluated for their effect on yields of crops. Blends have the added advantage of allowing a very

wide range of fertilizer grades, thus making it possible to match a fertilizer exactly to a soil test recommendation (Young, 1987). Micronutrients can enhance plant growth and stress tolerance if they are absorbed into the plant and transported where they can do their job. An example of the blended fertilizers called Yara Mila N-P_2O_5-K_2O containing was evaluated for a year in different districts of the Amhara Region, Ethiopia. Therefore the objective of the experiment was to evaluate the effects of Yara Mila cereal compound fertilizer and comparing with blanket recommended urea and DAP fertilizers on yield and yield components of bread wheat and teff.

Materials and Methods

Description of the Study Area

The field experiment was conducted in 2010/11 cropping season in North Shewa (Enewwari, and Bakelo), East and west Gojam (Enemay, Debre Elias and Gonji kolela) and South Wello (Jamma and Wereillu) on six, nine and six farmer's field respectively. These areas are known for their high rainfall, mid-to-high altitude and potential for wheat production. East Gojam is particularly potential for Tef production on both Vertisols and Nitosols.

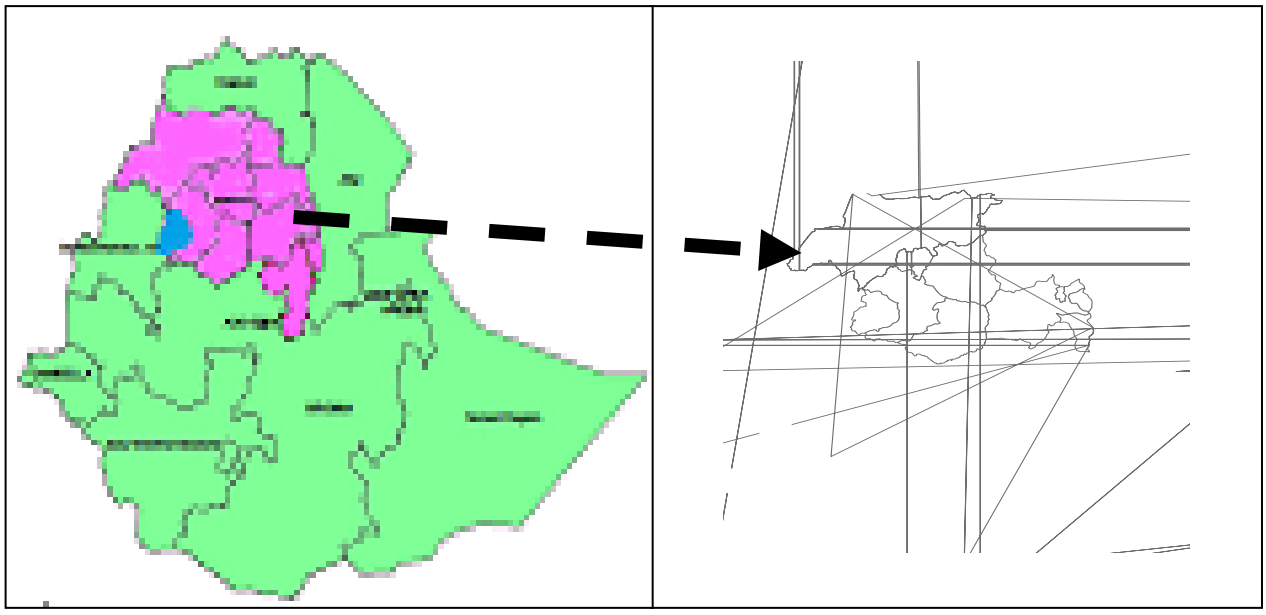

Figure1. Description of the study areas

Table 1 Agro-ecological features of the experimental locations

Parameters	Units	Enewari	Bakelo	Gonji kolela	Debre Elias	Enemay	Jamma	Wereillu
Soil Type	_	Vertisol	Vertisol	Nitosol	Nitosol	Vertisols	Vertisols	Vertisols
Altitude	m	2653	2837.0	2000	2200	2650	2630	2630
Rain fall	mm	899.0	910.0	1200	1320	1187	868.2	868.2
Min Temp	^{o}C	9.7	6.7	30.7	24.8^{o}c	34.5 ^{O}C	21.6 ^{o}C	21.6 ^{o}C
Max Temp	^{o}C	21.5	19.7	11.9	8.3 ^{o}c	13.7 ^{O}C	9·0^{o}C	9.0 ^{o}C

Experimental Design

The experiment contains five treatments in Randomized Complete Bock Design (RCBD) with 3 replications. The test crops used for the experiment were bread wheat (Menzie variety at North Shewa, TAY variety at East and west Gojam and Dinknesh at South Wello) and teff (Kuncho Variety for all sites). The seed rate used for wheat and teff were 175 and 30 kg ha^{-1} respectively. The treatments were; (1) Control (No fertilizer), (2) Recommended fertilizer rate (64/46 N/P_2O_5 kg ha^{-1}), (3) 150 kg ha^{-1}Yara Mila cereal (N-P_2O_5 -$K_2$0-MgO-S-Zn /23-10-5-2-3-3), (4) Yara Mila 200 kg ha^{-1}and (5) Yara Mila 200 kg ha^{-1} with adjusted N-P_2O_5 to the recommended rate /23-10-5-2-3-3). The plot size was 3.6m X 4m (three broad bed furrows for wheat and flat for tef). Yara Mila cereal and N were applied by splitting ½ at planting and ½ at tillering stages of test crops while all phosphorus was applied at planting. Data were collected on plot basis and extrapolated in to a hectare basis.

Data Analysis

The data collected from the field study were subjected for analysis of variance (ANOVA) using SAS software (SAS, 2004). Whenever treatment effects were significant, mean comparison were made using least significant difference (LSD (0.05)) statistical technique.

Results and Discussions

Effect of Yara Mila Cereal on Bread Wheat

Analysis of variance showed that wheat grain yield was significantly ($P<0.05$) affected by the fertilizers for all locations. At all locations, the highest grain yield was obtained from blanket recommended NP followed by Yara Mila cereal @ 200 kg ha^{-1} NP adjusted (Table 2). There was no significant difference between blanket recommended NP and Yara Mila cereal @ 200 kg ha^{-1} NP adjusted except at South Wello where the blanket recommended NP gave significantly higher grain yield (Table 2). At all locations, the lowest grain yield was obtained from the control (without input) and all fertilizer rates significantly differed in grain yield from the control (Table 2). Even though, there was no statistically significant difference in grain yield between the blanket recommended NP and Yara Mila cereal @ 200kg ha^{-1} with NP adjusted for almost all locations, the latter can't be used as an alternate fertilizer because of its bulkiness compared to DAP and urea. That is the amount needed to replace blanket recommended NP is double and incurred additional transportation cost though there is similar or relatively less effect on crop yield compared to blanket recommended NP (Table 2).

Table 2 Effect of Yara Mila chemical fertilizer on wheat grain yield (kg ha^{-1}) in 2010/11

Treatment (kg ha^{-1})	Grain Yield (kg ha^{-1})					
	Enewari	Bakelo	Gonji kolela	Debre Elias	Jamma	Wereillu
Control	1554.2d	968.1c	1553.0c	1132.45c	705e	850d
Urea/DAP 100/100	3088.8a	1868.3a	2570.9a	2033.98a	1957a	2207a
Yara Mila 150	2216.3c	1370.8b	1860.3b	1406.98b	1272d	1428c
Yara Mila 200	2429.3b	1495.7b	1818.0bc	1529.27b	1425c	1592bc
Yara Mila 200 + NPK	3009.7a	1879.5a	2349.5a	1972.84a	1830b	1725b
CV (%)	6.10	13.27	11.39	5.30	12.90	15.40
LSD (0.05)	124.4	166.6	276.16	161.26	124.50	232.00

Similar to the grain yield there was no significant straw yield between the blanket recommended NP and Yara Mila cereal @ 200 kg ha^{-1} NP adjusted at all locations except at South Wello (Table 3) where the blanket recommended NP gave significantly higher straw yield compared to Yara Mila cereal @ 200 kg ha^{-1} NP adjusted (Table 3). In another words, blanket recommended NP and Yara Mila cereal @ 200 kg ha^{-}1NP adjusted significantly affected bread wheat straw yield compared to all fertilizer rates under investigation (Table 3). However, at all locations, application of Yara Mila cereal was inferior to the blanket recommended NP fertilizer except at

Debre Elias where application of Yara Mila @ 200 kg ha^{-1} NP adjusted gave relatively better straw yield (Table 3).

Table 3 Effect of Yara Mila cereal fertilizer on bread wheat straw yield (kg ha^{-1}) in 2010/11

Treatment (kg ha^{-1})	Straw Yield (kg ha^{-1})					
	Enewari	Bakelo	Gonji kolela	Debre Elias	Jamma	Wereillu
Control	1792.3d	1188c	1147.0a	867.55d	1211.3d	1541d
Urea/DAP 100/100	4123.9a	2713a	1629.1a	1499.35a	3312.8a	3951a
Yara Mila 150	2565.9c	1875b	1508.3a	1326.36b	2040.1c	2521c
Yara Mila 200	3093.8b	2029b	1482.0a	1170.73c	2148.4c	2599c
Yara Mila 200 +NP	3934.9a	2608a	1411.7a	1627.16a	3038.7b	3206b
CV (%)	9.56	9.02	29.13	5.79	13.00	12.00
LSD (0.05)	245.58	155.58	499.27	141.47	204.00	232.00

Effect of Yara Mila Cereal on Teff

Analysis of variance showed that significantly higher grain yield was obtained from blanket recommended NP at Bichena compared to all Yara Mila cereal fertilizers followed by Yara Mila cereal @ 200 kg ha^{-1} (Table 4). Though there was no significant difference, relatively higher grain yield was obtained from blanket recommended NP at all other locations followed by Yara Mila cereal @ 200 kg ha^{-1} NP adjusted (Table 4). The other Yara Mila cereal fertilizers gave lower grain or equal grain yield with Yara Mila cereal but significantly lower from blanket recommended NP (Table 4).

There was no significant difference in teff straw yield between blanket recommended NP and Yara Mila cereal @ 200 kg ha^{-1}NP adjusted at Enewari and Gonji Kolela (Table 5). But, the difference in straw yield among the blanket recommended NP and the other fertilizer rates under investigation was statistically significant at all locations (Table 5). Similarly, Yara Mila cereal @ 200 kg ha^{-1} NP adjusted gave significantly higher straw yield at Enewari and at par with the other rates at the other locations (Table 5). At all locations the control plot was inferior in straw yield against the other fertilizer rates (Table 5). Generally, application of Yara Mila cereal NP adjusted or not did not outsmart over the blanket recommended NP fertilizer from DAP and Urea.

Table 4 Effect of Yara Mila chemical fertilizer on teff grain yield (kg ha^{-1}) in 2010/11

Treatment (kg ha^{-1})	Grain Yield (kg ha^{-1})		
	Enewari	Gonji kolela	Bichena
Control	1083.3c	715.0d	1117.50c
Urea/DAP 100/100	1501.7a	1795.0a	1707.50a
Yara Mila 150	1369.7b	1211.7c	1408.33b
Yara Mila 200	1371.7b	1375.0bc	1388.33b
Yara Mila 200 + NPK	1508.0a	1665.0ab	1473.33b
CV (%)	7.63	11.54	7.82
LSD (0.05)	86.38	293.94	208.85

Table 5 Effect of Yara Mila Chemical Fertilizer on teff Straw Yield (Kg ha^{-1}) in 2010/11

Treatment (kg ha^{-1})	Straw Yield (kg ha^{-1})		
	Enewari	Gonji kolela	Bichena
Control	1768.8d	1285.0c	1882.5b
Urea/DAP 100/100	3220.0a	5205.0a	4125.8a
Yara Mila 150	2304.5c	3455.0b	3591.7a
Yara Mila 200	2559.0b	3625.0b	3611.7a
Yara Mila 200 +NPK	3214.5a	4668.3a	4026.7a
CV (%)	7.33	8.50	14.60
LSD (0.05)	158.67	585.30	946.60

Conclusion and Recommendation

Generally, mean grain yield obtained from each independent site depicted that application of Yara Mila cereal fertilizer at different rate were not significantly different from the blanket recommended rate of 100/100 kg ha^{-1} of DAP and Urea. Even in almost all locations, the blanket recommended NP gave better than the Yara Mila cereal fertilizer. Even though the blanket recommended NP was by far below the area specific fertilizer recommendation and incurred yield penalty, it is still by far better than the newly introduced Yara Mila cereal fertilizer in grain and straw yield of bread wheat and teff. Though in most cases Yara Mila cereal @ 200 kg ha^{-1}NP adjusted gave comparable yield to the blanket recommended NP, it can't be used as an alternate fertilizer due to its bulkiness that is double of recommended NP and difficulty in transportation. Though the experiment was approved late, it was done at multi locations and the results reported

above were recorded. Therefore, further study shall be done on other better products against the area specific fertilizer rate than the blanket recommendation which was obsolete and not used in the potential areas producing bread wheat and teff for better yield and quality products.

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