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Refining Fertilizers Rate Recommendation for Wheat (Triticum aestivum) at Kafa Zone Adiyo Wereda

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Abstract
To refining the effect of different fertilizers NPKS with common Zn and B has significant higher yields in each fertilizer levels on wheat, an experiment were conducted at Adiyo Wereda Kaffa Zone. The experiment was laid out in simple randomized complete block design having three replications. Plot size of 9m2(3 m x 3 m), seed rate of 150 kg ha^{-1} and row to row distance of 20 cm was used. Various combinations of each fertilizers N (0, 46, 92,138,176 and 222 kg ha^{-1} with $69p_2o_5$,$80k_2o$,30s,2 Zn and 1B), P (,0,23 ,46,69,92and115 kg ha^{-1} with 92N,$90k_2o$,30s,2 Zn and 1B), K (0,18,36,54,72and 90 kg ha^{-1} with 92N,$69p_2o_5$,30s,2 Zn and 1B) and S (0,10,20,30,40 and 50 kg ha^{-1} with 92N,$69p_2o_5$,$90k_2o$,2Zn and 1B with additional treatments, control and recommended NP in each fertilizers were used. N=urea; P=TSP; K= KCl; S= $CaSO_4$; Zn=$ZnSO_4$; B = Borax were used as a sources of NPKSZnB. Recommended rates of NP (64:20 kg ha-1) were applied. Nitrogen was applied in two split doses half at sowing and half about 35-45 days after sowing. Variety **Digalo** was used during the experiment. Plant height, Spike length, Grain yield and biomass were significantly affected by different fertilizers levels. Grain Yield significant at different fertilizer levels 176 N $kgha^{-1}$ (3400.3$kgha^{-1}$), 115P $kgha^{-1}$ (4221.2 $kgha^{-1}$), 90K $kgha^{-1}$ (4128.9 Kg ha-1) and 40S $kgha^{-1}$ (3987.0 $kgha^{-1}$) were produced respectively in the interaction of ZnB. Based on the results, it is recommended a combined application of NPKS (176 kg N ha^{-1},115 kg P ha^{-1}, 90 kg K_2O ha^{-1} and 40 kg S ha^{-1} with 2kg Zn ha^{-1} and 1kg B ha^{-1}) fertilizers to achieve sustainable bread wheat production on the study area.
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1. INTRODUCTION

Wheat is a member of the Poaceae or Graminae grass family. It was one of the earliest crops cultivated and dates back to 11,000 B.C. in the Middle East. By about 4,000 B.C., wheat farming had spread to Asia, Europe, and northern Africa. In 1493, wheat was brought to the Americas. It reached Mexico in 1519 and Argentina by 1527. 'In 1988, the highest verifiable winter wheat grain yield of 190 kg per acre was recorded in British Columbia, Canada. In the U.S. in 2000, the average winter wheat yield was 41.9 kg per acre and the highest average state yield was 61.8kg per acre in the state of Washington (J. Benton Jones, Jr.2003, management of crops, soils and their fertility). Wheat covers more cultivated land (232 million ha) than any other food crop and is one of the most important (595 million tons).

In Ethiopia eastern and south part of country also one of the major cereal crops now the time being as the national level takes the mandate to improve yield of this crop through, among improvements soil fertility management is one of the limiting factor for higher productivity. Current fertilizer recommendation in Ethiopia is based on very general crop specific guidelines or more often, a single recommendation for all crops (100 kg DAP (18-46-0) and 100 kg Urea (46-0-0). 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, there by discouraging farmers from fertilizer application. Moreover, the nutrients in the blanket recommendation are not well balanced agronomical and its continued use will gradually exhaust soil nutrient reserves. Therefore, neither yields nor profits can be sustained using imbalanced application of fertilizers, as the practice results in accelerating deficiencies of other soil nutrients.

Since absence of one or more nutrients besides N and P can depress yield significantly. This could explain, in part, the modest crop yield improvements observed over the last few decades in contrast to significant increases in fertilizer use and investment made in the country. Today, in addition to N and P, S, B and Zn deficiencies are widespread in Ethiopian soils, while some soils are also deficient in K, Cu, Mn and Fe.

To overcome the constraint of low nutrient recovery and optimize fertilizer use, there is need to replace such general and over-simplistic fertilizer recommendations with those that are rationally differentiated according to agro-ecological zones (soils and climate), crop types, nutrient uptake requirements and socio-economic circumstances of farmers. Better matching fertilizer application recommendations to local climate, soil, and management practices helps ensure that production can be intensified in a cost-effective and sustainable way and, thereby, enhance regional food security.

Objective:

- To determine optimum NPKS response curve under balanced fertilization and to establish economic mixes blended fertilizers
- To determine soil- crop specific optimum N, P, K and S fertilizer rates for wheat

2. MATERIAL AND METHODS

2.1 Study Area

The study was conducted at Boka Kebele for two years'. Altitude range 2464 to 2551m, latitude Latitude 07°15'.388"and longitude 036°24'.979" at Adiyo Wereda which was located at, Kaffa zone, Southern Nations Nationalities and People's Region (SNNPR). The Wereda found within the southwestern plateau of Ethiopia and 705 km far from Addis Ababa. The altitude of the study area ranges from 1800m to 2800 m.a.s.l. The topography is characterized by slopping and rugged area.

The zone covers 1,932,659 ha from this 28.5% forest land, 4% graze land and 17.3% shrubs. The area experiences one long rainy season, lasting from March /April to October. The mean annual rainfall 1150mm. Over 85% of the total annual rainfall occurs in the 8 months' rainy season, with mean monthly values in the range of 125-250mm. The mean temperature ranges from 18.1^{0}C to 19.5^{0}C (BOA Kaffa Zone Adiyo Wereda). Most of the time wheat, faba bean, pea, barley, enset and maize are dominantly grown in the area. The sowing time for wheat, is from start of July12 to august 7, with at least the frequency of tillage four times. It harvested on at the end of October-November.

2.2 Treatment Setup

Treatments was seated for each NPKS levels by using Zn and B as common each factor or NPKS were have 6 levels with absolute and positive control totally 8 treatments was seated in each experimental units by using RCBD design which was replicated three times. The treatments of each factors (NPKS) placed on the space of 1m between blocks and 50cm between plots. Total area of and plot are was 864m^2 and 9m^2 respectively.spacing between rows was 20cm.

The variety of wheat used in this study was ***Digalo***. Source of fertilizers were N=urea; P=TSP; K= KCl; S= $CaSO_4$; Zn=$ZnSO_4$; B = Borax were used as a sources of NPKSZnB.PKSZnB fertilizers were applied by banding system during sowing period of time. While nitrogen fertilizer was applied at planting and the remaining half used after 35-45 days. All other agronomic practice (weeding, cultivation, sowing rate etc.) were carried out properly and equally for all treatment. RCBD design was used on the experiment which replicated three times and the data was analyzed through SAS Software version 9.0.

Treatments for N-fertilizer

T1= control
T2 = Recommended NP
T3 = 0, (69P_2O_5, 80K_2O, 30S, 2 Zn and 1B)
T4 = 46, (69P_2O_5, 80K2O, 30S, 2 Zn and 1B)
T5 = 92, (69P_2O_5, 80K_2O, 30S, 2 Zn and 1B)
T6 = 138, (69P_2O_5, 80K_2O, 30S, 2 Zn and 1B)
T7 = 176, (69P_2O_5, 80K_2O, 30S, 2 Zn and 1B)
T8 = 222, (69P_2O_5, 80K_2O, 30S, 2 Zn and 1B)

Treatment for P-fertilizer

T1= control
T2 = Recommended NP
T3 = 0, (92N, 90K2O, 30S, 2 Zn and 1B)
T4 = 23, (92N, 90K2O, 30S, 2 Zn and 1B)
T5 =46, (92N, 90K2O, 30S, 2 Zn and 1B)
T6 = 69, (92N, 90K2O, 30S, 2 Zn and 1B)
T7 = 92, (92N, 90K2O, 30S, 2 Zn and 1B)
T8 = 115, (92N, 90K2O, 30S, 2 Zn and 1B)

Treatment for K-fertilizer

T1= control
T2 = Recommended NP
T3 = 0, (92N, 69P_2O_5, 30S, 2 Zn and 1B)
T4 =18, (92N, 69P_2O_5, 30S, 2 Zn and 1B)
T5 =36, (92N, 69P_2O_5, 30S, 2 Zn and 1B)

T6 =54, (92N, 69P_2O_5, 30S, 2 Zn and 1B)
T7 =72, (92N, 69P_2O_5, 30S, 2 Zn and 1B)
T8 = 90, (92 N, 69 P_2O_5, 30 S,2 Z and 1B)

Treatment for S –fertilizer
T1= control
T2 = Recommended NP
T3 = 0, (92N, 69P_2O_5, 90K_2O, 2Zn and 1B)
T4 =10, (92N, 69P_2O_5, 90K_2O, 2Zn and 1B)
T5 =20, (92N, 69P_2O_5, 90K_2O, 2Zn and 1B)
T6 =30, (92N, 69P_2O_5, 90K_2O, 2Zn and 1B)
T7 =40, (92N, 69P_2O_5, 90K_2O, 2Zn and 1B)
T8 =50, (92N, 69P_2O_5, 90K_2O, 2Zn and 1B)

2.3 Crop Data
Data's that were taken during experimentation period of time includes plant height, plant population per quadrant, spike length, seed number per plant, grain yield and dry biomass. Plant height and spike length was taken during at the period of 90% maturity by using measuring tape. Plant population was recorded by laying and counting of quadrants that was five times randomly drawn in the experimental plots at the time of 90% maturity. Seed number was done after by taking of five randomly selected plant spikes and counting seed from each spike make them average as raw data. Biomass and grain yield were recorded after harvesting of through using of standardized digital balance.

3. RESULT AND DISCUSSION
3.1 Plant height, Spike length, Grain yield and biomass at N Fertilizer
Plant height, spike length, grain yield and biomass of wheat were significantly affected ($P<0.05$) by application of nitrogen fertilizer rate with common fertilizers PKSZnB as compare to control. The highest mean grain yield (3400.3 kg ha^{-1}), mean plant height (95.107cm), mean spike length (8.6722cm) and mean biomass (8361.1 kg ha^{-1}) were achieved with the treatments 176 kg N ha^{-1} with PKSZnB, 92 kg N ha^{-1} with PKSZnB and 222 kg N ha^{-1} with PKSZnB respectively. All treatments or nitrogen fertilizer rates produced significantly higher yield and yield components than the control, The application of nitrogen and phosphors containing fertilizers without PKSZnB improve the growth and yield of wheat than control (Table1).

This result agreed with study of Eyasu (2013) who found that yield and yield components of wheat significantly affected by NPK fertilizers than control. Moreover, grain yield significantly increased as increment Nitrogen fertilizer rate with a common PKSZnB. This indicated that nitrogen fertilizer application increases grain yield. The increment could be due to rapid portioning of assimilates as a result of nitrogen fertilization. The low yield in Nitrogen unfertilized plots (control) might have been due to reduced leaf area development resulting in lesser radiation interception and consequently, low efficiency in the conversion of solar radiation Spedding *et al.*, 1981)

Treatment N $kgha^{-1}$	Pht (cm)	pp/qu	Sl (cm)	Seed No	Yield kg ha^{-1}	Biom kg ha^{1}	Hi%
T1= control	79.689c	39.133	7.3756c	40.856	1791.8c	4855.6d	33.226
T2= RNP	87.711ab	37.244	8.0178b	47.148	2487.9bc	6444.4c	38.847
T3 =0, PKSZnB	89.044 ab	41.778	8.0111b	46.193	2966.2ab	6805.6bc	38.910
T4 =46, PKSZnB	91.056ab	42.622	8.1044ab	46.444	3063.2ab	7180.6abc	41.589
T5 =92, PKSZnB	95.107a	44.733	8.6422a	50.596	3352.7a	7944.4ab	43.901
T6 =138, PKSZnB	90.433ab	43.267	8.2356ab	46.004	3001.6ab	7597.2abc	39.130
T7 =176, PKSZnB	93.322ab	45.600	8.3733 ab	45.819	3400.3a	8361.1a	41.067
T8 =222, PKSZnB	92.322ab	43.533	8.6722a	48.073	3007.9ab	8138.9ab	35.400
LSD	6.6163	NS	0.5771	NS	773.13	1344.6	NS
CV%	7.8	19.7	7.5	14.5	28.5	19.9	21.7

Table 1. Effect of N fertilizer with PKSZnB on wheat at Adiyo.
Recommended nitrogen and phosphorus (RNP),plant height (pht), plant population per quadrant (pp/qu), Spike length(Sl), number of seed per spike (Seed No/spike),Yield per hectare (Yield $kgha^{-1}$),biomass per hectare (Biom kg ha^{1}) and harvesting index (Hi%).

3.2 Plant height, Spike length, Grain yield and biomass at P Fertilizer
Significant effect on Plant height, Spike length, yield and biomass were observed in different levels or rates of phosphors fertilizer with a common application of NKSZnB as compare to control or untreated plots (Table 2).

Significantly the highest plant height of wheat was observed at treatment 92 kg P ha^{-1} with NKSZnB (95.129cm) whereas the lowest plant height was obtained from unfertilized plots.in similar way the highest and the lowest spike length of wheat was observed at 92 kg P ha^{-1}, NKSZnB (8.5267cm) and control (7.2889cm) respectively.

Additionally, significant grain yield was gain in P-treated plots over control and recommended NP. The highest grain yield of 4221.2 kg ha^{-1} was observed in 115P with NKSZnB which was closely followed by 92 kg P ha^{-1} with NKSZnB beside of this the lowest grain yield of wheat 2672.9 kg ha^{-1} was obtained at control. Phosphorus application at rate of 115 kg P ha^{-1} resulted in long stature plants, increase plant height, number of grains $spike^{-1}$, which resulted in greater grain yield as compared to other P levels. This disclosed that P at the rate of 115 kg ha^{-1} might be the optimum rate to cause a desirable increase in production per unit area with per unit increase in P content because the grain yield in the control plots was the lowest whereas it was highest in the plots with P applied at 115kg ha^{-1}.

Similar results were also reported by Tariq and Masood (2011) they found that grain yield of maize increased with phosphorus application and plots receiving 100 kg P ha^{-1} gave maximum grain yield as compared to lower dose and control grain yield. A good and optimum supply of P is associated with increased root growth which makes the plants explore more soil nutrients and moisture. On the other hand, biomass yield was significantly affected by different levels or rates of phosphors fertilizer with a common application of NKSZnB fertilizers. The highest biomass yield of wheat was recorded at 92 kg P ha^{-1} with NKSZnB 10125.0 kg ha^{-1} whereas the lowest biomass yields 6802.8 kg ha^{-1} was at control or unfertilized plots.

Table 2. Effect of P fertilizer with NKSZnB on wheat at AdiyoWoreada.

Treatment P $kgha^{-1}$	Pht (cm)	pp/qu	Sl (cm)	Seed No	Yield kg ha^{-1}	Biom kg ha^{1}	Hi%
T1= control	80.844d	42.911	7.2889d	39.407	2672.9c	6802.8d	39.088
T2= RNP	87.822bcd	43.289	7.9133bc	47.593	2918.5bc	7422.2cd	39.131
T3 = 0, NKSZnB	86.147cd	43.044	7.4378cd	43.963	3594.9ab	8611.1bc	41.360
T4 = 23, NKSZnB	89.222abc	44.311	7.8244bcd	45.370	3597.7ab	8458.3bc	41.665
T5 = 46, NKSZnB	93.822ab	47.933	7.7978bcd	43.778	4045.1a	9625.0ab	42.239
T6 = 69, NKSZnB	93.333abc	43.244	8.1000ab	45.148	3844.6a	9763.9ab	39.569
T7 = 92, NKSZnB	95.733a	45.200	8.5267a	41.074	4140.5a	10125.0a	40.746
T8 = 115, NKSZnB	95.129a	46.022	8.2222ab	44.963	4221.2a	9708.3ab	43.372
LSD	7.2272	NS	0.6072	NS	768.78	1497.9	NS
CV%	8.5	19.0	8.2	19.3	22.5	18.0	11.3

Recommended nitrogen and phosphorus(RNP), plant height (pht), plant population per quadrant (pp/qu), Spike length(Sl), number of seed per spike (Seed No/spike),Yield per hectare (Yield $kgha^{-1}$),biomass per hectare (Biom kg ha^{1}) and harvesting index (Hi%).

3.3 Plant height, Spike length, harvesting index, Grain yield and biomass at K Fertilizer

The application of different levels of potassium fertilizer positively influenced on plant height, spike length, harvesting index, grain yield and biomass production (Table 3). However, it did not influence the plant population per quadrant and seed number per spike (Table 3). Application of potassium fertilizer at the rate 36 kg Kha^{-1} with PNSZnB scored the highest plant height (92.589cm) as compare control that scored 81.658cm. Similarly spike length and harvesting index also significantly affected or increased with application potassium fertilizer and the highest spike length and harvesting index was observed at treatments which received 90 kg K $ha^{-1}$with PNSZnB that produced 8.3711cm and 45.495% respectively and the lowest mean value of spike length and harvesting index was gain at control or unfertilized plots.

The data regarding grain yield that presented in Table3 implies there was highly significant difference among treatments. Consequently the highest wheat grain yield (4128.9 Kg ha^{-1}) was obtained when application of 90 kg K ha^{-1} with PNSZnB. The lowest grain yield (2562.6 Kg ha^{-1}) was obtained from control (without fertilizer). The yield from Table 3 showed increasing K with a common application of NPSZnB cause resulted in increase of yield. These results are in harmony with Abdul (2010) who concluded that grain yield of wheat increase with application of NPK fertilizer. Additionally, biomass yield of wheat was significantly increased due to the main effect of potassium with a common NPSZnB fertilization (Table 3). The highest biomass yield was recorded at the 36 kg K $ha^{-1}$with PNSZnB .This reveals that potassium also one of yield limiting factor in yield and yield component of wheat responded to potassium application with NPSZnB. this research finding confirm to Abdullahil (2006) application potassium fertilizer with NPSZnB increase yield and yield component of wheat as increase of its rate

Table 3. Effect of K fertilizer with NPSZnB on wheat at Adiyo Woreada.

Treatment K kgha^{-1}	Pht (cm)	pp/qu	Sl (cm)	Seed No/spike	Yield kg ha^{-1}	Biom kg ha^{1}	Hi%
T1- control	81.658b	43.956	7.2844b	39.778	2562.6d	6722.2c	38.239c
T2- RNP	86.984ab	43.022	8.0244a	43.111	3042.0cd	7611.1c	40.357bc
T3 = 0, PNSZnB	91.367a	39.511	8.2711a	40.222	3225.2bc	7972.2bc	40.299bc
T4 = 18, PNSZnB	91.140a	46.156	8.2956a	45.519	3798.4ab	8944.4ab	42.795ab
T5 = 36, PNSZnB	92.589a	40.733	8.3200a	45.000	3994.6a	9305.6a	43.029ab
T6 = 54, PNSZnB	91.282a	47.444	8.1844a	46.111	4033.4a	9111.1ab	44.286ab
T7 = 72, PNSZnB	91.333a	47.089	8.2978a	46.556	3860.6a	9027.8ab	42.420 ab
T8 = 90, PNSZnB	92.478a	43.400	8.3711a	48.037	4128.9a	9083.3ab	45.495a
LSD	5.955	NS	0.5524	NS	630.61	1295.7	4.0923
CV%	7.0	16.1	7.2	16.9	18.7	16.2	10.3

Recommended nitrogen and phosphorus(RNP), plant height (pht), plant population per quadrant (pp/qu), Spike length(Sl), number of seed per spike (Seed No/spike),Yield per hectare (Yield kgha^{-1}),biomass per hectare (Biom kg ha^{1}) and harvesting index (Hi%).

3.4 Population per quadrant, Spike length, Number of seed spike^{-1}, Grain yield and biomass at S Fertilizer

The effect of different sulfur applications was statistically significant. The lowest Population per quadrant obtained from the control plots, whereas the highest values were obtained from the plots given 20 kg S ha^{-1} with common addition of NPKZnB followed by treatments receiving 50 and 30 kg S ha^{-1} with NPKZnB (Table 4). The spike length ranged between 6.8911 – 8.0711 cm duet the application of different rates of sulfur with NPKZnB . The lowest values were obtained from the control plots, whereas the plots given 0 kg S ha^{-1} with NPKZnB gave the highest values. This dis agreed with Yesim (2008) who reported that the highest spike length was obtained from the application of 160 kg S ha^{-1}.

The lowest seeds number per spike was obtained from the control plots for both combined years result (Table 4). The highest seeds numbers per spike were obtained from 10 kg S ha^{-1} with PNKZnB. Yesim (2008) reported that the number of seed per spike increased as the sulfur doses increased and found highest number of seed per spike from addition of 160 kg S ha^{-1} in barley. In the same way the lowest biomass yield was obtained from the control plots and the highest biomass yield was obtained from the 20 kg S ha^{-1} with NPKZnB application. Withers *et al*. (1997) reported that inorganic Sulfur application increased straw yield of cereals by 34%.

Additionally, grain yield also ranged between 2340.4 - 3987.0kg ha$^{-1.}$ The lowest grain yields were obtained from the control plots unfertilized plots whereas the highest grain yields were obtained from the plots given 40 kg S ha^{-1}with PNKZnB. This work agreed with Sutaliya *et al*. (2003) studies who stated that the highest grain yield was obtained from 45 kg S ha^{-1} application in barley and Garcia *et al.* (1999) also reported that the sulfur based fertilizers increased the yield. In the same way, biomass also significantly affected due to the application different rates of sulfur with NPKZnB.the highest biomass yield (9680.6 kg ha^{-1}) was obtained from the application of 20 kg S ha^{-1}with NPKZnB while the lowest (6111.1kg ha^{-1}) was recorded at control.

Table 4. Effect of S fertilizer with NPKZnB on wheat combined result at Adiyo Wereada

Treatment S kgha^{-1}	Pht (cm)	PP/qu	Sl (cm)	Seed No/spike	Yield kgha^{-1}	Biom kg ha^{1}	Hi%
T1- Control	80.176	37.089bc	6.8911c	36.963c	2340.4b	6111.1a	37.767
T2- RNP	86.396	35.044c	7.6711b	44.667ab	2789.5b	7388.9b	37.968
T3 = 0, PNKZnB	91.844	42.333ab	8.2467a	49.889 ab	3959.9a	9555.6a	41.367
T4 = 10, PNKZnB	92.000	40.311abc	7.9667ab	51.296a	3805.1a	9277.8a	40.895
T5 = 20, PNKZnB	94.896	44.733a	7.7711ab	46.259 ab	3875.7a	9680.6a	40.246
T6 = 30, PNKZnB	92.967	43.489ab	7.9867ab	43.222bc	3732.5a	9333.3a	40.243
T7 = 40, PNKZnB	91.889	38.578abc	7.6111b	45.148ab	3987.0a	9666.7a	40.794
T8 = 50, PNKZnB	91.767	43.800a	8.0711 ab	47.704ab	3881.8a	9444.4a	41.346
LSD	NS	6.6276	0.5401	7.0335	664.79	1416.1	NS
CV%	9.6	17.3	7.4	16.4	19.9	17.1	11.0

Recommended nitrogen and phosphorus (RNP), plant height (pht), plant population per quadrant (pp/qu), Spike length(Sl), number of seed per spike (Seed No/spike),Yield per hectare (Yield kgha^{-1}),biomass per hectare (Biom kg ha^{1}) and harvesting index (Hi%

4. CONCLUSION

Nitrogen, phosphorus, potassium and sulfur are known as the most yield limiting nutrients constraining cereal productivity including wheat in Ethiopia. Though there were some evidences on the effects of Nitrogen, phosphorus, potassium and sulfur on wheat productivity, in high rain fall area like the case of Adiyo.The results also in this experiment indicated that increasing of wheat yield and yield components were due to the application of Nitrogen, phosphorus, potassium and sulfur with Zinc and Boron fertilization. Even though the experimental fields were near to each other, wheat responses varied to the different nutrients differently.

Each fertilizer's affect wheat yield and yield component at different rate specially grain yield. due to this Nitrogen and Phosphors significantly increased grain yield at 176 kg N $ha^{-1}$with PKSZnB and 115 kg P ha^{-1} with PKSZnB respectively whereas potassium and sulfur also significantly affect grain yield at the rate 90 kg K ha^{-1} with NPSZnB and 40kg S ha^{-1} with NPKZnB so that a combined application (176 kg N ha^{-1},115 kg P ha^{-1}, 90 kg K_2O ha^{-1} and 40 kg S ha^{-1} with 2kg Zn ha^{-1} and 1kg B ha^{-1}) of NPKS fertilizers are required. Generally, it can be concluded that a combined application of NPKS (176 kg N ha^{-1},115 kg P ha^{-1}, 90 kg K_2O ha^{-1} and 40 kg S ha^{-1} with 2kg Zn ha^{-1} and 1kg B ha^{-1}) fertilizers may recommended achieving sustainable bread wheat production on the study area or Adiyo Wereda Kaffa Zone.for the future soil test based researches very important to get coherent result in the area.

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