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Grain Yield, Yield Components and Quality of Bread Wheat *(Triticum aesitivum L.)* as Influenced by NPSB and Nitrogen Fertilizer Rate in the Highlands of Bale, South Eastern Ethiopia

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Abstract: The experiment was conducted at three locations (Sinana on-station, Sinana on-farmandAgarfa) of Bale zone for three years from 2020-2022 during the main cropping season with the objective of elucidating the effects of NPSB and N rateon agronomic performance and grain quality of bread wheat. The experimental design in all locations was RCBD with three replications. Five NPSB rates (0, 50, 100, 150 and 200 kg ha^{-1}) and five nitrogen rates (0, 23, 46, 69 and 92kg N ha^{-1}) were used as a treatment. The main effects of NPSB and N rate significantly influenced bread wheat thousand kernel weight and hectoliter weight, while interaction effects significantly influenced ($P<0.05$) grain yield, bio-mass yield and harvest index. Plant height and kernels per spike were not significantly influenced by applied NPSB and N rates. Main effects of NPSB and N rate significantly and variably influenced thousand kernel weight and hectoliter weight of bread wheat. The highest thousand kernel weight 45.3g and 45.6g were recorded from 150 kg NPSB ha^{-1} and 69 kg N ha^{-1} rate, respectively. The highest hectoliter weight 81.9kghl^{-1} and 81.9kghl^{-1} were recorded from 150 kg NPSB ha^{-1} and 69 kg N ha^{-1} rate, respectively. The highest grain yield 5347 kg ha^{-1} was obtained from the interaction effects of 150 kg NPSB ha^{-1} and69 kg N ha^{-1}, respectively. The highest bio-mass yield 16306 kg ha^{-1} and harvest index 42 were obtained from the interaction effects of 150 kg NPSB ha^{-1} and69 kg N ha^{-1}, respectively. The highest grain protein content (13.1%) and (13.5%) were also recorded from the highest NPSB rate (200 kg ha^{-1}) and nitrogen rate (92 kg N ha-1) in statistical parity with (150 kg ha^{-1}) and (69 kg N ha-1), respectively. According to the result of this study optimum bread wheat grain yield and quality was obtained at NPSB rate of 150kg $ha^{-1}$and 69 kg N ha^{-1}. Economic analysis also indicated that economically feasible NPSB and N rate were 150 kg ha^{-1} and 69kgN ha^{-1}, respectively. Therefore, bread wheat producing farmers in the study area should use 150 kg ha^{-1} NPSB and 69 kg N ha^{-1} to realize maximum grain yield grain quality of bread wheat.

Keywords: Bread Wheat, NPSB, Nitrogen, Grain Yield, Protein Content, Economic Analysis

1. Introduction

Ethiopia has a favorable environment for wheat production and is the largest wheat producer in Sub-Saharan Africa, where the crop is predominantly grown by subsistence farmers under rain fed conditions. The national average of wheat productivity is estimated to be 2.7t ha^{-1}, which is below the world average of 3.0 t ha^{-1} [12]. The production of wheat in the country is insufficient to meet the increasing demand for food due to the ever-increasing population. Domestic wheat production in Ethiopia covers only 75% of the demand and the remaining 25% wheat is imported commercially and through food aid [11].

The low yield of wheat is primarily allied to the depletion of soil fertility due to continuous nutrient uptake of crops, low fertilizer use and insufficient organic matter application [13]. In addition, for the last three decades, Ethiopian agriculture depended solely on imported fertilizer products namely urea and di-ammonium phosphate (DAP) which are source of N and P although most Ethiopian soils lack other macro- and micro-nutrients (Ethiopian Soil Information System [6]. This may lead to low nutrient uptake efficiency of crops due to low availability or lack of synchrony of maximum growth of crops with adequate availability of the nutrients in the soil. Nutrient mining due to sub optimal fertilizer use in one hand and unbalanced fertilizer uses on other have favored the emergence of multi nutrient deficiency in Ethiopian soils [9]. Based on the national soil data base, in addition to the macronutrients, due to long year cultivation, some of the micronutrients like zinc, boron, and copper are depleted from the soil in the major crop producing area of the country [6].

Many researchers reported that the use of balanced fertilizers have a promising role in growth and development of crop plants which resulted in improved quality and quantity of the agricultural produce. High fertilizer responsive varieties express their full yield potential when trace elementsare applied along with NP fertilizers. Chaudry et al. (2007) [4] Stated that micronutrients (Zn, Fe, B) significantly increased the wheat yield over control when applied in combination with N, P, S nutrients [4]. It has been long understood that the role of macro and micronutrients is crucial in crop nutrition and important for realizing higher yields. Soil test based application of plant nutrient rather than the blanket recommendation of urea and DAP, especially those containing sulfur, boron, and other nutrients is recommended in averting problems caused due to nutrient deficient soil [6].

Bale zone farmers have limited information on the impact of balanced fertilizer types and rates except only urea and DAP which are source of N and P. However, new blended fertilizer such as NPSB a mixture of inorganic fertilizer is currently being used by the farmers in the study area based on the soil fertility map of the area [6].

The use of new soil nutrients such as S and B is expected to increase the nitrogen requirement of bread wheat. Thus, there is a need to test the blended NPSB fertilizer by supplementing it with nitrogenous fertilizer source such as urea for optimum productivity of bread wheat. To this end, it is worth to investigate balanced fertilizer rates and supplemental N rates to advance production and productivity of bread wheat. Therefore, the present study was undertaken with the objectives to determine optimum blended NPSB and N fertilizer rates for the production and productivity of bread wheat.

Objectives:

1) To determine optimum NPSB and Nitrogen fertilizer rates for high grain yield and quality of Bread wheat
2) To determine economically optimum NPSB and Nitrogen fertilizer rates for higher grain yield and quality of Bread wheat

2. Material and Methods

2.1. Description of the Study Area

The experiment was conducted for three years (2020-2022) at three locations (Sinana on-station, Sinana on-Farm, and Agarfa) in main cropping season. The altitude of the experimental site is 2400 masl for Sinana and 2350 for Agarfa. Average annual rainfall (mm) is 860 and 560 for Sinana and Agarfa, respectively. Maximum temperature (°C) is 21 for Sinana and22 for Agarfa. Minimum temperature (°C) is 9 for Sinanaand 8 for Agarfa. Soil types are PellicVertisols and Cambisols for Sinana and Agarfa, respectively. Soil PH is 7.7 for sinana 6.4 and 6.7 for Agarfa..

2.2. Treatments and Design

The treatments consisted of combinations of five NPSB rates (0, 50, 100, 150 and 200 kg ha^{-1}) and five Nitrogen rates (0, 23, 46, 69 and 92 kg N ha^{-1}). The entire arrangement of treatments (5x5) twenty five treatment combinations were replicated three times. The experiment was laid out as Randomized Complete Block design (RCBD) in a factorial arrangement with three replications. Treatments were assigned to each plot randomly. The size of each plot was ($1.6x2.5m=4m^2$). The distance between plots and blocks were 0.5 m and 1.5 m respectively. Recently released Bread wheat variety Gelan was used as a test crop. The highest rates of Nitrogen (46, 69 and 92 kg N kg $ha^{-1)}$ were splited to 1/3 at planting and 2/3 at tillering. NPSB was used as a source of fertilizer. Field activities such as land preparation and weed control were carried out accordingly.

3. Data Management and Statistical Analysis

Analysis of variance (ANOVA) was done using Gen Stat 15^{th} edition and means comparisons for the significantly different variables will be made among treatments using least significant differences (LSD) test at (0.05) level of significance.

4. Result and Discussion

4.1. Soil Analysis Before Planting

Selected physico-chemical properties of the soil were determined for composite surface soil (0-20 cm) samples collected before sowing (Table 1). Accordingly, the texture of the soil of the experimental site is dominated by the clay fraction. The clay texture indicates the high degree of weathering that took place in geological times and the high nutrient and water holding capacity of the soil.

Soil pH values for both locations varied from 7.7to 6.7 for soils of the experimental sites (Table 1). pH status was categorized as neutral soil. Based on these results the pH value is optimum range for most crop production since most plant prefer the pH range 5.5 to 7.0. Soil Organic Matter values for both locations varied from 2.18 to 1.83 for soils of the experimental sites (Table 1). As the rating range established by [18]. Soil organic matter content categorized under moderate and low for Sinana and Agarfa, respectively.

Soil Total Nitroen values for both locations varied from 0.16 – 0.15. As ratings suggested by [14] for soil total nitrogen soils of the experimental site were rated into low for Sinana and Agarfa. Available Phosphorous values for both locations varied from 6.8-11.7 (Table 1). According to the rating established by [5] the studied soils have low phosphorus content for both locations Sinana and Agarfa.

Cation exchange rating established by [10] the soil of the study sites were high to moderate for sinana and Agarfa, respectively.

Table 1. *Selected soil physicochemical characterization of the experimental locations.*

Locations (Districts)	pH (1:2.5H_2O)	Available P (mg kg^{-1})	Total N%	OM%	CEC (cmol kg^{-1})	Texture
Sinana	7.7	6.8	0.16	2.18	49.24	Clay
Agarfa	6.7	11.7	0.15	1.83	37.38	Clay

4.2. Grain Yield

The ultimate goal in crop production is maximum economic yield, which is a complex function of individual yield components in response to the genetic potential of the cultivars and inputs used.

The analysis result showed that the interaction effect of NPSB and Nitrogen rate significantly affected ($P<0.05$) Grain yield of Bread wheat. The highest grain yield (5347 kg ha^{-1}) was recorded at 150 kg NPSB ha^{-1} and 69 kg N ha^{-1}, while the lowest (2447 kg ha^{-1}) was recorded at Zero kg NPSB and N ha^{-1} (Table 2).

Grain yield of bread wheat increased as rate of NPSB and nitrogen applied increased from the lowest to the highest level, indicating grain yield variation under different fertilizer rate treatments. The highest grain yield at the highest NPSB and N rate might have resulted from improved root growth and increased uptake of nutrients and better growth due to the synergistic effect of the four nutrients which enhanced yield components and yield. Nitrogen enhances the vegetative growth as well as yield whereas phosphorus plays a fundamental role in metabolism and energy producing reaction thus resulting in enhanced grain yield [15]. Tagesse *et al.* (2018) [19] found that the mean grain yield of bread wheat was significantly affected by the application of blended NPS and nitrogen fertilizer rates and the highest mean grain yield (6832 kg ha^{-1}) was obtained from the application of 200/92 kg NPS/N ha^{-1}.

Table 2. *Effects of blended NPSB and nitrogen fertilizer rate on mean plant height and grain yield of bread wheat.*

Plant height (cm)							Grain yield (kg ha^{-1})					
N kg ha^{-1}	0	23	46	69	92	Mean	0	23	46	69	92	Mean
NPSB kg ha^{-1}												
0	91.4	96.1	91.3	96.4	95.7	94.2	2447n	3017l	3508j	3797ghi	3908efg	3335
50	96.1	95.8	97.7	95.9	98.6	96.8	2761m	3578j	3841fgh	4073e	4026ef	3656
100	97.3	99.6	98.1	94.2	98.1	97.5	3257k	3921efg	4366d	4617c	4579c	4148
150	100.3	95.3	96.2	100.3	100.3	98.5	3648ij	3944efg	4530cd	5347a	4828b	4459
200	98.0	99.4	99.2	100.6	94.0	98.2	3663hij	4045e	4491cd	4825b	4826b	4370
Mean	96.6	97.2	96.5	97.5	97.3		3155	3701	4147	4532	4433	
CV (%)			7						6.9			
LSD (0.05)												
NPSB			NS						110			
N			NS						115			
NPSB x N			NS						256			

Means with the same letter are not significantly different at 5% level of significance; NS=Non significant; N=Nitrogen; CV (%) =Coefficient ofvariation (%).

4.3. Bio-mass Yield and Thousand Kernel Weight

The analysis result showed that the interaction effect of NPSB and Nitrogen rate significantly affected ($P<0.05$) Bio-mass yield of Bread wheat. The highest Bio-mass yield (16306 kg ha^{-1}) was recorded at 200 kg NPSB ha^{-1} and 92 kg N ha^{-1}, while the lowest (7422 kg ha^{-1}) was recorded at Zero kg NPSB and N ha^{-1} (Table 3).

Biomass yield increased as rate of NPSB and nitrogen applied increased from the lowest to the highest level. Mean biomass yield ranged from 7422 kg ha^{-1} for the lowest treatment to 16306 kg ha^{-1} for the highest treatment indicating biomass yield variation under the different NPSB and nitrogen rate treatments. The aboveground dry biomass increase with the increase in NPSB rate which might be due to improved root growth and increased uptake of nutrients favoring better growth, tillering and delayed senescence of leaves of the crop due to synergetic effect of the applied NPSB and N fertilizer. Tagesse *et al.* 2018 [19] found that the mean dry biomass of bread wheat was significantly affected by the application of blended NPS and nitrogen fertilizer rates and high biomass yield was obtained from higher blended NPS and nitrogen fertilizer rate application.

4.4. Thousand Kernel Weight

The main effects of NPSB and N were significantly influenced thousand kernels weight of bread wheat. However, the interaction effects did not significantly influence thousand kernels weight of bread wheat (Table 3). The highest thousand kernels weight (45.3g) was recorded by the application of 150 kg NPSB ha^{-1} while the lowest was recorded (34.6g) at zero kg NPSB ha^{-1}. The highest thousand kernels weight (45.6g) also recorded by 69 kg N ha^{-1} while the lowest (37.5g) was recorded at zero kg N ha^{-1}. In general, the highest thousand kernels weight was recorded at the highest NPSB and N rates. The increase in thousand kernels weight with increased rates of NPSB and N fertilizer might be due to the provision of adequate and balanced nutrients which enhanced accumulation of assimilate in the grains, resulting in good grain filling and development of bigger kernels. In line with this result, [17] reported maximum 1000 kernels weights of 49.4 g and 46.6 g for wheat in two consecutive years with the application of 120 kg N ha^{-1}.

Table 3. *Effects of blended NPSB and nitrogen fertilizer rate on mean bio-mass yield and thousand kernel weight of bread wheat.*

Bio-mass yield (kg ha^{-1})							**TKW (g)**					
N kg ha^{-1}	**0**	**23**	**46**	**69**	**92**	**Mean**	**0**	**23**	**46**	**69**	**92**	**Mean**
NPSB kg ha^{-1}												
0	7422m	8728kl	9256jk	10500efg	10417fgh	9264	34.6	36.6	38.9	40.2	43.1	38.7d
50	8506l	9306ijk	10444fgh	11056def	11139de	10090	36.3	38.1	40.2	41.8	43.6	40.0c
100	9394ijk	10500efg	11472d	12372c	12756c	11299	37.8	40.9	44.3	47.0	45.7	43.1b
150	9806hij	10389fgh	11667d	12814c	14500b	11835	39.3	41.3	46.7	50.8	48.3	45.3a
200	9972ghi	11222d	12472c	14639b	16306a	12922	39.7	42.6	45.9	48.1	48.4	44.9a
Mean	9020	10029	11062	12276	13023		37.5d	39.9c	43.2b	45.6a	45.8a	
CV (%)			6.7						4.9			
LSD (0.05)												
NPSB			300.9						0.80			
N			308.9						0.87			
NPSB xN			690.7						NS			

Means with the same letter are not significantly different at 5% level of significance; NS=Non significant; N=Nitrogen; TKW=Thousand kernel weight; CV (%)=Coefficient of variation (%).

4.5. Harvest Index

Harvest index, the ratio of grain to total biological yield, is a measure of the degree to which a crop partitions photosynthetic products into grains [7].

The analysis result showed that the interaction effect of NPSB and Nitrogen rate significantly affected ($P<0.05$) harvest index of Bread wheat. The highest (42%) harvest index was recorded from 150 kg NPSB ha^{-1} and 69 kg N ha^{-1}. The lowest (30%) was recorded by the highest NPSB (200 kg ha^{-}1) and N (92kg ha^{-1}) (Table 4). The reduction in HI at higher rate of NPSB and nitrogen might be attributed to greater vegetative biomass yield production compared to grains yield. Similarly this result is supported by the findings of [19] who reported that harvest index was significantly affected by the interaction of blended NPS and supplemental N rates. Mengel and Kirkby (2001) [15] also reported that harvest indices of modern wheat cultivars normally range from 35.0 to 40.0% which were almost in consistent with this study that ranges harvest index from 30 to 42% (Table 4).

Table 4. *Effects of blended NPSB and nitrogen fertilizer rate on mean seeds per spike and harvest index of bread wheat.*

Seeds per spike							**Harvest index (%)**					
N kg ha^{-1}	**0**	**23**	**46**	**69**	**92**	**Mean**	**0**	**23**	**46**	**69**	**92**	**Mean**
NPSB kg ha^{-1}												
0	44.9	43.8	44.7	45.8	45.3	44.9	33f	35ef	38bcd	36cde	38bcd	36
50	44.7	44.7	44.4	44.2	46.0	44.8	32f	39bc	37bcde	37bcde	36cde	36
100	45.3	44.6	45.8	45.3	46.8	45.6	35ef	37bcd	38bcd	37bcd	36de	37
150	45.9	46.3	45.0	47.3	43.4	45.6	37bcd	38bcd	39ab	42a	33f	38
200	41.7	44.6	44.0	45.3	44.1	43.9	37bcde	36cde	36cde	32f	30g	34
Mean	44.5	44.8	44.8	45.6	45.1		35	37	38	37		
CV (%)			11.6						7.8			
LSD (0.05)												
NPSB			NS						1.0			
N			NS						1.2			
NPSB xN			NS						2.6			

Means with the same letter are not significantly different at 5% level of significance; NS=Non significant; N=Nitrogen; TKW=Thousand kernel weight; CV (%)=Coefficient of variation (%).

4.6. Hectoliter Weight

Hectoliter weight is a measure of the density of the sample and is an indicator of milling yield and it is used as a criterion in grading of grains, especially wheat. The ANOVA results revealed that main effects of NPSB and N rate treatments significantly affected hectoliter weight

(P<0.05) of bread wheat, while the effect of interaction was not significant (Table 5). The highest hectoliter weight (81.9kg hl^{-1}) was recorded by the application of 150 kg NPSB ha^{-1} while the lowest was recorded (77.8 kg hl^{-1}) at zero kg NPSB ha^{-1}. The highest hectoliter weight (82.1 kg hl^{-1}) was also recorded by 92 kg N ha^{-1}which was statistically at par with69 kg N ha^{-1}while the lowest (77.2 kg hl^{-1}) was recorded at zero kg N ha^{-1}. Significantly higher hectoliter weight with the application of NPSB and N fertilizer might be due to the role of balanced nutrients on quality of wheat such as flour yield and protein content as N increases the plumpness and protein content of the cereal grains [2]. In agreement with this result, [1] reported hectoliter weight range of 78.5-81.6 kg hL^{-1} and [8] found hectoliter weight ranging between 81.36 - 83.43 kg hL-1 for durum wheat varieties.

The variation in hectoliter weight reported by different authors might be due to differences in varieties, soil type, climate and agronomic practices as these factors affect hectoliter weight. Nataraja et. al. (2006) [16] indicated that hectoliter weight ranged from about 57.9 kg hL^{-1} for poor wheat to about 82.4 kg hL^{-1} for sound wheat. The current result indicated hectoliter weight range of 77.2 to 82.1 kg hL-1.

4.7. Grain Protein Content

The analysis results showed that main effects of NPSB and N rate treatments significantly affected Grain protein content (P<0.05) of bread wheat, while the effect of interaction was not significant (Table 5).

The highest grain protein content (13.1%) and (13.5%) were recorded from the highest NPSB rate (200 kg ha^{-1}) and nitrogen rate (92 kg N ha-1) in statistical parity with (150 kg ha^{-1}) and (69 kg N ha-1), respectively. Abdo *et al.* (2012) [1] also reported that applied nitrogen increased wheat grain protein content by 20.29 %.

Table 5. *Effects of blended NPSB and nitrogen fertilizer rate on mean hectoliter weight and* ***g****rain protein content of bread wheat.*

N kg ha^{-1}	HLW (kg hl^{-1})						Grain protein content (%)					
	0	23	46	69	92	Mean	0	23	46	69	92	Mean
NPSB kg ha^{-1}												
0	74.7	76.3	78.1	79.6	80.6	77.8d	10.1	10.4	11.4	12.1	12.7	11.3d
50	75.6	78.3	79.4	80.5	80.9	78.9c	10.5	11.2	12.1	12.9	12.9	11.9c
100	76.7	78.8	81.3	82.8	82.7	80.5b	10.8	11.3	12.4	13.2	13.5	12.2b
150	79.4	80.5	82.5	83.7	83.6	81.9a	11.2	12.0	13.1	14.4	14.2	13.0a
200	79.6	80.2	83.3	83.1	82.9	81.8a	11.7	12.4	12.8	14.1	14.4	13.1a
Mean	77.2d	78.8c	80.9b	81.9a	82.1a		10.9d	11.5c	12.4b	13.3a	13.5a	
CV (%)			1.7						4.6			
LSD (0.05)												
NPSB			0.5						0.23			
N			0.6						0.20			
NPSB xN			NS						NS			

Means with the same letter are not significantly different at 5% level of significance; NS=Non significant; N=Nitrogen; HLW= Hectoliter weight; CV (%) = Coefficient of variation (%).

4.8. Economic Analysis

The economic analysis was based on the procedures by [3]. Partial budget and Net benefitl analysis were performed for NPSB and N fertilizer rate and the decision for selecting the profitable treatment was made based on the highest net benefit (Tables 6&7). The Net benefit analysis indicated that 150 kg NPSB ha^{-1} and Nitrogen69 kg ha^{-1} gave the highest net benefit, 146,231and 149,002 Birr/ha, respectively. There for, the best NPSB and N rate for Bread wheat productivity and profitability in the high lands of bale are 150 kg NPSB ha^{-1} and 69 N kg ha^{-1}, respectively.

Table 6. *Partial budget analysis result for NPSB rate study on Bread wheat.*

	Treatments (NPSB kg/ha)				
	0	50	100	150	200
Average yield (kg/ha)	3335	3656	4148	4459	4370
Adjusted yield (kg/ha)	3002	3290	3733	4013	3933
Gross field benefits (Birr/ha)	120080	131600	149320	160520	157320
Cost ofNPSB (Birr/ha)	0	2000	4000	6000	8000
Cost of labour to applyNPSB (Birr/ha)	0	38	75	113	150
Transportation cost of NPSB (Birr/100kg)	0	50	100	150	200
Harvesting, packing and transportation (Birr/ha)	6004	6580	7466	8026	7846
Total costs that vary (Birr/ha)	6004	8668	11641	14289	16196
Net benefits (Birr/ha)	114076	122932	137679	146231	141142

Cost of NPSB 4000 Birr 100 kg^{-1}or (40 Birr kg^{-1} NPSB); NPSB application cost of 50kg NPSB ha^{-1} (Half day); 100 kg (One day): 150kg (One and half day); 200kg (Two days) @ 75 Birr /day; harvesting, packing and transportation 200 Birr per 100 kg; sale price of Wheat 4000 Birr per 100 kg (40 birr/kg).

Table 7. *Partial budget analysis result for Nitrogen rate study on Bread wheat.*

	Treatments (N kg/ha)				
	0	23	46	69	92
Average yield (kg/ha)	3155	3701	4147	4532	4433
Adjusted yield (kg/ha)	2840	3331	3732	4079	3990
Gross field benefits (Birr/ha)	113600	133240	149280	163160	159600
Cost of Urea (Birr/ha)	0	1900	3800	5700	7600
Cost of labour to apply Urea (Birr/ha)	0	50	100	150	200
Transportation cost of Urea (Birr/100kg)	0	50	100	150	200
Harvesting, packing and transportation (Birr/ha)	5680	6662	7464	8158	7980
Total costs that vary (Birr/ha)	5680	8662	11464	14158	15980
Net benefits (Birr/ha)	107920	124578	137816	149002	143620

Cost ofUrea 3800 Birr 100 kg^{-1}or (38 Birr kg^{-1} NPSB); NPSB pplication cost of 50kg NPSB ha^{-1} (Half day); 100 kg (One day): 150kg (One and half day); 200kg (Two days)@ 75 Birr /day; harvesting, packing and transportation 200 Birr per 100 kg; sale price of Wheat 4000 Birr per 100 kg (40 birr/kg).

5. Conclusion and Recommendations

An experiment was conducted with the objectives of assessing the effect of NPSBand N rate on grain yield and yield components of bread wheat. The experimental design was RCBD with three replications. Fiver NPSB rate (0, 50, 100, 150 and 200 kg ha^{-1}) and five Nitrogen rate (0, 23, 46, 69 92 kg ha^{-1}) factor ally combined and replicated three times. The results of the experiment revealed that NPSB and nitrogen rate significantly influenced important bread wheat agronomic traits.

Therefore, from the results of three years data over locations, it was observed that 150 kg ha^{-1}NPSB and 69 kg N ha^{-1}were the most promising and economically feasible NPSBand N rate for production, productivity and quality of bread wheat. Bread wheat producing Farmers in bale highlandsand similar agro-ecologies advised to use *150 kg ha^{-1}*NPSB and *69kg N ha^{-1}*fertilizer rate to realize maximum Bread wheat grain yield.

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Conflicts of Interest

The authors declare no conflicts of interest.

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