YIELD RESPONSE OF BREAD WHEAT (*Triticum aestivum* L.*)*VARITIES TO BLENDED (NPSBZn) FERTILIZER AT WOLISO DISTRICT OBI KOJI KEBELA, CENTRAL ETHIOPIA

M.Sc. THESIS

YILMA DABA NANESSAA

JUNE, 2023

WOLKITE UNIVERSITY, WOLKITE, ETHIOPIA

YIELD RESPONSE OF BREAD WHEAT(*Triticum aestivum L.)*VARITIES TO BLENDED FERTILIZER (NPSBZn) AT WOLISO DISTRICT OBI KOJI KEBELA, CENTRAL ETHIOPIA

YILMA DABA NANESSA

A THESIS SUBMITTED TO THE
DEPARTMENT OF PLANT SCIENCE,
COLLEGE OF AGRICULTURE ANDE NATURAL RESOURSE SCHOOL

WOLKITE UNIVERSITY

IN PARTIAL FULFILLIMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRONOMY

MAJORE ADVISOR:GETACHEW MEKONNEN(PhD, Associate professor)

CO-ADVISOR:WORKU MENGESHA(Assistant Professor)

JUNE,2023

WOLKITE UNIVERSITY,WOLKITE,ETHIO

WOLKITE UNIVERSITY

SCHOOL OF GRADUATE STUDIES

ADVISORS' APPROVAL SHEET-1

(Submission Sheet-1)

This is to certify that the thesis entitled **"Yield Response of Bread Wheat (*Triticumaestivum* L.*)* Verities. To Blended Fertilizer (NPSBZn) At Woliso District Obi Kojii Kebele, Central Ethiopia**" Submitted in partial fulfillment of the requirements for the degree of Master of Science in Agronomy Department of plant science, College of Agriculture and Natural Resource, Wolkite University and is a record of original research carried out by Yilma Daba Nanessa, under our supervision, and no parte of the thesis has been submitted for any other degree, or Diploma. Therefore, we recommend that the student for any requirements and hence hereby can submit the thesis to the department.

Getachew Mekonnen (PhD, Associate Professor) _______________ ______________

Name of Major Advisor Signature Date

Worku Mengesh (Assistant Professor) _______________ ____________

Co- Advisor Signature Date

WOLKITE UNIVERSITY

SCHOOL OF GRADUATE STUDIES

EXAMINERS APPROVAL SHEET-2

(Submission Sheet-2)

We, the undersigned members of the board of the examiners of the final open defense by Yilma Daba have read and evaluated his thesis entitled "**Yield Response of Bread Wheat (*Triticumaestivum* L.*)* Verities. To Blended Fertilizer (NPSBZn) At Woliso District Obi Kojii Kebele, Central Ethiopia**" and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree of **Master of Science** in **Agronomy.**

____________________	____________________	____________________
Name of the Chairman	Signature	Date
____________________	____________________	____________________
Name of Internal Examine	Signature	Date
____________________	____________________	____________________
Name of External Examiner	Signature	Date

Final approval and acceptance of the Thesis is contingent upon the submission of its final copy thesis to the school of Graduate Studies (SGS) through the Department/School Graduate Committee (DGS/SGC) of the candidates Department. of plant Science.

Stamp of SGS **Date__________________**

DEDICATION

This Thesis Manuscript is dedicated to my wife Tsigereda Adane, and my cousin Gosaye Beyecha who in one way or the other contributed whole heartedly to the successful completion of my study.

STATMENT OF THE AUTER

First, I declare and affirm that this Thesis is a result of my own work .I have followed all ethical principles of research preparation, data collection, data analyses and completion of thesis.

This Thesis is submitted in partial fulfillment of the requirements for a Master of Science degree in Agriculture (Agronomy) at Wolkite University and deposited at the university library to be made available to borrowers under rules of university. I seriously declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgment of source is made. Requisites for permission for extend quotation from or reproduction of this manuscript in whole or in part may be granted by the head of department of plant science or the Dean of the school of Graduate studies when in his or her judgment the proposed use of the material is in the interest of scholarship. In all other instances, however permission must be obtained from the author.

Name: Yilma Daba Signature: ___________________

Place: Wolkite University

Date of Submission:___________________

BIOGRAPHICAL SKETCH

Yilma Daba was born on June 19, 1972 to his father Daba Nanessa and to his mother Worke Damea in south west showa, Becho District, Known as Tulu Bollo area, Ethiopia. He attended his primary and junior Education at Fet-Awrarii Habete Georges Abba Mechal Junior secondary School and His secondary Education in Tulu Bollo Hebrit firea secondary school from 1978 to 1989. He joined Holeta Agricultural College in 1994 and graduated in General Agriculture obtained certificate. He has been employed by West Showa Zone agricultural office and worked in the Ameya District for 10 years. After seven years' service of his work, he also joined Bako college of agriculture in 2001 and graduated in 2003, obtained Diploma in plant sciences, The author joined Haremaya University in 2006 and graduated in 2010 obtained B.Sc Degree in plant science. He worked as a department head of Agronomy in south west showa Zone Agricultural office, until he joined The postgraduate studies of Wolkite University in 2019 to study for his master science degree in Agronomy.

ACKNOWLEDGMENTS

First and foremost I praise my almighty God for I did everything through him He gave me strength in my all ups and down during my research work

I would like to thank with due appreciation My Major advisor Dr.Getachew Mekonnen for his constrictive criticisms, consistent guidance and co-operation from the beginning of proposal, throughout the research work at the field and in the preparation of this thesis manuscript. I also appreciates and thanks to my Co-Advisor mister Worku Mengesha for his continued follow up during the proposal development and my thesis write up.

Thanks and appreciations are extended to Wolkite University and the Department of Plant Science staff member especially Ato Germa Woldea for his helpful suggestion and constrictive comments at the time of field work and reminding schedules of graduate Studies at different time.

My special tanks go to Wolkite Agricultural Research center for providing me the seed of bread wheat Varieties and some measurement tools that I used for the experiments.

I am deeply indebted to my beloved wife Tsegereda Adane, that has supported me in countless ways staying with me during my study, also my cousin Gosaye Beyecha that he helped me in many different ways and my friend Tamerat Dajene, Bekele Defar, Geneti Fufa, who were consistently with me with their constructive comments and positive attitude to words my Research.

LIST OF ABBREVATIONS AND ACRONYMS

ANOVA	Analysis of variance
CEC	Cat ion exchange capacity
CF	Conversion factor
CSA	Central Statics Authority
EARO	Ethiopian Agricultural Research Organization
EIAR	Ethiopian Institute of Agriculture Research
FAOSTAT	Food and Agriculture Organization of the United Nations Statistics
HI	Harvest index
LSD	Lest significant difference
MC	Moisture content
RCBD	Randomized Complete Block Design
SSA	Sub-Saharan Africa
SNNP	South Nations Nationalities and Peoples
USDA	United State Department of Agriculture
WANRO	Woreda Agricultural and Natural Resource Office

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

LIST OF TABLES IN THE APPENDIX

Appendix Figure Page

Yield Response of Bread Wheat (*Triticum aestivum* L.*)* Varieties to Blended (NPSBZn) Fertilizer, At Woliso District, Central high Land of Ethiopia

Yilma Daba (B.Sc. Plant Science, Wolkite University)

ABSTRACTS

*Ethiopia is one of the important wheat producing countries. However yield is low mainly due to low soil fertility especially lack of improved verities and climate variability Therefore, a field experiment was conducted at Woliso District during the 2021 main cropping season to investigate the effect of NPSBZn fertilizer levels on wheat growth phenology and yield. The factorial combination of three bread wheat varieties (**Kekeba, Kingbird and Boiyido**) and four rates of NPSBZn fertilizer (0, 50,100 and 150) were laid out in randomized complete block design with three replication. The collected data were subjected to analysis of variance using SAS version 9.2 and the mean separation was computed using the least significant difference at ($p<0.05$). The result showed that the spike length, plant height, thousand kernels weight, above ground biomass and the straw yield were highly significantly ($p<0.01$) affected by the main effects of fertilizer NPSBZn and Varieties. The maximum spike length(8.80) and total dry biomass yield(9751.55kg ha^{-1}), were obtained at the NPSBZn rate of 150kg ha^{-1}.The interaction effect of fertilizer and varieties were highly significant on grain and above ground dry biomass yield. The maximum grain yield (5145.4 kg ha^{-1}) and above ground dry biomass (9718.2kg ha^{-1}), were obtained due to Combination of the highest rates of NPSBZn 150kg ha^{-1} with variety kekeba. In general the economic feasibility of the fertilizer over varieties combination indicated that application of 150 kg ha^{-1} of NPSBZn to king bird variety resulted in maximum marginal rates of return* 3753.92%*The partial budget analyses revealed that the highest net return (*135675.9 Birr *ha^{-1}) with MRR (1872.36%) was obtained from kekeba with the fertilizer application of 150 kg NPSBZn ha^{-1}. Based on this result, tentatively concluded that bread wheat Varity kekeba and NPSBZn rate of 150kg $ha^{-1}$to be applicable for bread wheat production in the study area.*

Keywords: *Blended fertilizer, Bread wheat, Economic feasibility, Grain yield, Main effect*

1. INTRODUCTION

Bread wheat (*Triticum aestivum L.*) with an annual global production of 772.6 million tons, is stable food for more than 35% of the world's population (CSA, 2021) Globally china, India and Russia are the largest wheat producers, while south Africa and Ethiopia are the largest wheat producers in sub-Saharan Africa (USDA 2019)

Global demand for wheat is boosting due to the unique viscoelastic and adhesive attributes of gluten proteins, which facilitate the production of processed foods, whose consumption is increasing as a result of the worldwide industrialization process and the westernization of the diet. Wheat is an important source of carbohydrates. Globally, it is the leading source of vegetal protein in human food, having a protein content of about 13%. The demand for wheat has increased sharply due to human population pressure, urbanization and life style changes (Minot et al. 2015).Wheat productivity in SSA varies across countries where It ranges from 0.7 tons/ha in Burundi to 3.4 tons/ha in mail.

Ethiopia's current wheat production is insufficient to meet domestic needs, forcing the country to import 30 to 50% to fill the gap (Dixon et al., 2009). The low yield is primarily allied with the depletion of soil fertility due to continuous nutrient uptake of crops, low fertilizer use and insufficient organic matter application (Kidane Giorgis, 2015).

Wheat accounts for about 17 % of the total grain production in Ethiopia making it third most important cereal crop after teff (*Eragrostis tef*) and maize (*Zea mays L.)* (CSA 2021) but the annual production is about 5.8 million tons with mean productivity not more than 3 tons per hectare (CSA 2021), which is relatively lower than the attainable yield of the crop, reaching up to 5 tons ha^{-1} (Zegeye et al. 2020) Wheat production and productivity are affected by complex and Collaborative effects of biotic and abiotic influences and depleting soil fertility, low levels and imbalanced use of chemical fertilizers, Limited Knowledge on time and rate of fertilizer applications, economic challenges, particularly in the small holder farming system and wheat Disease, are among the critical biotic factors affecting wheat production in Ethiopia. Other major factors that that Contributed to low wheat yields in are a lack of access to improved varieties, back word agronomic practices (Hei et al. 2017) .To alleviate this all problems understanding plant nutrient requirement of a given area and solving the un availability of modern crop management do have a vital role to increase crop production and productivity. (Anderson and Schneider, 2010).

Oromia, The region characterized by subsistence farming households that largely grow grain. The region economy was based on agriculture, which accounted for 69 percent of the region's growth domestic product and employed 89 percent of the total labor force. Oromia accounts for large part of the country's agricultural exports: Coffee, Legumes and oil seeds. Traditional agricultural methods, rapid population growth, fragmentation of natural resources and farm size decline are some common limitation factors for increasing agricultural production and productivity of the region (Erkossa et. el. 2018)

South west showa Zone was the most productive zone where the majority of the agricultural lands occupied by cereal crops Teff, Wheat, Barley and Maiz which is 75 percent of the total area cultivated. Among those Cereal crops the coverage of wheat reached 25.7 percent with production of 24,762 tons annually, With this regard the amount of blended fertilizer NPSBZn used at Zonal level is not more than 967tons this is 2.09% of the total amount of fertilizer used out of this amount at district level only 201tons NPSBZn has been used for the cropping season of 2020.That of 0.38% of the total fertilizer used.

Wheat is the dominant cereal crop produced with inside Woliso Districts following teff. Due to having appropriate climatic situation. However the low productivity was seen. Annual production in 2020/21 was about 11,171 ha. Which share an area over 42.93% of the total cereal crops produced (WANRO, 2020 annual report). The current average productivity in the area is low when compared to the international; this may be because of shortage of improved varieties and other cultural practices, low in efficient use of full package, low soil fertility, are major constraint of maximum harvest and defect on harvest.

Recently soil inventory data revealed that the deficiencies of most of nutrients such as Nitrogen Phosphorus Sulfur Borone and Zinc are wide spired in Ethiopian Soils.(Ethio-SIS,2013). Therefore, the management of nutrients should be given adequate attention to increase yields and sustain productivity. In this regard, application of other sources of nutrient beyond urea and DAP, especially those containing K, S, Zn and other micro-nutrients increase crop productivity (CSA,2011).Balanced fertilizer containing N, P, K, S, Zn and B in blend form have been recommended to improve site specific nutrient deficiencies and thereby increase crop productivity.(ATA 2014). The Research validation on the effect of blended fertilizer and the response of wheat varieties to the blended fertilizer is lacking around the study area Therefore:

The current investigation to study the responses of blended (NPSBZn) fertilizer on two improved bread wheat varieties is initiated, kekeba and king bird with check (Boyido), which will recommend the efficiency of NPSBZn at the end of the experiment the major objectives of this study were:-

- To investigate the effect of NPSBZn fertilizer levels for bread wheat growth and yield performance at study area and recommend economically feasible fertilizer rats.

The specific objective:

- To determine interaction effect of NPSBZn and verities on growth phenology and wheat yield

2. LITERATURE REVIEW

2.1. Origin of Bread Wheat

Wheat is the universal cereal of old world agriculture (Zohary et al, 2012) and the World's foremost crop plant (Carver, 2009) followed by rice and maize. Bread or common wheat is certainly one of the most essential cultivated plants, in fact, in addition to its ancestry, the cereal represents a great part of the history of agriculture itself. (Bilgic et al.2016). Today, wheat is the foundation of a significant part of the world's diet, being an imperative source of energy providing 20% of calories and protein, as well as vitamins and other beneficial compounds, not only for humans, but also as animal feed. Hawkesford et al. (2013), It is grown from 67° north to 45° south, including a wide range of altitudes, but it is less cultivated in tropical regions (Feldman M., Harlow; 1995). In 2016, more than 749 million tons of this cereal were produced on 220 million hectares around the world, which puts wheat in second place regarding production among the cereal crops (behind maize Zea mays L.) but in the first position regarding area harvested amongst all crops (FAOSTAT 24 Nov 2018).

2.2. Production and Importance of Wheat in Ethiopia

Wheat is one of the most important among all cereals cultivated in Ethiopia. Ethiopia is the second largest producer of wheat in sub-Saharan Africa following South Africa and about 2.1 million hectare of land is cultivated (1.7million ha rain fed and 0.4 million ha irrigated) annually with the total production of 6.7millon tons of grain during cropping season 2020/22 (CSA 2022).in area of production wheat ranks 4th after teff, maize and sorghum and 3rd total grain production after teff and maize and second in yield to maize . It is cultivated by 4.846 million farmers and accounts for more than 15.63% (CSA, 2017) .

Oromia region is the major wheat producer in Ethiopia with 2.6 million tons with the productivity 2.97tons^{-1} from the production area of 898.46hektars (CSA,2017/2018). Bread wheat is mainly grown in eastern Ethiopia. Southern and south west showa of high land and midlands area including Woliso district are ogolcho,king bird , kekeba, wanea, and various local genotypes especially Boyido (south west showa Agricultural office, 20022).

2.3. Agro Ecological Requirements of Wheat

Wheat is one of the most important small cereal crops in Ethiopia widely cultivated in wide range of altitudes. Most wheat producing area in Ethiopia lie between 6o and 16o N latitude and 35^o and 42^o E longitudes of an altitude range from 1500 to 3000 meters above sea level (masl). The most suitable agro-ecological zones, however, fall between 1900 to 2700 meters above sea level (Bekele et al., 2000). Wheat in Ethiopia is produced exclusively under rain fed conditions with rain fall amount ranging from 600 mm to 2000 mm. The temperature required for wheat during growing season is around 15.5°C. The weather should be warm and moist during the early stage of growth and sunny and dry in the later stages. The average temperature of the hottest month should not exceed 20°C. A frost-free period of 100 days is usually required but some fast-ripening varieties may mature only in 90 days.

2.4. Soil Fertility Management and Bread Wheat Production.

In Ethiopia the yield gap of more than 3 tons ha^{-1}, suggests the potential for rising production through better soil and crop management practices, mainly increased use of fertilizers and ample soil fertility maintenance program. Permanent cropping and insufficient substitute of nutrients removed in crop harvest or lose through erosion and leaching has been the key causes of soil fertility refuse (van Beek et al., 2016). This is particularly evident in the intensively cultivated high-potential areas that are mainly concentrated in the highlands of Ethiopia (Hillette et al., 2015).

Nutrient balances in the highlands of Ethiopia, typically the high potential areas for agricultural productions are currently exposed to severe nutrient depletion (Van Beek et al., 2016). Studies on nutrient cycles in the Central highlands of Ethiopia revealed that the nutrient balance in different soil fertility classes varied from -20 to -185 kg N, from +11 to -83 kg P and from +23 to -245 kg K ha-1 yr-1 (BaleshTulema, 2005), and the average annual soil loss from agricultural land is estimated to be 137 tons ha-1 yr-1, which is approximately an annual soil depth loss of 10 mm (Gete Zelleke et al., 2010). These indicate that major nutrients outflows far exceed inflows in a range of soil types which results negative nutrient balances. Yet, agricultural production is increasing which benefits farmers' livelihoods and contributes to food security of the country as a whole, but at the expense of the natural resource base (Van Beek et al., 2016).

Upholding of soil fertility at levels which are economically most advantageous in the long run, given the fruitful potential of the land as determined by water availability and other climatic factors are essential for sustainable agriculture. With this condition, soil fertility management studies have been started in Ethiopia with large emphasis on inorganic fertilizers appliance mainly Urea and DAP some five decades ago. Earlier wheat soil fertility research achievements in the country (Asnakew Woldeab, 1991)

2.5. Characteristics of the improved wheat Varies recommended in the area.

Improvement of end-use, grain and straw quality in wheat depends on a thorough understanding of the influences of environment, genotypes and their interaction. The protein composition of wheat seeds is essential in decisive determining bread-making quality (Johansson et al., 2001).

Gluten proteins, a large complex composed mainly of glutens and gliadins play a key role in baking quality because of their impact on water absorption capacity of the dough, dough stretchiness and extensibility that can influence wheat flour quality (Torbica et al., 2007). The protein substance in the wheat grain is dependent on genotype, but, it is also obviously influenced by environmental variables such as nitrogen appliance, water access and temperature in growth especially through the grain filling stage.(Tea et al., 2004).

Proper soil nutrient management is useful to increase the overall performance of cropping systems, provide economically optimum nourishment to the crop, and minimize nutrient losses from the field and supporting agricultural system sustainability. Cropping system, soil and water management, use of appropriate N fertilizer source and rate based on crop variety and soil type are among the main management options to increase N fertilizer use efficiency (USDA, 2011). In addition, use of slow N releasing fertilizers, nitrification inhibitor, N efficient species or genotypes, and disease, insects and weeds control are also important factors to be considered to improve N use efficiency (Fageria, 2009). Nutrient use efficiency addresses a few but not all aspects of crop performance (Mikkelsen et al., 2012).

Nutrient use efficiency may be defined as the same time as yield per unit fertilizer input or in terms of revitalization of fertilizer applied. It can also be defined as the nutrient recovered in the above ground part of the plant. The applied N recovery often varies between 40 and 60% in most cropping systems (Mikkelsen, 2005). Fertilizer N recovery efficiencies from researcher managed experiments for major grain crops range from 46 to 65% as compared to on-farm N recovery efficiencies of 20 to 40% (Roberts, 2008). Improved nitrogen use efficiency is vital for sustainable crop production and environmental health. The Low and unbalanced fertilizers application together with poor soil fertility management is presented as the major case for low agricultural productivity in Ethiopia (Hailu et al. 2015). Under such conditions, the application of multi nutria blended fertilizers is acknowledged for being able to enhance the productivity and nutrient use efficiency of crops (Elias et al.2019).

2.5.1. Effect of NPSBZn fertilizer on wheat productivity

Wheat responds well to fertilizer application with balanced nutrients for increased wheat productivity. Fertilizer is the most important inputs which contributes significantly towards fine grain yield of wheat and exploit the inherited potential of cultivar, but productivity wheat for long time was low due to the absence of essential /unbalanced crop nutation /

To overcome this problem ministry of agriculture and natural resource introduced different balanced fertilizer according to soil balanced fertilizer NPS, NPSB, NPSBZn which replace DAP (Abebual, 2019)

Phosphorus has lower mobility than any other nutrients and it does not remain in a free state for long in which it is slowly available to plants, plants in phosphorus deficient have showed stunted growth its deficient in wheat caused reduced tillering, and leaf areas and increases susceptible to disease .Marschner,H.(1995). It is a necessary nutrient for the normal development of plant It plays an important role and number of functions in the plant growth (Kaleem et al., 2009) and Boron is essential for cell membrane integrity and improvement of the cellular defence mechanism (Xuan et al.2001) also Zinc up take, root to shoot translocation, internal utilization efficiency were grain yield is measured, remobilization to grain. Plant response to Zn diffidence. And plant response to Zn deficiency are complex and operate at different level of plant organisation, from molecular responses to differences in plant morphology and development.(Garahamand Rengel,1993)

3. MATERIALS AND METHODS

3.1. Description of study areas

The experiment was conducted at Obbi Koji Kebele, South West Showa Zone Woliso District. The soils of the study area is silt loam in texture. The area lies from 8^{0}34’16’’N and 37^{0} 59’59’’E. The average temperature of the area is 23°C and, the elevation of the sit are 2110meters above sea level. The area receive an average annual rain fall of 900mm.

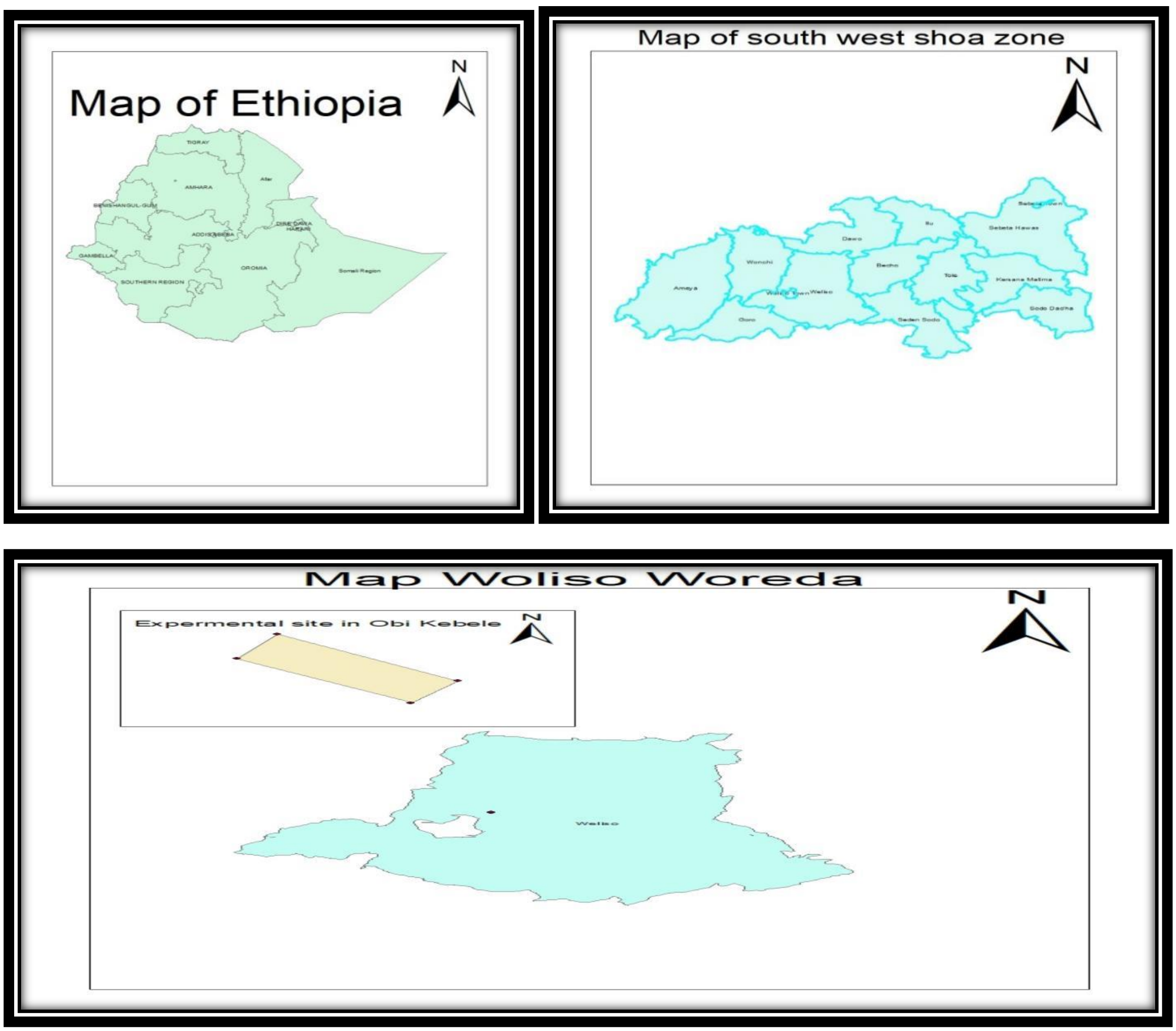

Figure 1. Map showing the experimental site,Woliso Woreda, South West Showa Zone Central Ethiopia.

3.2. Experimental Materials

Experiment were carried out using two improved wheat varies kekeba, king bred, and the check used as planting materials. Different rats with (0, 50, 100 and 150) NPSBZn and urea was constant.

These varieties are selected based on their adaptability to agro-ecological zone of the area.

Table 1 Improved variety with its adaptability

No ti	**Varieties**	**Year of release**	**Area of adaptation**	**Maturity day**	**Rain fall(mm)**	**Productivity ($kg.ha^{-1}$)**
1	Kekeba	2010	Midland, kola	90-120	500-800	33-52
2	King bird	2015	Midland, kola	90-95	500-850	40-50

Source: Kulumsa Agricultural Research Center (KARC),Wheat Breeding program(2017)

3.3. Soil sampling and Analysis

The Soil samples were taken from different location at depth of 0-20cm were collected using auger and with plastic sheets throughout the experimental field before sowing the crop and mixed together as a composite sample to asses some physical and chemical properties of N, P,S,B, and Zn and air dried, cleaned of any stones and plant residues. And analyzed at Wolkite soil laboratory and Melkasa agricultural research center. The PH (H_2O) of the soil was determined during soil samples test by using PH meter, The electro conductivity (EC) was determined by using soil water ratio, Soil texture was analyzed by Bouyoucose hydro meter method Bouyoucos (1936), Available P was determined using Olsen strategy by extracting the soil sample with 0.5M sodium bicarbonate at PH 8.5(Olsen and samners,1982). Soil organic carbon was determined following the Walkrly (1947) procedure. The soil Zinc content was extracted with dietherence T riamicpenaactic acids(DTPA) and determined by Atomic absorption Spector photo meter (Lindsay and Norvell 1978).Total N was determined by Kjeldal method, Borone was first isolated (1808) by French chemists Joseph-Louis Gy-Lussac and Louuis-Jacques Thenard, was determined by heating (B_2O_2) with potassium metal. The impure amorphous product, a brownish black powder, was the only form of boron. S was determined by fumigation experiment wind and adequate soil moisture

3.4 Treatments and Experimental Design

Four level of blended fertilizer rates was combined with three types of Varieties (Kekeba,Kingbird and Boyido)

The two factors were arranged in factorial combination using Randomized Couplet Block Design (RCBD) with three replication. The gross plot area was 37m x 11m (407m^2),net area of 283.5m^2**,** 3m x 2.625m=7.87m^2 were arranged in each plot size with 13 rows and the spacing between rows, plots and blocks was 0.20m, 0.50m and 1m apart respectively

Table 2. Treatment Combinations

Treatment No	Varieties	Blended Fertilizer rate(NPSBZn) (Kg ha-1)
1	Check(Boyido)	0
2	Check(Boyido)	50
3	Check(Boyido)	100
4	Check(Boyido)	150
5	Kekeba	0
6	Kekeba	50
7	Kekeba	100
8	Kekeba	150
9	King bird	0
10	King bird	50
11	King bird	100
12	King bird	150

3.5 Experimental procedure and Management

Experimental field were ploughed 3 times, 7 days interval by oxen and harrowed. Experimental units or Plots was leveled manually. The Layout were designed and prepared with quadrate method and divided it plot by plots and The seed was sowed at 20cm of inter row spacing with 3-4cm planting depth and were covered with fine soil after sowed, and the blended fertilizer NPSBZn was drilled in rows at different rate of experimental plots and mixed with soil at planting and the urea was applied one third (1/3) that is 39.33g/plot at planting and the rest was top dressed at crown root initiation stage which is one month after sowing

Field inspection was under taken from a week after planting up to harvesting to check that what the plant needs. All necessary agronomic practices like 1st weeding was don one month after sowing which helps to save unnecessary consumption of micro nutrients applied for wheat. 2nd weeding was don at near to plant elongation 70 days after sowing. Protecting from disease and pest was undertaken as required the major wheat pests Aphids, Cut worms and army worms, this all can't be seen at the experimental site but as soon as some of diseases symptoms of loose smut was seen which is ears were filled with black fungal powder rejected by hand picking before wind carries away the powder. Harvesting and threshing was done were at the time of just the stem below the spick turn yellow from green manually cut at the base of the soil. Threshing was under taken by beating the cut plants in bundles within sack until the grain not to remain in wheat ear.

3.6. Data Collected

3.6.1. Pheonological data:

Data on agro morphological treats of wheat verities were collected on plot and plant bases according to Dargicho et,al, (2015) and description for wheat.

Days of 50% Emergence: was determined from the time of sowing until above 50% germination.

Days of 50% heading: The number of days taken from planting to 50% of plants from each plots produces spike by visual observation.

Days to 90% physiological maturity: Days to physiological maturity was recorded as the number of days from date of sowing till 90% of the plants changed their green color to yellowish, in each plot.it was recorded when no green color remained on panicles of the target plants.

3.6. 2. Growth Parameters

Leaf Area : was determined by measuring the length of the leaf from the base to the tip and the width of the leaf from ten plants from each plant three leaves in each plot and will be determined as length x width x 0.8 at the flowering stage.by using leaf area measurement caliper

Plant Height: was measured in cm from ground level to the tip of the spike excluding the awn of ten randomly taken plants from the middle four rows of each plot. And the mean values recorded

Spike length: The main spikes from the ten sampled plants from the central four rows of each plot were measured in cm and averaged to represent the spike length in cm (excluding own).

3.6.3. Yield and Yield Components Data

Number of Productive Tillers/plant: Number of Productive tillers per plant excluding the main plant was recorded at maturity and expressed as an average of ten plants

A number of spikelet's per spike: was recorded by counting the number of spikelets on each spike on the main tiller of each plant and was expressed as an average of five plants in a plot.

Number of Kernels per spike: Total number of grains in the main spike was counted at the time of harvest from ten randomly taken plants and to be expressed as an average and recorded from central rows of each plot.

Biomass yield per hectare: Biomass weight was taken after harvesting from the whole plant parts, including leaves and stems, and seeds from the whole plot.

Straw yield per hectare: After threshing and measuring the grain yield, the straw yield was measured by subtracting the grain yield from the total above-ground biomass yield.

Grain yield per hectare: Grain yield was measured by harvesting the crop from 11 rows in the net middle plot area of 5.785m^2 to avoid border effects. Then the grain yield of each treatment was adjusted to the standard moisture level by computing the conversion factor for each treatment to get the adjusted yield using the following formula (Biru, 1979):

$$\textbf{Conversion factor (C.F)} = \frac{(100-Y)}{(100-X)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Y is actual moisture content and X is the standard moisture content to which the yield is to be adjusted (for cereals the standard moisture content is 12.5%).

$$\textbf{Adjusted yield} = \text{C.F} * \text{Grain yield} \text{--} \ (2)$$

Harvest index (%): The harvest index was calculated as the ratio of grain mass to the total above ground biomass and expressed in percentage (Singa, 1977)

Mathematically, HI= (GY/BY)*100=where GY= Grain yield and BY=Biomass yield (Above ground biomass yield)

Thousand seed weight: The number of grain was counted by grain counter machine and the thousand counted grain was weighed and taken as thousand grain weight. The Moisture content of grain were determined by simple moisture tester. Which was adjusted to 12.5% of standard moisture content of bread wheat moisture level.

3.7. Statistical analysis

The data were subjected to analysis of variance (ANOVA) as per the design used in the experiment using statistical software (SAS 9.2) and interpretation was made following the procedure of Gomez and Gomez, (1984). Mean separation was conducted using the least significant difference test (LSD) to evaluate the different blended (NPSBZn) levels on Bread Wheat varieties at a 5% level of significance. The correlation analysis was performed to determine relations between phonological, growth parameter, and yield and yield components as influenced by blended (NPSBZn) application rates

3.8. Partial budget Analysis

A partial budget analysis (The economic analysis) was carried out by using the methodology described in CIMMYT (Centro International de Mejoramiento de Maiz y Trigo).1988. in which harvesting market price for inputs at planting and for out puts at harvesting were used all costs and benefits were calculated in hectare basis in Birr.

Actual yield was adjusted downward by 10% to reflect the difference between the experimental yield and the yield of farmers could expect from the same size field.

Adjusted grain yield (AGY) (kg ha^{-1}) was the average yield adjusted downward by a 10% reflect the difference between the experimental yield and yield of farmers.

Gross field benefit (GFB) (ETB ha^{-1}) was competed by multiplying field gate price that farmers receive for the crop when they sell it as GFB=AGY x field price per unit of the crop.

The net benefit (NB) was calculated as the difference between the gross field benefit and the total variable (TVC) using the formula NB=GFB-TVC

Marginal rate of return, which refers to net income obtained by incurring a unit cost of fertilizer and application of each ferti+lizer rate. Based on net income, % marginal rate of return (MRR) was calculated using the formula

MRR (%) =$\frac{(change\ in\ NB\ (NBb-NBa)}{cange\ in\ TCV\ (TVCb-Tvca)}\ x\ 100$

Where $NB_{a.}$=NB with the immediate lower TVC, NB_b = NB with the next higher TVb, TVCa= the immediate lower TVC and TVCa = the next highest TCV.

Total variable cost (TVC) (ETB ha^{-1}) was calculated by summing up the cost that vary including the cost of NPSBZn, UREA and the application cost. The cost of each variable was as follows; NPSBZn (Birr 19.90kg^{-1}); urea (Birr 16.20 kg^{-1}) and bread wheat seed (Birr 33.40kg^{-1}) of improved variety and (Birr 25 kg^{-1}) of local variety during sowing time (July 19, 2021). The labor cost for application of NPSBZn and urea at sowing was 7 persons ha^{-1} each 100 ETB day^{-1}, and the second split application of urea was 6 persons ha^{-1}, each 100 ETB day^{-1}.

The costs of other inputs and production practices such as labor cost for land preparation, planting, weeding, harvesting and threshing were considered the sum of all treatments or plots. The average open price of wheat grain at Woliso market was Birr 30 kg^{-1} and stow price was Birr 1.75 kg^{-1} in January 2022 during harvesting time

The dominance analysis procedure as described in CIMMYT (1988) was used to select potentially profitable treatments from the range that was tested, the discarded and selected treatments using this techniques were referred to as dominated and un-dominated treatments, respectively. Then the treatment with the highest net benefit and marginal rate of more than 100% was considered for the recommendation as described by CMMYT (1988).

4. RESULTS AND DISCUSSION

4.1. Soil physic– chemical Properties of The experimental site

Soil physic-chemical properties indicated that the soil textural class was loam with particle size distribution of 45% sandy, 20% clay and 35% silt (Table 3). According to Hailu (1991), soil types used for wheat production vary from well-drained fertile soils to water logged heavy vertisols. Thus, the soil of experimental site is suitable for the production of wheat the pH of the soil was 6.4, which is slightly acidic (Ethiosis, 2013), FAO (2000) reported that the preferable pH ranges for most crops and productive soil are 4 to 8 Mengle and kirby (1996), reported optimum pH range of 4.1 to 7.4 for wheat production. Thus, the pH of the experimental soil was within the range for productive soils for wheat.

The soil of the study site had 1.77% organic carbon (OC) Table 3 which is according to the rating of Tekalign (1991), Who rated soils having OC value in the range of 0.8 to 2.59% as low, indicating low potential of the soil to supply nitrogen to plants through minimization of organic carbon Low amount of organic carbon might be due to through low addition of crop residues so that the study area needs the bio-mass of wheat incorporates with the soil to enhance the soil organic carbon rather used to animal feed.

The analysis shows that The available P of the soil was 5.58.mg kg^{-1} (Table 3).Indicated range of available phosphorus has been established by Olsen *et al*. (1954), As <5 mg kg^{-1} (very low), 5-15 mg kg^{-1} (Low). 15-25 mg kg^{-1} (Medium), >25 mg kg^{-1} of soil (high). Thus the soil of the experimental site was considered as 5.58mg/kg^{-1}in available P content. The medium available phosphorus in the soil is not satisfactory to get potential yield from the crop. So, it is important to apply phosphorus fertilizer from external source based on the recommended rates. The analysis of available sulfur value of the study area was 11.12mg.$kgha^{-1}$ (Table 3) based on Ethio-SIS soil classification for sulfur value lies on low rang. The classification is <9 is very low, 10-20 low, 20-80 optimum, and > 80mg kg^{-1}. So, addition of sulfur contained fertilizer is important. This low in sulfur content of the soil may be due to loss of OM or lack of using S mineral fertilizer.it also related to continued cultivation which result intensive mining of S from the soil. The results of the analyses also indicated that the soil has 0.35mg kg-1 boron according to the range of Horneck *et al*. (2011)

Catain Exchange Capacity (CEC) is an important parameter of soil, because it gives an indication of the type of clay mineral present in the soil and its capacity to retain nutrients against leaching according to Bouyoucos (1936), according to landon (1991) top soil having CEC greater than 40 cmol (+) kg^{-1} as rated as very high and 25-40 cmol (+) kg^{-1} as high and 15-25,5-15,and <5 cmol (+) kg^{-1} of soil are classified as medium, low and very low respectively in CEC. According to this classification the soil of the experimental site had (21.3 cmol (+) kg^{-1} soil) indicating its medium capacity to retain actions.

Table 3. Selected physico- chemical properties of the experimental site of the soil before sowing during 2021 min cropping season

Parameter	**unit**	**Values**	**Rating**	**Reference**
Soil texture Sand	(%)	45		
Clay	(%)	20		
Silt	(%)	35		
Texture class		Loam		
pH (1:2.5H2O)	(%)	6.4	Medium	Tekaligh(1991)
Total N	(%)	0.11	Low	Tekaligh(1991)
Organic Carbon	(%)	1.77	Low	Tekaligh(1991)
CEC	(Cmol(+)/kg)	21.3	Medium	Landon(1991
Available phosphorus	$mgkg^{-1}$	5.58	Low	Olsen(1954)
Available Sulfur	$mgkg^{-1}$	11.12	Low	Olsen(1954)
Available Boron	$mgkg^{-1}$	0.35	Low	Berger and Truog(1939)
Available Zinc	$mgkg^{-1}$	2.06	Low	Bereket H(2011)

4.2. Effects of Blended Fertilizer Rates and Variety on phenological Parameters

4.2.1. Leaf area

The results showed that the main effect of blended NPSBZn fertilizer was highly significant ($p \leq 0.01$) and the verities and its interaction with blended fertilizer had no significant ($p \leq 0.05$) effects on Leaf area. The highest (22.88) mean Leaf area was recorded from 150 kg ha^{-1} blended fertilizer rate however the lowest (20.28) mean was obtained from the control treatment that was local Varity with no blended fertilizer. (Table 4) The leaf area index increment observed with the blended fertilizer application might be attributed due to better photo assimilate supply associated to combination macro and micro nutrient like B and N used for high vegetative growth that enables the plants to have broader leaves (Brady and weil, 2008).The result was also in line with the findings of salam et al. (2004) who reported that, application of B resulted in increased plant growth, Leaf area index, root length of crop. Also N resulted in more foliage and promoted photosynthetic action, P has a role in the synthesis of cellulose which is leading to the expansion of leaves.

4.2.2. Days to 50 % heading

The analysis revealed that highly significant ($p \leq 0.01$) differences was observed with the main effect of Fertilizer rate and Varsities on days of 50% heading ($p \leq 0.05$) however, non-significant effect was observed due to the interaction effect. The longest days to 50% heading (66 days) was recorded from blended fertilizer rate of 150kg^{-1}while the shortest days (62days) were recorded from non-fertilized (Table 4) .The variation in days to 50% heading among the blended fertilizer rats could be credited to the high level of N in NPSBZn fertilizer Considering varieties the longest days to 50% heading (66 days) was observed from the variety kekeba and while the lowest (64 days) was recorded with local variety The result is in conformity with Makonnen (2005),who reported that, days to heading was significantly delayed when N fertilizer was applied, compared to the lowest rate. Radhid et al, (2007) also reported that NP application significantly increased days to heading of barley.

4.2.3. Days to 90% Physiological maturity

The main effect of varieties and fertilizer rates had showed highly significant ($P<0.01$) effect on days to physiological as showed (Table 4).However the interaction did not show significant effect on days of physiological maturity. The longest days to physiological maturity (100.88 days) was recorded at the NPSBZn fertilizer rate of 150 kg ha^{-1}on the variety of kekeba and kingbird as compared to check variety (Boyido) no blended NPSBZn fertilizer was obtained from (89 days). Generally, the number of days to physiological maturity recorded at the highest rate of NPSBZn was significantly higher than that of unfertilized plot and lower rate of NPSBzn fertilizer. The Number of days required to 90% physiological maturity varied between 105 for variety kekeba and kingbird to 94.88 for check variety (Boyido) (Table 4). The highest significant difference between verities might be due to genetic difference among the varieties with the favorable environmental conditions and as a result there is difference on enhancing or delaying the physiological maturity among wheat varieties. Current findings has corroborated with the findings of Beena et al.(2012) reported significant effect of physiological maturity among wheat Varity. The increase in days of maturity of wheat at higher rate of NPSB fertilizer. The nutrients interaction and synergetic effect of them, especially N and S. Nitrogen is involved in all major processes of plant development and yield formulation. Besides, a good supply of nitrogen the plant stimulates root growth and development as well as up take of other nutrients (FAO,2000; Bardy and Weil,2002).An adequate supply of N is associated with high photosynthetic activity, various vegetative growth, and dark green color as result it delayed the crop maturity. On the other hand sulfur is essential element best role in the synthesis of proteins, oils, vitamins and flavored compounds and it is essential not only for plant growth but also enhances other nutrients use efficiency.

The current result is in line with the study by Melesse Harfe(2017) who reported the increasing the N/P fertilizer from zero level to 69/30 kg N/P_2O_5 ha^{-1} for wheat, prolonged the physiological maturity from 124.87 to 127 days.

4.2.4. Plant height:

The result showed that, the main effect of fertilizer and Varieties had highly significant ($p<0.01$) effect on plant height. The interaction effect of varieties and fertilizer rates was not significant. The tallest plant height value of 93.26cm, was recorded from kekeba, the check variety (boyido) and king bird variety had plant height 86.25cm and 89.89cm.respectively.(Table 4).

In case of fertilizer plant height was reduced at the lowest fertilizer rate Abebaw and Hirpa, (2018) reported that blended fertilizer and sowing method significantly affect plant height. With regarding to this the experimental value showed the highest 93.52 cm was recorded from 150kg ha^{-1} blended NPSBZn fertilizer, while the lowest 86.37cm plant height was observed from treatments that receive 0kg fertilizer, as indicated that increasing the blended fertilizer increases plant height.

On the other hand, the least plant height in un fertilized plot might have been due to low soil fertility level that result low height in plant, plant growth and development may be retarded significantly if any of nutrient elements is less than its threshold value in the soil or not adequately balanced with other nutrient elements (Landon,2014)

Abebual *et al (2019)* showed that there were significant variation ($P < 0.001$) among the fertilizer types on wheat height. Application of fertilizer highly significantly increased plant height as compared to the local Varity. The increment in plant height might be due to increase in cell elongation and more vegetative growth attributed to different nutrient content of blended fertilizer containing NPSBZn and micro nutrients. Additionally sulfur is one of the essential nutrient and it accumulates 0.2 to 0.5% in plant tissue on dry matter basis. It is required in a similar amount at that of phosphorus, Ali et al, (2008). It is also building block of protein and key ingredient in the formation of chlorophyll

Table 4. Main effect of varieties and fertilizer rats on Leaf area (LA), Plant highlight (PH), Days of heading (DH), Days to Maturity (MD)of bread wheat as influenced During 2021cropping season.

Varieties	**LA**	**DH**	**DM**	**PH(cm)**
Local (Boyido)	20.75^{b}	63.5^{b}	98.66^{a}	89.85^{b}
Kekeba	22.70^{a}	65.58^{a}	100.75^{a}	93.26^{a}
Kingbird	22.06^{a}	64.91^{ab}	95.75^{b}	86.25^{c}
LSD (5%)	0.79	1.64	2.5	2
Fertilizer rates(kg ha^{-1})				
0 kg NPSBZn ha^{-1} + 150 kg Urea ha^{-1}	20.28^{c}	62.22^{b}	94.88^{c}	86.37^{b}
50 kg NPSBZn ha^{-1} + 150 kg Urea ha^{-1}	21.41^{b}	65.00^{a}	98^{b}	87.71^{b}
100 kg NPSBZn ha^{-1} + 150 kg Urea ha^{-1}	22.77^{a}	65.22^{a}	$99.77a^{b}$	91.55^{a}
150kg NPSBZn ha^{-1} + 150 kg Urea ha^{-1}	22.88^{a}	66.22^{a}	100.88^{a}	93.52^{a}
LSD (5%)	0.91	1.89	2.88	2.3
CV	4:02	3:00	3:00	2:63

4.2.5. Number of productive tillers:

Tillering refers to the growth of lateral shoots from axillary meristems at the plant base poaceae species such as wheat (Assuero and Tognetti 2010). The result showed number of productive tillers per plant were significantly ($P<0.01$) influenced by interaction effect varieties and fertilizer rate. The lowest numbers of productive tillers **(3)** were recorded for check variety (Boyido), The result in agreement with that of Abdullatif, et al.(2010) who reported that increasing in the number of effective tillers with nitrogen fertilization.

Tillering may affect wheat yield positively or negatively depending on the availability of natural resources such as water, light and nutrients (Elhani et al, 2007). Accordingly the result indicated kekeba and king bird (6.66). The highest result of king bird and kekeba were improved by (45.5%) as compared to the lowest number of productive tillers per plant of local variety (Boyido)

Table 5. The productive tillers of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and variety

	Blended NPSBZn (kg ha-1)			
Variety	0	50	100	150
Local (Boyido)	3^{e}	3.66^{e}	3.66^{e}	5.66^{bc}
Kekeba	5.33^{cd}	$6ab^{c}$	6.33^{ab}	6.66^{a}
Kingbird	3.66^{e}	$6ab^{c}$	6.33^{ab}	6.66^{a}
LSD (0.05)	0.94			
CV (%)	10.44			

Means in columns and rows followed by the with the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.2.6. Spike length:

The main effect of NPSBZn and varieties had highly significant ($p<0.01$) effect on spike. Length of bread wheat, while the interaction of fertilizer rates with varieties was significant ($P<0.05$) effect. The result showed Increasing the rate of fertilizer NPSBZn increased spike length Thus, the longest spike length (8.80 cm) were obtained at the rate of 150kg NPSBZn ha^{-1},while the shortest spike length (6.83cm) were recorded at the rate of 0 kg NPSBZn ha^{-1} . The increase in spike length at the highest NPSBZn might have been resulted from improved root growth and increased up take of nutrients, better growth and activate cell division due to availability of adequate crop nutrients. Khan et al, (2000) reported that spike length is genetic charters of variety, which is less influenced by agronomic practices.

Table 6. Mean spike length (Cm)/spike) of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and varieties

Variety	Blended NPSBZn (kg ha-1)			
	0	50	100	150
Local (Boyido)	6.83[g]	7.46[ef]	8.2b[c]	8[cd]
Kekeba	8.2b[c]	8.6[ab]	8.53[ab]	8.8[a]
Kingbird	7.2[fg]	8[cd]	7.73[de]	8.06[cd]
LSD (0.05)	0.44			
CV (%)	3.27			

Means in columns and rows followed by the with the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.3. Yield and Yield Components

4.3.1. Number of kernels per spike

The result reveled that fertilizer rates and Verities showed highly significant ($P<0.01$) effect with respect to the number of kernels per spike. However, the interaction between the two factor ($p<0.5$) was significant effect

Varity kekeba showed the highest average number of kernels per spike (42.33).while, verities king bird and check variety (Boyido) had 41.33 and 40.33 respectively significantly lower number of kernels per spike with the same rate of fertilizer. The difference in between the verities might be due to genetic variability's among verities due to genetic difference among the varieties. With this result knezevic *et a*l, (2012) reported that highly significant among the tested experiments for number of kernels per spike with largest impact belongs to the genetic variability (63,92%).

Spike length is the most important yield components as increased spike length would have more number of spikelet's per spike and subsequently higher grain yield (Abdelkhalik 2019)

The effect of fertilizer also showed the highest number of kernels per spike (42.33) was recorded from NPSBZn fertilizer rate of 150kg ha^{-1}(Table 7) such response can be attributed to the adequate nutrient availability which might facilitate the tillering ability of the plants(r=0.69455**), resulting in a greater spike population. This result agreed with the study by Jan and khan (2000) who observed significant effect of nitrogen application on grain number per spike. Similarly Rehaman et al, (2008) stating that number of grain per spike was significantly increased with each increment of NPK fertilizer. Geleto et al, (1995)

Table 7. Number of kernels per spike of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and variety

Varieties	Blended NPSBZn rates (kg ha-1)			
	0	50	100	150
Local (Boyido)	30.33^{d}	31.33^{d}	36.33^{c}	40.33^{abc}
Kekeba	38.66^{abc}	30.33^{d}	39^{abc}	42.33^{a}
Kingbird	30.33^{d}	36.33^{c}	38^{bc}	41.33^{ab}
LSD (0.05)	2.312			
CV (%)	6.41			

Means in columns and rows followed by the with the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.3.2. Thousand Kernel weight (g):

Thousand kernel weight is a measurement of seed size. As its name indicates, the weight of 1,000 seeds. Knowledge of this seed characteristic is important to seeding management decisions, crop establishment, and thus, yield potential.

The result reveled that fertilizer rate and the interaction effect of fertilizer with variety showed highly significant ($P<0.01$) effect on Thousand kernels weight while the varieties showed significant ($P<0.05$) difference Varity kekeba was the highest mean thousand kernels weight (34.33) and the lowest (24.33) Local (Boyido) (Table 8) this might be due to good grain filling period and favorable environmental condition increases the thousand seed weight differ among the verities. In line with this result the significant variation with the highest 42.9g and lowest 39.59g thousand seed weight among the verities was reported by Fayera et al.(2014) reported that thousand grain weights had significant difference with application of micronutrient's in blended form(Zinc + Boron).

The effect of fertilizer rate showed that the highest thousand kernels weight (34.53) was recorded from NPSBZn fertilizer rate of 150 kg ha^{-1}rate while the lowest thousand kernels (23.88) weight was obtained with the 0 NPSBZn fertilizer application (Table 8) This may be due to the provision of balanced nutrients application had enhanced the accumulation of assimilate in the grain and thus resulting in heavier grains of wheat. This could also due to adequate and better nutrition of the plants resulting in good grin filling and development of better seed size. The fact that higher amount of nitrogen application resulted in higher grandee of weight gain in grain filling stage in kernels and there by thousand kernel weight increased. (Kauser, k, M. at el.,1993)

Table 8. Thousand Kernel weight (g) of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and varieties

Varieties	Blended NPSBZn (kg ha-1)			
	0	50	100	150
Local (Boyido)	24.33^{e}	31.73^{abcd}	31.40^{bcd}	32.53^{bcd}
Kekeba	30.91^{cd}	29.46^{d}	32.86^{abc}	34.23^{a}
Kingbird	23.88^{e}	33.06^{abc}	34.33^{a}	33.73^{ab}
LSD (0.05)	1.60			
CV (%)	5.27			

Means in columns and rows followed by the with the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.3.3. The above ground dry biomass (kg ha^{-1}):

The above ground biomass is widely used agronomic parameter for characterizing crop growth status and predicting grain yield.

The analysis of variance showed that the main effect of Varities, fertilizer and the interaction effect of varieties with fertilizer also were highly significant ($p<0.01$). on above ground biomass yield. Variety kekeba produced the highest above ground dry bio mass yield (9718.2kg ha^{-1}) while the lowest bio mass (6164.6kg ha^{-1}) was produced from Local variety (Boyido). (Table 9). This might be due to increase number of tillers per plant, (r=0.83501**), increase of leaves area and vegetative growth of the plants.(r=0.76764**), The increase in above ground bio mass in the highest rate of NPSBZn (r=0.66170**) might have resulted from upgraded root growth and increased up take of nutrients and favoring better growth and delaying senescence leaves of the crop. (Fageria et.al. 2011) indicated application of S enhancing the photosynthetic assimilation of N in crops which in tern increases the dry matter accumulation.

Conformation With this result, (Jaseemi, S.S, at el.2014) Vegetate growth and biological yield has much dependence to conception of chemical fertilizer, application of the fertilizer lead to increasing biological yield of wheat.

Table 9. The Above ground dry bio mass of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and variety

	Blended NPSBZn (kg ha-1)			
Variety	0	50	100	150
Local (Boyido)	6164.6^{g}	6499.1^{gf}	6805.9^{de}	7506.6^{c}
Kekeba	7147.3^{de}	8249.2^{b}	8607.0^{b}	9718.2^{a}
Kingbird	6319.1^{f}	8181.1^{b}	8219.4^{b}	8496.7^{b}
LSD (0.05)	473.33			
CV (%)	3.64			

Means in columns and rows followed by the with the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.3.4. Grain yield

Grain yield is quantitatively inherited trait and the product of plant density, tiller number, number of spikes per plant, number of spikelet's per spike, number of kernels per spikelet and kernel weight.

The interaction effect of Varieties and NPSBZN showed highly significant ($p<0.01$) differences on grain yield. Thus, the highest grain yield 5145.4kg^{-1} was observed at the rates of 150kg NPSBZn ha^{-1} whereas the lowest grain yield 2741.4kgha^{-1}) was recorded at no fertilizer application check Verity (Boyido). The highest grain yield at the highest NPSBZn rate might have caused from improved root growth and enhanced up take of nutrients and butter growth due to responded effect of those blended fertilizer which increased growth, yield components and yield. The correlation analysis indicated that number of productive tiller (r=0.85434**), number of kernels per spike (r=0.78215**), Thousand grain weight (r=0.73195**)

(Bereket et, al.,2014), reported that application of nutrients like K, S, Zn, and B significantly increased grain yield and yield components bread wheat therefore:

The increase in yield of bread wheat with increasing the amount of blended NPSBZn fertilizer rate application. This might be due to the role of nitrogen, increasing the vegetative growth of wheat which facilitates the photosynthesis efficiency contributed for improvement of better yield of wheat. (Fresew et al.2018)

Phosphorous (P) is the second plant nutrient required by plant in large quantity after nitrogen (N) for growth. Phosphorous is the primary constituent of plant and animal life. P always plays a vital role in several metabolic process. It has structural role in metabolic path ways and digestion. (Barbers. S.A 1995) so that wheat yield improved with adequate amount of P fertilizer. (Halvorson et al.2002)

Boron is essential for cell division and elongation in meristimatic tissues, floral organs and for flower male fertility. Pollen tube germination along within its seed/fruit formation.(Marschner 1995)

Sulfur plays a vital role in plant Photosynthesis: particularly production of chlorophyll. Sulfur deficiency will impact growth and yield of wheat. (Jaenisch,et, al. 2020)

Zinc is an important components of various enzymes that are responsible for driving many metabolic reactions in crops. Growth and development would stop if specific enzymes were not present in plant tissue. It do have a vital role in Carbohydrate, protein and chlorophyll synthesis.so that those cumulative effect had been its own role for the increment of grain yield.

Table 10. The grain yield (kg ha^{-1}) of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and variety

	Blended NPSBZn (kg ha-1)			
Varieties	0	50	100	150
Local (Boyido)	2741.4^{g}	3035.^{8ef}	3254.6^{de}	3963.9^{c}
Kekeba	3365.1^{d}	3940.2^{c}	4188.5b^{c}	5145.4^{a}
Kingbird	2944.2^{fg}	4055.4^{bc}	4123.8^{bc}	4254.5^{b}
LSD (0.05)	278.86			
CV (%)	4.40			

Means in columns and rows followed by the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.3.5. Moisture adjusted grain yield (MAGY)

The result showed that fertilizer, Variety and variety with fertilizer interaction were highly significant ($p<0.01$) on moisture adjusted grain yield. The highest moisture adjusted grain yield at 150kg ha^{-1} of fertilizer was 5135.6 kg ha-1 with the variety kekeba. and the lowest mean grain yield 2784.3 ha^{-1}) was recorded at no fertilizer application on variety king bird From this observation increasing the application of blended fertilizer rate increase the production of bread wheat

Table 11. Mean Moister adjusted grain yield (MADGY) (kg ha^{-1}) of bread wheat as influenced by the interaction of blended NPSBZn fertilizer and variety

	Blended NPSBZn (kg ha^{-1})			
Variety	0	50	100	150
Local (Boyido)	2794.1^{f}	3054.7^{ef}	3261.8^{de}	3963.5^{c}
Kekeba	3380.6^{d}	3938.9^{c}	4173.7^{bc}	5135.6^{a}
Kingbird	2980.1^{f}	4075.4^{bc}	4138^{bc}	4260.7^{b}
LSD (0.05)	278.77			
CV (%)	4.40			

Means in columns and rows followed by the some letters are not significantly different at 5% level of significance; LSD (0.05)=Least significance at 5% level; CV=Coefficient of variation;

4.3.6. Straw yield (kgha^{-1}):

The result showed that, the main effect of fertilizer and verity had highly significant ($p<0.01$) effect on straw yield the interaction effect of verity and fertilizer rates was not significant. Variety kekeba had the highest straw yield (4240.62kg ha^{-1}) whereas variety king bird and Check(boyido) the lowest straw yield (3788.5kg ha^{-1}) and (3488kg ha^{-1}) respectively (Table 12) This might be due to varying response of varieties to fertilizer application or differences in genetic make-up of the varieties. Similarly (Hasina Gul,et al.2012)

The result showed that an interaction in straw yield when fertilizer rate increased from the lowest to the higher rate. The highest straw yield of (4606.19kg ha $^{-1}$) was obtained at the highest NPSBZn rate of 150kh ha^{-1} whereas the lowest straw yield (2904.91kg ha^{-1}) was from the king bird with no fertilizer (NPSBZn) seen from the mean value. The significance increase in straw yield in response to the highest rate of blended NPSBZn might be attributed synergistic role of nutrients that in chanced growth and development of the crop. The result is consistent with that of (Nasser, K.B.and EL-Gizawy,B. 2009) Who reported that increased straw yield with increase NP fertilizers rats 90/45 kg ha^{-1}.

Table 12. Mean of straw yield SY (kg ha^{-1}), Moisture content (MC) and Harvest Index of bread wheat as influenced by the main effect of blended NPSBZn fertilizer and variety

Treatments	**Straw yield (kg ha^{-1})**	**Harvest Index (HI)**
Varieties		
Local(Boido)	3520.1^{c}	0.4783^{a}
Kekeba	4309.0^{a}	0.4916^{a}
Kingbird	4006.5^{b}	0.4916^{a}
LSD(0.05)	252.68	0.021
Fertilizer(kg ha^{-1})		
0NPSBZn	3574.5^{b}	0.4600^{c}
50NPSBZn	4009.0^{a}	0.4833^{bc}
100NPSBZn	4004.0^{a}	0.488^{b}
150NPSBZn	4193.2^{a}	0.5166^{a}
LSD(0.05)	291.77	0.24
CV (%)	7.56	5.08

LSD(0.05)=least significant difference at 5% level; CV= coefficient of variation; NS=not significant, Mean in Column followed by the some latters are not significantly different at 5% level of significance

4.3.7. Harvest Index

Harvest Index (HI) is proportion of total crop biomass growth (dry matter) that is harvested as grain. Harvest Index (HI) Percentage were highly significant (p<0.01) affected by fertilizer rates whereas the variety and the interaction between the two factors Varieties with fertilizer were not significantly affected. (Table 12).Harvest index of the verities, averaged across all treatments, varied Whete and (Wilson, 2006).In agreement with the present, a non-significant effect of N supply on harvest been reported for wheat (Ibrahim et al, 2014)

4.4. Partial budget Analysis

Partial budget analysis is important to identify experimental treatments with an optimum return to the farmer's get and to recommendation for the agronomic data. Experimental yields are often higher than the yield that farmers could expect using the same treatments; hence in economic Calculation, yield of farmers are adjusted by 10% less than that of the research result CIMMYT (1988) As indicated in (table 14) the partial budget analyses showed that highest net benefit (135675.9)Birr ha^{-1} was observed with variety kekeba through the use of 150kg $^{-1}$ NPSBZn fertilizer but the lowest average net value of (75439.62)Birr ha^{-1} were found with no blended fertilizer of the Varity Check (Boyido)

In this study kekeba variety were recorded the highest average economic benefit of (5135.59kg ha^{-1}) with adjusted yield of (4622.03kg ha^{-1}) and The local variety (boyido) was observed the lowest average yield of (2794.06 kg ha $^{-1}$) with adjusted yield of (2514.65kg $^{-1}$) in General the results of this study showed that application of NPSBZn ha^{-1} to both varieties kekeba and kingbird gave satisfactory yield than that of local variety.

Table 13. Summary of partial budget analysis for response of bread wheat verities to blended NPSBZn fertilizers in Woliso District, Southern West Ethiopia.

Treatments		**Average yield (kg ha^{-1})**	**Adjusted yield (kg ha^{-1}) 10% down**	**Total Variable Cost (ETB ha^{-1})**	**Gross return (ETB ha^{-1})**	**Net return (ETB ha^{-1})**	**MRR(%)**
Varieties	Fertilizer rate						
Check(Boyido)	0	2794.06	2514..65	-	75439.62	75439.62	607.26
Check(Boyido)	50	3054.7	2749.23	995	82476.9	81481.9	462.09
Check(Boyido)	100	3261.84	2935.65	1990	88069.68	86079.68	1749.11
Check(Boyido)	150	3943.46	3549.11	2985	106473	103488	409.11
Kekeba	0	3380.6	3042.54	-	91276.2	91276.2	1415.07
Kekeba	50	3938.93	3545.037	995	106351.1	105356.1	537.1
Kekeba	100	4173.71	3756.33	1990	112690.2	110700.2	2510.12
Kekeba	150	5135.59	4622.03	2985	138660.9	135675.9	1872.36
Kingbird	0	2980.07	2682.06	-	80461.89	80461.89	2872.36
Kingbird	50	4075.44	3667.89	995	110036.9	109041.9	69.81
Kingbird	100	4138.02	3724.21	1,990	111726.5	109736.5	232.95
kingbird	150	4260.7	3834.64	2985	115039.4	112054.4	3753.92

ETB ha^{-1} =Ethiopian birr per hectare; Cost of improved bread wheat seed =32.00ETB kg^{-1} Cost of local brad wheat seed=25.00kg^{-1} Cost of NPSBZn=19.90kg^{-1} Cost of urea =16.20 kg^{-1} labor cost at sowing and NPSBZn application 7 person ha^{-1} each 100 ETB day^{-1}, labor cost Urea top dress application 6 person ha^{-1} each 100 ETB day^{-1} , Market price of bread wheat grain =30Birr kg ha^{-1} and in Woliso town at harvesting time in January 2022

4.5. Result of Correlation Analysis

Yield being a complex trait is governed by many interacting with the environment and depend on a number of related traits. Knowledge of interrelationship among various traits affecting yield directly as well as indirectly is essential for selecting best yielding genotypes.

The result showed that all yield and yield related parameter like productive tillers, plant height, thousand kernels widget, Biomass yield, straw yield and spike length, are positively correlated with grain yield

	DH	MD	PH	LA	SL	PT	NKPS	TGW	BMY	SY	MC	GY	MAGY	HI
DH	1													
MD	0.82926**	1												
PH	0.55006**	0.72360**	1											
LA	0.41701*	0.48359*	0.71335**	1										
SL	0.56441*	0.63108**	0.73915**	0.58139*	1									
PT	0.63945**	0.67411**	0.76047**	0.74875**	0.69455**	1								
NKPS	0.49980*	0.62350**	0.76218**	0.62429**	0.70353**	0.69455**	1							
TGW	0.62643**	0.61413**	0.56947*	0.69280**	0.58478**	0.75408**	0.64371**	1						
BMY	0.66973**	0.69715**	0.73010**	0.73167**	0.76764**	0.83501**	0.73676**	0.53011*	1					
SY	0.53373*	0.58055*	0.59498**	0.63792**	0.64918**	0.69997**	0.57818*	0.53064*	0.89177**	1				
MC	0.32952*	0.44316*	0.46137*	0.38855*	0.61654**	0.53286*	0.55241*	0.55435**	0.59334*	0.58324**	1			
GY	0.69647**	0.67143**	0.74058**	0.76245**	0.69928**	0.85435**	0.78215**	0.73195**	0.96123**	0.76638**	0.57895*	1		
MAGY	0.68544**	0.67540**	0.74096**	0.77338**	0.68982**	0.84726**	0.78897**	0.72606**	0.96829**	0.85146**	0.54486ns	0.99910**	1	
HI	0.50500*	0.41462*	0.51510*	0.41462*	0.51510*	0.49112*	0.39437*	0.639928**	0.59358**	0.65044**	0.21766*	0.47119**	0.72998*	1

DH=das to heading, DM=Days to maturity, PH=Plant height (cm), SL=spike length (cm), NKPS=Number of kernels/spike, TGW=thousand grain (g) weights, PT =Productive tillers, BMY=Above ground bio mass yield(kg/ha), SY=Straw yield (kg/ha), MC=Moisture content, HI=Harvest index.

5. SUMMARY AND CONCULUSION

Bread Wheat production is greatly dependent on the available nutrients in soil and other environmental conditions for plant growth. Information on crop response to Blended Fertilizer (NPSBZn) rats and improved variety is essential to come up with profitable and sustainable bread wheat production. The objective of the experiment was to investigate the effect of NPSBZn fertilizer levels for bread wheat performance, to determine the optimum rate of NPSBZn fertilizer on growth and yield of bread wheat Varieties, identify the most responsive bread wheat varieties for NPSBZn fertilizer. and estimate the economic feasibility of fertilizer and wheat variety under existing input and output price levels in study area.

The soil laboratory results of the experiment showed the soil physical properties of partial size distribution in size (%) 45, 20, and 35 present sand, clay and silt respectively this failed under silt loam textural group with the PH of 6.4 slightly acidic soil, and has low OC which needs the crop residuals to incorporating with the soil to enhance the soil OC and its fertility that increases the nutrient uptake from the soil.

The result of growth and yield attribute investigations showed kekeba variety had better performances as compared to king bird and check Varity (Boyido) Varieties and interaction of varieties to NPSBZn fertilizer for the number of productive tillers, above ground bio mass yield and grain yield had good performance at 150kg ha^{-1} NPSBZn fertilizer showed significant differences for growth and yield parameters .similarly Varity kekeba recorded the highest thousand kernel weight, the highest number of kernels per spike, maximum adjusted grain yield, also, the application of blended NPSBZn fertilizer at the highest rate showed the best performance this is due to recent accepted facts shows the high protein cereals like wheat can be decreased its productivity by the deficiency of S and other nutrients. Thus addition of nutrients such as N, P, S, B and Zn to low fertile soil is important to increase yield,

The result obtained revealed that, The growth yield parameter like: leaf area, spike length, plat height, planting tillers total dry bio mass, yield and moisture adjusted grain yield, straw yield were highly significantly ($p<0.01$) affected by main effect of NPSBZn and as well as main effect of variety. The highest number of mean productive tillers per plant (6) ,number of kernels per spike (41.33), were recorded with variety kekeba and at the NPSBZn rate of 150kg ha^{-1} .0n the other hand the lowest number of productive tiller (3), number of kernels per spike (30), were recorded at zero level of NPSBZn rate. With regards to the effect of verity, the maximum days to heading (65.25) and days to physiological maturity (99.66) were recorded for the Varity kekeba.

The interaction of the Two NPSBZn and Variety also significantly affected above ground bio mass, thousand grain yield and grain yield. The highest above ground bio mass (9718.22 kg ha^{-1}), straw yield (6461.59 kg ha^{-1}) and grain yield (5145.4 kg ha^{-1}) were recorded at a combination of the highest rate of 150 kg. NPSBZn fertilizer with variety kekeba. With the revers, the minimum grain yield (2734.3 kg. ha^{-1}), and (2944.16) were recorded at the combination Zero level of NPSBZn ha^{-1} fertilizer rate with variety local (boyido) and king bird consecutively. In General application of 150kg Blended NPSBZn enhances in Grain yield. This yield advantage was achieved. due to the positive effect of Blended NPSBZn and nitrogen fertilizer that had increased planting tillers, Number of kernels per spike length and biomass yield that cumulatively increased the Grain yield

The partial budget analysis revealed that Combined application of 150kg ha-1 blended fertilizer rate with Varity kekeba gave the highest net benefit of (135675.9Birr ha$^{-1)}$ with MRR of (1872.36%)which is above the acceptable minimum range of MRR 100%, while the lowest net returns (75439.62ETB ha^{-1}) and MRR (607.26%)was recorded with Zero blended NPSBZn rate and of variety Local(Boyido). In general, this study Provided that yield and economic returns of bread wheat could be improved by appropriate application of blended NPSBZn and variety.

Therefore, from the result of present study that the application of the 150kg ha^{-1} blended NPSBZn fertilizer with Varity kekeba can be tentatively recommended to farmers for production of wheat in the study area and other areas with similar agro ecology based on this it is suggested that, it will be essential to combine tactical management including the choice of crop Varity (Cultivar) fertilizer rate and timing weed insect and disease control, to afford additive benefit for the farmers. However, it is somewhat difficult to develop concrete conclusions from one season experiment about blended fertilizer rate application, Therefore, further investigation is necessary over several location and seasons to give valid conclusions and recommendations to farmers.

6. REFERENCES

Abdullatif M,Asmat UM,sattar A,Fiaz Hussain,Abbas G,.(2010); Response of growth and Yield of wheat to NPK fertilizer,Sci Int(Lahore) 24(2):185-189

Abebual Woldetsadik, Wondwosen Tena and Asmare Melese, (2019**);**Effect of Different Blended Fertilizer Formulation on Yield and Yield Components of Bread Wheat (TriticumaestivumL.) in Siyadebrenawayu District, North Showa, Ethiopia. Journal of Biology, Agriculture and Healthcare 9 (15): 13-23.

Abdelkhalik S.A.M. Assessment of some genetic for yield and its components in four bread wheat crosses using six parameter model Egypt. J. Plant Breed, 23 (2019), pp. 719/736

Abebaw Tadele, Hirpa Legese (2018) Effect of Fertilizer rates (Blended) and sowing methods onyield of bread wheat (Triticum aestivum) and its economic profitability in western Ethiopia. International Journal of Advanced Research in Biological Sciences 5:1-14.

Anderson L. and Schneider K.(2010) Yield gap and productivity potential in Ethiopia Agriculture: Staple Grains and Pulses.Evens Shoole policy Analysis and Research(EPAR) Brief No 98

Ali, Q.and Ashrf,M.(2008) Modulation of growth, photosynthetic capacity and water relations in salt stressed wheat plant by exogenously applied 24-epibrassinolide. Plant growth Regulation, 56(2),107-116

Assuero, S.G. and Tognetti J.A. (2010).Tillering regulation by endogenous and environmental factors and its agricultural management. The American .Journals of plant science. Biotechnol.4 (special Issue 1), 35-48.

ATA (agricultural Transformation Agency), (2014) soil Fertility status and Fertilizer Recommendation Atlas for Tigray Regional state, Ethiopian Agricultural Transformation Agency (ATA),Addis Ababa Ethiopia.

Bekele HK, Varkuijl H, Mwangi W, Tanner DG (2000); Adaptation of improved wheat Technologies in Adaba and Dodola Woredas of the Bale highlands, Ethiopia. Mexico: International Maize and Wheat Improvement Centre (CIMMYT) and Ethiopian Agricultural Research Organization (EARO)

Berket Haileselassie, Mehretab Haileselassie (2014) Effect of mineral nitrogen and phosphorus fertilizers on yield and nutrient utilization of bread whet (Triticum aestivum) on the sandy soils of Hawzen District, Northern Ethiopia. Agricultural Forestry Fisheries,3(3):189-198.

Bekele. (2015); Soil fertility status and wheat nutrient content in Vertisols cropping Systems of high lands of Ethiopia. Agric& Food Secur 4:19

Bilgic H, Hakki EE, Pandey, Khan MK, Akkay Ms (2016)Ancient DNA forom 8400 year- Old catalhoyuk wheat: implications for the origin of Neolithic agriculture. PLos one 11:e0151974

Brady, N.C and R.R.Weil,(2008).the nature and properties of soil.13thand 14th Edition. Prentice. Hall. per Saddle River, new jersey, United State of America.

Barbers. S.A. (1995) soil nutrient Bioavailability. A Mechanical Approach. Fertilizer Development. New York Bio-Fertilizers.36-51

Bouyoucos (1936); Soil texture analyses by hydrometer: modifications of the Bouyoucous method.Cien.Inv.Agr.41 (2):263-271

Cambisols and Fluvisols in major Maiz, Wheat, Teff and Citrus growing areas of Ethiopia. In: Proceedings Agricultural Research found, p 77-96.

Carver BF ed.2009. Wheat: Science and trade. Ames, Lowa: Wiley-Blackwell.

CIMMYT (Centro International de Mejoramiento de Maiz y Trigo).(1988); From agronomic Data to farmer’s recommendations: An economics tanning manual completely Revised edition Mexico, DF Corporation, New Delhi, India.

CSA (Central statistical Agency). (2022) Agricultural sample survey of area production of major crops accessed (2022) jul.15

CSA (Central statistical Agency). (2011); Agricultural sample survey Report on area and production of major crops, 1, Addis Ababa.

CSA (Central statistical Agency). (2014); Agricultural sample survey 2013-14

CSA (central statistical Authority). (2021); Agricultural sample survey on area and production of major crops (privet peasant holdings, Meher season)

CSA (central statistical Authority). (2017); Agricultural sample survey 2016/17.

Dargicho D, Sentayehu A Firdisa E,Genetic (2015):Variablity in bread wheat (*Triticum aestivum L.)* germplasm for yield and yield component traits. J.Biol.Agric.Healthcare. 5(17):140-147.

Dixon,J., H.-J.Braun,P. kosina, and J.crouch (eds) (2009).wheat and Facts Futures 2009.Mexico, D.F.:CIMMYT.

Elhani,S, Martos,V and Rharrabti,Y (2007) Contribution of main stem and tillers to durum wheat (Triticum turgidium L. Varity durum) grain yield and its components grown in Mediterranean Environment. Field crops Research 103,25-35.

Elias E,Okoth PF,Smailing EMA.(2019) Explaining bread wheat (Triticum aestivum) yield differences by soil properties and fertilizer rates in the highland of Ethiopia. Geoderma 339(5):126-133

Erkossa, Teklu, Timothy O.Willams and Fanuel Laekemariam. 'Integrated soil water and agronomic management effects on crop productivity and selected soil properties in western Ethiopia'. '*International soil water conservation Research:* 6 (2018):305-316.

Ennos, A.R. **(**1991). The mechanics of anchorage in wheat (Triticumaestivum L.)II. Anchorage of the mature wheat plant. J. Exp. Bot., 42: 1607-161

Ethiosis (Ethiopian Soils Information System). (2013). Status of soil resources in Ethiopia and priorities for sustainable management, GSP for eastern and southern Africa Mar 25-27 Nairobi, Kenya FAO (Food and Agriculture Organization of the United Nations)-1984 Ethiopian highlands reclamation study (EHRS). Final Report, Vols.1-2, Rome.

Fageria, (2009); Fertilization may be a vital and dynamic Proportion of the crop.

FAO (Food and Agriculture organization of the united Nation).(2000); Fertilizers and Their use.4th ed. International Fertilizer Industry Association. Food and Agricultural organization of the United Nations. Rome, Italy.

FAO, Nutritional quality of cereals Retived, June (2017); Gete Zelleke, Getachew Agegnehu, Dejene

Abera, Shahid Rashid. (2010). Fertilizer and soil fertility potential in Ethiopia: Constraints and opportunities for enhancing the system. International Food Policy Research Institute (IFPRI), Addis Ababa, Ethiopia, 63p.

FAOSTAT (2018); Statistical databases. Food and Agriculture Organization of the United Nations

Feldman, M. (1976); Wheat's. In *Evolution of Crop Plants* (ed. N. W. Simmonds), Longmans, london, pp. 120–8.

Fayera Asefa, Adugna Debela and Muktar Mohamed (2014).Responses to Different Rates of NPK along with Zn and B

Fresew,B,D.Nigussie, M Adamu and T.Tamado,(2018).Effect of Nitrogen fertilizer rates on grain yield and nitrogen up take and use efficiency of bread wheat (*Tritcum aestivum L*.) varieties on the vertisols of central highlands of Ethiopian Agriculture and Food security,7(78):1-12.

Graham R D and Rengel Z 1993 Genotypic variation in Zn uptake and utilization by plants, in Zn in siol and plants, Ed Ad Robson pp.107-114.

Gomez, K.A. and A.A Gomez, (1984). Statistical procedures for agricultural research (2$^{ed.)}$ John Wiley and sons, New York, 680p.Hailu Geberemariam. (1991); wheat production and research in Ethiopia.pp.1-15.in: Hailu G.M, Tanner, D. G, Mengestu, H. (eds).wheat research in Ethiopia: Historical Perspective. IAR/CIMMYT, Addis Ababa, Ethiopia.

Hawke Sford MJ, Araus J-L, Park R, et al. (2013); Prospects of doubling global wheat yields. Food Energy Secur. 2:34–48

Hasina Gul, Amir Zamd khan(2012) Varieties showed appreciable response towards N and S application over growth factor

Halvorson. A.D., Havlin. J.L and Reule. C.A.(2002) Fertilizer phosphorus management options for No. of till Dry land winter wheat. Better crops with plant food. 86.4-7.

Hei N, shimelelis H, Laing L.(2017) Appraisal of farmers' wheat production constraints and breeding priorities in rust-prone agro-ecologies of Ethiopia. African journal of Agricultural Research. 12: 944-952.

Hillette Hailu, TekalignMamo, R. Keskinen, E. Karltun, Heluf Gebrekidan and Taye Bekele. (2015). Soil fertility status and wheat nutrient content in Vertisols Cropping systems of central highlands of Ethiopia. Agric& Food Secur 4:19

Homeeck, D.A., D.M. sullivan, JS Owen, and J.M. Hart. (2011).soil Text interpretation Guide. Oregon State University, EC 1478-E,http://extension.oregonstate.

Ibrrahim OM, Bakry AB, Thalooth AT and EL-Kaamany MF.(2014) influence of nitrogen fertilizer and foliar application of Salic acid on wheat. Agricultural Sciences, 5:1316-1321.

Jaenisch,Brent R.:Wilson,Tara:Nelson,Nathan .;Guttieri,Mary; and Lollato, Romulo.(2020) wheat Grain yield and protein concentration Response to Nitrogen and sulfur Rates, Kansas Agricultural Experiment station Research Reports:Vol.6:lss.9.

Jaseemi, S.S, Akbari,G.A,Najafian,G,& Moradi,F.(2014); Nutrition management effects on Grain yield, and yield component and some physiological characters of bread Wheat cultivars *International journal of agronomy and agricultural Research((IJAAR), 5(3):1-6*

Johansson (2001); wheat production based on better grain quality, Nitrogen Use Efficiency and Nitrogen Harvest Index is Important in determining bread making quality. Report on area and production of Major crops for private peasant holdings, meher season stoical bulletin 584. Central statistical Agency, Addis Ababa, Ethiopia.

Kauser, k, M. Akbar, E Rasul and A.N Ahimd (1993); physiological response of nitrogen, Phosphorus and potassium on growth and yield of wheat. *Pakistan J.Agric.24 (1): Res, 14:2-3*

Kidane Giorgis. (2015); Dry land Agriculture Production Systems in Ethiopia. Nation Publishers, Addis Ababa, Ethiopia.

Kaleem,S.,Ansar,M.,A., A.Ahemd,G.,Rashid,M (2009 Effect of phosphorus on the yield and yield components of wheat variety, Under rain faded condition –sarhad Journal Agriculture 25(1):21-24

Knezevic Desimir, Zecevicveselinka, stamenkoviv sevtislav, Atanasijevic srdjan, Milosevic qxbozidar.(2012); Variability of number kernels per spike in wheat Cultivars (Tritcum aestivum L.) Journal of central European, Agriculture, 13(3):617-623.

Landon, J.R, (2014);.Booker tropical soil manual: a handbook for soil survey and agricultural Land evolution in the tropics. Marschner,H Mineral nutrient of higher plant 2nd Edition . New York Academic press, pp. 889, 1995.

Lindsay,W.A.Norvell (1978) Development of a DTPA Soil Test for Zinc, Iron, Manganese and Copper first published 01:May 1978, 5,379

Marschner,H.(1995) Mineral nutrient of higher plants. 2nd. Acad. press. London 889pp

Mengle, K. And Kirby, E.A. (1996); principles of plant nutrition. Panima publishing

Melesse Harfe, (2017). Response of bread wheat (Triticum aestivum L.) varieties to N and P fertilizer rates in ofia district, southern Tigray, Ethiopia, African Journal of Agricultural Research, vol.12 (19),pp. 1646-1660.

Mengistu. (2016). Soil Nutrient balances under diverse agro-ecological settings in Ethiopia. NutrCycl.

Mikkelsen,T. Wade,C.,(2005) Genome sequence, Comparative analysis and haplotype structure of the domestic dog.Nature 438,803-819.

Minot,N Wamer,J., Lemma, S., Kassa, L., Gashaw,A., and Rashid, S.(2015). The wheat supply chain in Ethiopia: patterns, Trends, and policy options. International Food policy Research institute (IFPRI) Washington, DC.

Nasser, K. b. and EL-Gizawy,B.(2009);.Effect of planting date and Fertilizer Application on Yieldof wheat under No till system. *World Journal of agricultural sciences, 5(6):777-783.*

Olsen and Samners,(1982); Grain yield responses to fertilizer N increases more steeply at Low rate and increases at decreasing rates

Routledge Lindsay and Norvell (1978); Development of DTP soil test for Zinc, iron manganese and Copper soil science Shewry PR. Wheat. J Exp Bot. (2009); 60:1537–53 and Andrson (2010);Effect and factors affecting efficiency in wheat Production the maximum higher yield gaps Salm, P,K, (2004). Ann, Agricultural Research. New Series 25(2):329-332

SAS Institute (2002); SAS/STAT User's Guide, Version 9.0. SAS institute Inc., Cary, NC Tekalign (2001), Ethiopia is one of the wheat producing countries in world (N) is Deficient in almost all soils and phosphorus (P) is deficient bread wheat.

Tekalign Mamo, Mengesha Bekele and Tefera Ajema. (1991); Soil Fertility Management Studies on Wheat in Ethiopia. pp. 112-144. In: Hailu Gebre-Mariam, Tanner, D.G. and Mengistu Hulluka (Eds.). Wheat Research in Ethiopian Historical Perspective. Agricultural Research ,CIMMYT, Addis Ababa.

Tekalign Mamo and Haque. (1991). phosphorus of some Ethiopian soils 111.Evaluation of some soil test methods for available phosphorus. Topical Agriculture

Tea (2004); vietran has potential to increase the share of the values as it relation ship

Tobica (2007); Bread wheat production based on better grain quality, Nitrogen Use Efficiency and Nitrogen Harvest Index

USDA (2019); USDA world markets and Trade Report. Accessed on December 15, 2019.

USDA (2011); Estimates for production and yields truncate the Niyzonbrod cast on state Television Van Beek, C. L. E. Elias, G. S. Yihenew, H.,Heesmans. A., Tsegay H., Feyisa M., TollaM. Melmuye Y., Gebremeskel S.,

Van Beek, C.L.,Elias,E Yihenew,G.S (2016) Soil nutrient Balances Under Divers Agro Ecological settings in Ethiopia.Nutrien cycling Agroecosystem 106,257-276.

WANRO (2020);The annul postharvest report of WANRO (Woliso Agricultural and Natural Resource Office.)

Walkley,A.(1947) A critical examination of rapid method for determining organic carbon in soils-Effect of variations in digestion conditions and inorganic soil constituents. Soil science, 63,251-264

Wilson, C. (2006). Stochastic ranking as probabilistic choice. Unpublished manuscript, University of California, Los Angeles.

Xuan,H., J.Streif,H.pfeffer, F.Dannel,F.Bangerth (2001).Effect of pre harvest boron application on the incidence of CA-storage related disorders in in ‘Conference’pers. The journal of Horticultural Science and bio technology 76:133-37.

Zohary,D.,.Hopf., M., and Weiss., E., (2012). Domestication of plants in the world: the Origin and Spread of Domesticated Plants in Southwest Asia, Europe, and the Mediterranean Basin. Oxford: Oxford University Press.

7. APPENDICES

Appendix 1. Mean square Values of ANOVA for phonological parameters of Bread wheat as affected by Verities and Blended fertilizer (NPSBZn) levels at Woliso central high land of Ethiopia.

	Mean Square		
Source	DF	DH	DM
V	2	13.58*	75.69**
NPSBZn	3	26.44**	61.74**
V*NPSBZn	6	1.94ns	4.87ns
Error	22	3.76	8.78

V=Variety, NPSBZn=Blended fertilizer, DF=Degree of freedom, V*NPSBZn=Variety and Blended fertilizer interaction, DH=Days to 50% heading, DM=Days to 90% physiological maturity, NS=Non significant,*=significant different at 5%**highly significant at 1%

Appendix 2. Mean square Values of ANOVA for growth parameters of Bread wheat as affected by Verities and Blended fertilizer (NPSBZn) levels at Woliso central high Land of Ethiopia.

	Mean Square			
Source	DF	PH	LA	SL
V	2	147.38**	11.87ns	2.90**
NPSBZn	3	99.03**	13.75**	1.35**
V*NPSBZn	6	7.61ns	2.96ns	0.21*
Error	22	5.58	0.88	0.06

V=Variety, NPSBZn=Blended fertilizer, DF=Degree of freedom, V*NPSBZn=Variety and Blended fertilizer interaction, PH=Plant height, LA=Leaf Area, SL= spike Length, NS=Non significant,*=significant different at 5%,**highly significant at 1%

Appendix 3.Mean square Values of ANOVA for Yield and Yield Components parameters of Bread wheat as Affected by Verities and Blended fertilizer (NPSBZn) levels at Woliso central high Land of Ethiopia.

	Mean Square							
Source	DF	PT	NKPS	BMY	SY	TGW	GY	HI
V	2	11.08**	76.36**	8447208.43**	1900511.4**	10.90*	2577748.89**	0.00071n
NPSBZn	3	8.96**	108.74**	6572028.15**	619349.39*	93.78**	3160890.51**	0.0048**
V*NPSBZn	6	0.82*	14.99*	468736.78*	131201.05ns	18.08**	206613.77**	0.00054n
Error	22	0.31	5.59	78138.07	89068.334	2.68	26708.07	0.00061

V=Variety, NPSBZn=Blended fertilizer, DF=Degree of freedom, V*NPSBZn=Variety and Blended fertilizer interaction, PT=Plant Tillers, NKPS=Number of kernels per spike, BMY= Biomass yield, SY=Straw yield, TGW= Thousand grain weight, GY=Grain yield, HI=Harvest index, *=significant different at 5%,**highly significant at 1%

Appendix Figure 1.*Lay out (3,4,5)*

Appendix Figure 2. *Land preparation and Row making*

Appendix Figure 3. *High lighting the row and sowing*

Appendix Figure 4. *Crop Performance After a week*

Appendix Figure 5. *Weeding and hoeing the Experimental plots*

Appendix Figure 6.*Crop Performance after top dressing of Urea*

Appendix Figure 7. *Crop inspection after 60 days from sowing*

Appendix Figure 8. *50% Heading stage of the Experimental plot*

Appendix *Figure 9. During the supervision of Experimental site with my advisor*

Appendix *Figure 10. Crop Maturity stage*