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Performance evaluation of new improved and released varieties of bread wheat (*Triticum Aestivum* L.) for yield and related traits in mid altitude agroecologies of Hadiya Zone, Southern Ethiopia

Tesfaye Wolde[1], Mulugeta Abeba[1], Wondimu Tamirat[1], Kibemo Detamo[2]
[1] College of Agricultural Science, Wachemo University, Ethiopia
[2] College of Social Science, Wachemo University, Ethiopia

Abstract
Wheat is one of the staple cereal crops for production and consumption in Ethiopia. Frequently using the same varieties of wheat in the same field for successive cropping seasons is one of the problems in the study area. The experiments were conducted at Wachemo University main station and Anlemo district in the 2021 main cropping season to select and recommend the best performing and high yielding varieties. Twenty newly improved and released varieties with the local check were evaluated in a randomized complete block design with three replications. The results of the variance analysis showed highly significant differences (<0.001) in each location for most of the characteristics of the study. Balcha (6555.6kg/ha), Deka (6444.4 kg/ha) produce high yields in Wachemo district, similarly, they had (4811.1kg/ha) and (5541.7kg/ha) in Anlemo and Wachemo districts, respectively. Both varieties showed good performances in grain yield and other important agronomic traits in both locations followed by Boru (6333.3 kg/ha) and (4222.2kg/ha) respectively; suggested for further demonstration and popularization in the study area. Newly improved varieties had good potential in yield performances and other agronomic traits in the studied area indicated farmers give more attention to using newly improved varieties than released before.

Keywords: evaluation, bread wheat, grain yield, improved varieties, locations

Introduction

Wheat is a self-pollinating annual plant in the true grass family Gramineae (Poaceae), from the species of Triticum (T.) and grouped into diploid, tetraploid and hexaploid with chromosome numbers of 2n = 14, 28, and 42, respectively whereas Bread wheat (Triticum aesivam) is hexaploid and characterized with chromosome number 2n=42 (Abu, 2012). In the world Wheat is considered the largest cereal crop dominantly grown as a staple food (Mollasadeghi *et al.,* 2011).

In Ethiopia Wheat can be developed at heights ranging from 1500 to 3000 m.a.s.l, between 6-160 N scope and 35-420 E longitude. However, agro- ecologically more suitable area founds between 1900 and 2700_m.a.s.l. (Abu, 2012). it is the third most important cereal crops in terms of cultivated land, food value and a number of smallholders engaged in production after Tef (Eragrostis tef L.) and Maize (Zea mays L.) (Birhanu *et al.,* 2016). The production of wheat in the world is 728.3 million tons from this East Africa produced 5.7 million tons; however, Ethiopia had produced likely 4.6 million tons (FAO, 2019). Even though, the productivity of wheat is increasing from time to time in the last few years in Ethiopia; still the production is very low as compared to other wheat-producing countries. Nationally the average wheat productivity in Ethiopia is likely to be 2.74 tons/ha (USDA, 2022) which is by far below the world's average of 3.49 tons/ha (USDA, 2022). On the other hand, the average productivity of wheat in Hadiya Zone was enumerated as 2.87t/ha (CSA 2017).

Wheat is an important source of calorie intake in Ethiopia it has 14% which makes wheat the second-most important food after maize (19%) and ahead of teff (10%), sorghum (11%) and enset (12%) (FAO, 2014). The grain is used in the preparation of different traditional as well as modern processed food products such as injera, bread, nifro, and other industrial processed products like pasta and macaroni (Nigussie *et al.,* 2015). Besides these, the straw is mainly used as a roof tacking material and as a feed source for animals in the dry season.

Although a number of high-yielding wheat varieties have been released through the research system in the country, farmers in Ethiopia are reluctant to adopt them, with only 3-5% of the cultivated land covered with seeds of improved crop varieties (World Bank, 2005). Shortage of seeds of improved varieties, lack of attributes desired by farmers, low information exchange between farmers and researchers about the improved varieties, and farmers' uncertainty about the improved varieties or risk-aversion could be the major reasons for the low adoption rate of improved crop varieties (Wale and Yallew, 2007; Abebe *et al.,* 2013). In order to exceed the adoption capacity of new improved varieties of wheat and improve its production potential in the country, the production constraints and varietal preferences ought to be well known.

The abdicate potential of wheat in Ethiopia must move forward assist to level up with Africa and the world's normal wheat yields, which were 13 and 32% higher than the average wheat yield in Ethiopia, respectively (Bekele *et al.*,2019). The development of bread wheat has begun in 1949 and up to present numerous varieties have been disseminated by national and territorial inquire about establishing. But as it may, those varieties are not broadly disseminated to all parts of wheat growing area. The improved varieties are usually not tested for adaptability in the region before general cultivation in farmers' fields. Development of the well-adapted and high-yielding varieties which have the most attributable traits is of fundamental significance to upgrading the abdicate of the locale Alam *et al.* (2006).

The development and provision of high-yielding wheat varieties have always been a major objective of wheat breeding programs throughout the world (Bhutta, 2006). The national wheat improvement program had worked in different agricultural research institutes to develop varieties which had widely adapted, resistant, and high-yielding. However, the potential of the expected traits was not achieved. As it was indicated by Zegeye *et al.* (2001), DRRW (2010), and Nelson (2013), most of the released varieties in Ethiopia had been poorly adopted by the small scale farmers because of the need of viable seed generation and conveyance instruments, weak integration of variety prerequisites between breeders and ranchers, and less adjustment of the breeders' created variety to the nearby situations.

Wheat is the major cereal crop that is dominantly cultivated in Hadiya Zone. Even though different varieties of bread wheat have been improved and released to farmers from various agricultural research centers; in Hadiya Zone the yield potential is not complemented by the status of research centers or around the community of the wheat growing area. This is often due to the improved varieties are afforded to the farmers not tested in the agro-ecological system of the study area, most farmers grow the same varieties from year to a long time or they had to induce the seed from neighbourhood markets and inadequate use of new technology. Even if the released varieties of bread wheat have been cultivated, the performance of those varieties for yield and yield components along the agro-ecological suitability is not studied yet. Hence, the present study was designed to distinguish and select the best performing and high yielding varieties to the study area.

Materials and Methodology

Description of the Study Sites

The experiment was conducted on two locations of which one is in the experimental field sites of Wachamo University, Main campus and Anlemo woreda during 2013/2021 main cropping seasons. Wachamo University is located in Hadiya Zone Limo district, which is situated at 7014' to 70 45' N latitude and 370 5' to 370 50' E longitude at about 232 km away south of the capital city of Addis Ababa and an altitude of 2106 meters above sea level. The mean annual rainfall is 1320 mm and the minimum and maximum annual temperatures are 120ºC, and 240ºC, respectively. Anlemo district is located at about 214 km away South of the capital city of Addis Ababa and its altitude is 2350 masl the mean annual rainfall ranges from 1001 to 1200 mm and its mean temperature is 25 0C. The main rainy season extends in both locations from June to September; whereas the maximum rainfall is received in the months of June, July and August.

Experimental design and treatments

Experimental materials were collected from Kulumsa agricultural research centre that comprises twenty bread wheat varieties which were released before the research conducted and newly improved varieties. The varieties were grown in randomized complete block design (RCBD) with three replications. Each plot consisted of six rows spaced 20cm X 2.5m long. The plot area was $3m^2$ (2.5m X 1.2m). A 1.5 meter distance was maintained between replication and 50cm between plots used for both sites. Fertilizers applied at the rate of 150 kg/ha urea and 100kg/ha NPS at the time of planting and tillering. Seeding was done at the rate of 125Kg/ha. All recommended agronomic practices were applied

Table 1: Description of varieties

Variety	Year of release	Variety	Year of release	Variety	Year of release
Dereselgne	1974	Honqolo	2014	Bodena	-
Pavone-76	1982	Biqa	2014	Mekele-01	2011
Alidoro	2007	king bird	2015	Deka	2018
Danda'a	2010	Liben	2015	Balcha	2019
Kakaba	2010	Lemu	2016	Dursa	2020
Hoggena	2011	Wane	2016	Boru	2020
Shorima	2011	Local	-		

Data Collection

Days to heading (DTH): The number of days from date of sowing to the stage where 50% of the spikes have fully emerged.

Days to maturity (DTM): The number of days from sowing to the stage when 90% of the plants in a plot have reached physiological maturity.

Grain filling period (GFP): The number of days from heading to maturity, i.e. the number of days to maturity minus the number of days to heading.

Grain yield (GY): Grain yield in grams obtained from the central four rows of each plot and converted to kilograms per hectare at 12.5% moisture content.

1000-kernel weight (TKW): Weight of 1000 seeds in gram of each plot.

Above ground biomass (AGB): The plants within the four central rows were harvested and weighed in grams.

Harvest index (HI): On a plot basis, the ratio of dried grain weight to the dried above ground biomass weight multiplied by 100.

Tillers/plant (TPP): The average number of tillers counted from tagged plants in each plot

Plant height (PHT): The average height in cm from ground level to the tip of the spike.

Kernels per spike (KPS): The average number of kernels per spike of each tagged plants.

Spikelet per spike (SkPS): The average number of spikelet's per spike counted from selected and tagged plants of each plot.

Spike length (SL): took the average spike length measured in cm from its base to the tip of tagged plants in each plot.

Data Analysis
The data were subjected to analysis of variance using SAS software 2008 version 9.2 and Treatment means were separated using Duncan's Multiple Range Test (DMRT).

Result and Discussion
The analysis of variances for all the studied traits were highly significant differences (<0.001) in both locations which indicated that the varieties had various performances for the studied traits Table ( ). Similarly Bekele *et al.,* (2019) revealed significant differences were observed among varieties of studied for grain yield, biomass yield, plant height and maturity date.

The mean performance for phenological traits at Anlemo district
The mean for days to heading ranged from 80 to 57 days with the pool mean of 69.78 days at Anlemo district. The variety Hoggena took the longest (80 and 130.3 days) at Wachemo districts and (77.3 and 129 days) at Anlemo districts for days to heading and physiological maturity respectively. Whereas; Deresalegn took the shortest days (57 and 81.67 days) at Wachemo and (53.67and 101.67) days at Anlemo for both days to heading and physiological maturity, respectively. The days for grain filling ranged from 57.33 to 24.57 days at Wachemo and (61.00 to 45.67) days at Anlemo districts respectively. The variety Bodena took the largest (61 days) for grain filling at Anlemo, whereas at Wachemo the variety Biqa took the largest (57 days) this revealed that the location variation influences the differential performance of phonological traits for the studied varieties.

The mean performance of growth traits
The mean for plant height ranged from 106.53 to 76.77cm at Wachemo district and 107.4 to 81.87cm at Anlemo districts, with the pool mean of 93.09cm and 93.12cm, respectively. The variety Dereselgn performed the highest plant length in both locations, whereas Honqolo had a short plant length (76.77cm) at Wachemo and the variety Mekele-01 scored short plant height (81.87cm) at Anlemo district. The varieties, which revealed short plant lengths in the studied locations, are important for logging resistance to prevent yield losses through logging; similarly. Girma *et al.,* (2021) reported that the varieties studied exhibited variation in plant height.
The mean for spike length ranged from 12.67cm to 7.87cm at Wachemo district whereas in Anlemo district ranged from 10.33cm to 7.00cm with the average mean of 9.15cm and 8.57cm, respectively. The largest spike length was recorded from the variety Alidoro (12.67cm and 10.33cm) at Wachemo and Anlemo locations, respectively, and even though it scores the highest value in both locations, the magnitude of performance varies; this is due to the interaction of variety to environment. The shortest spike length was recorded at the Wachemo district from Hoggena (7.87cm) and Wane (7.00cm) in the Anlemo district, indicating that the varieties studied revealed different performances across locations. The mean for the number of spikelets per spike ranged from 22.07 to 15.2 with the pool mean of 17.75 in the Wachemo district whereas, in the Anlemo district it was ranged from 20.67 to 13.20 with the average mean of 16.73. The highest number of spikelets per spike recorded from Alidoro (22.07) followed by Boru (21.40) but, the least number was observed by Honqolo and Mekele-01 (15.20) at Wachemo district; however, at Anlemo the highest number of spiklets per spike was recorded from Boru (20.67) while the least number was recorded by Balcha (13.20). The variety with an increasing number of

spikelets per spike together with other growth parameters provides ample opportunity for increasing grain yield in bread wheat improvement.

The mean ranges of tiller number were 6.07 to 3.07 with a pool mean of 4.18 at Wachemo district while at Anlemo it ranged from 4.73 to 2.73 with an average mean of 3.62. The highest tiller number per plant was recorded by variety Boru (6.07) followed by Alidoro (6.00) while the least number was obtained from variety Deka (3.07) at Wachemo whereas, at Anlemo district the variety Dereselgn revealed more number of tillers (4.73) however, the least number was counted from Bodena (2.73). The variation in tiller numbers for each variety across locations is due to variety-to-environment interaction effects.

The mean performance of yield components

The number of grains per plant revealed highly significant differences in each location Table 2. The mean for the number of grain per plant at Wachemo district ranged from 83.37 to 26.07 with an average mean of 56.98 whereas, at Anlemo it ranged from 82.20 to 45.53 with the pool mean of 58.26. The highest number of grains per plant were recorded from the variety of Alidoro (83.37) followed by Deka (80.87) and the least number was exhibited from variety Mekele-01(26.07) at Wachemo district whereas, at Anlemo district maximum number of grain yield recorded from variety Deka (82.2) followed by Boru (79.73). The lowest number was obtained from the variety Balcha (45.53). In accordance with the given results, Obsa *et al.*, (2019) revealed that the number of kernels per plant in different environments varies due to genotypic, environmental, and genotype-by-environment environment interaction variation.

The mean range for biomass yield scored 23111kg/ha to 11111kg/ha with a pool mean of 16422.22kg/ha and 13694kg/ha to 8333kg/ha with an average mean of 10273.33kg/ha at Wachemo and Anlemo district, respectively. The highest biomass yield was recorded from variety Balcha (23111kg/ha) followed by Alidoro (20000kg/ha) at Wachemo district whereas, at Anlemo district, the highest biomass yield was measured from variety Balcha (13694kg/ha) followed by Deka (12189kg/ha). The highest biomass yield at both locations was recorded from the variety Balcha. On the other hand, Mekele-01 exhibited the lowest biomass yields in both locations.

Even though similar varieties performed the highest and lowest biomass yields in both locations, the magnitude is not complemented; this is due to environmental differences. The result is in agreement with the finding of (Kole *et al.,* 2015; Lobell *et al.,* 2011) who stated the location itself differs greatly in temperature, humidity, and rainfall variation, which affects yield and yield contributing traits in crops.

The variances for thousand-grain weight revealed significant differences Table2. The mean ranged from 42.46gm to 24.51gm with an average mean of 33.95gm at Wachemo district and it was ranged from 45.72gm to 34.39gm with a pool mean of 39.01gm at Anlemo district. The highest grain weight was recorded from variety Deka (42.46gm) followed by Danda'a and Boru (41.39gm, 41.32) respectively; at Wachemo while at Anlemo the highest thousand-grain weight was recorded from variety Boru (45.72gm) followed by Danda'a (45.51gm) but, the variety Hoggena scored the lowest thousand-grain weight (34.39gm). Most varieties that studied at Anlemo district exhibited the greatest weight for thousand-grain weight, which increases seed quality for farmers' selection.

In agreement with the given results, Obsa *et al.* (2018) and Khan *et al.,* (2019) also pointed out there were significant differences among varieties for thousand-grain weight. Harvest index in each location exhibited highly significant differences Table 2. It was ranged from 40% to 11% with an average mean of 26% at Wachemo district; it was also ranged from 46% to 33% with an average mean of 38% at Anlemo district. At Wachemo district, the highest mean for harvest index was obtained from Danda'a(40%) followed by Kakaba(38%) while the lowest mean resulted from Local(11%) on the other hand, at Anlemo district, Deka(46%) and Kakaba(44%) scored highest harvest index. Varieties that exhibit a greater harvest index are considered for selection in further improvement of bread wheat. Rehmat *et al.,*(2017) found a similar range of harvest indexes for different traits in bread wheat.

Grain yield revealed highly significant (<0.001) differences among varieties studied in each location Table 2. The mean for grain yield ranged from 6555.5kg/ha to 1555.5kg/ha with an average mean of 4290kg/ha at Wachemo district and it was ranged from 5541.7kg/ha to 3055.6kg/ha with an average mean of 3911.67kg/ha at Anlemo district.

The varieties that scored the highest grain yield at Wachemo district is Balcha(6555.5kg/ha) followed by Deka(6444.4kg/ha) while the lowest yield was obtained by Local (1555.5kg/ha). The reason for the low yield recorded from local varieties was due to susceptibility to disease in the area during the grown year. At Anlemo district, on the other hand, the highest grain yield was obtained from Deka(5541.7kg/ha) followed by Balcha(4811.1kg/ha) while the lowest yield was recorded from Honqolo(3055.6kg/ha). Even though the magnitude of yield varies, the varieties, Dekaka and Balcha produced considerably greater yields in both locations. The given result is in agreement with the findings of Fano *et al.,* (2017), Obsa *et al.,* (2018), and Solomon (2019) who reported significant differences between bread wheat varieties for grain yield.

Table 2: Mean squares for different traits of bread wheat varieties at Wachemo and Anlemo district in 2013/21

	Wachemo District					Anlemo District				
Trt	**MSRp (df=2)**	**MSVar (df=19)**	**MSEr (df=38)**	**CV**	**LSD**	**MSRp (df=2)**	**MSVar (df=19)**	**MSEr (df=38)**	**CV**	**LSD**
DH	54.72	85.17**	0.44	0.95	1.09	27.05	107.10**	0.87	1.41	1.55
DM	24.07	302.96**	2.12	1.21	2.41	120.68	155.36**	0.26	0.43	0.84
GF	8.02	136.18**	2.29	3.02	2.51	6.47	45.56**	1.186	1.80	0.69
PH	2.38	138.32**	8.81	3.19	4.91	40.50	148.79**	11.19	5.53	5.52
SL	0.104	3.47**	0.240	5.355	0.81	1.04	2.43**	0.16	4.69	0.66
SPS	1.766	12.72	0.79	5.00	1.47	0.15	7.81**	0.48	4.16	0.445
NTPP	0.186	2.48**	0.280	12.66	0.87	4.44	0.76**	0.17	11.32	0.68
NGPP	4.33	761.38**	59.64	13.55	12.76	132.46	259.23**	29.11	9.26	8.92
BMY	5601851.8	27019883.0**	7369883	16.53	4487.2	1546125.00	4501886.94*	2019746	13.83	2349.1
TGW	2.36	73.15**	5.35	6.81	3.82	0.05	35.55**	0.10	0.81	0.52
HI	0.0008	0.0197**	0.0019	16.78	0.07	0.00071	0.0034**	0.0012	8.89	0.06
GY	241555.6	8311653.0**	435863.5	15.39	1091.3	78635.42	952138.40**	373868.1	15.63	1010.7

** = significant, Ns = not significant at p<0.01 probability levels; SV=source of variation, DF=degree of freedom, DH=days to heading, DM=days to maturity, PH=plant height, SL=spike length, NTPP=number of tillers per plant, NGPP=number of grain per plant, BMY=biomass yield, TGW=thousand grain weight, HI=harvest index, GY=grain yield

Table 3: Mean performance Bread wheat varieties at WCU district in 2013/2021 main cropping season

No	**Trt**	**DH**	**DM**	**GF**	**PH**	**SL**	**SPS**	**NTPP**	**NGPP**	**BMY**	**TGW**	**HI**	**GY**
1	Dereselgn	57.00k	81.67j	24.67m	106.53a	8.87c-f	15.73g	3.93c-f	43.80fg	13667fg	30.55fgh	0.17g-i	2333.3g-i
2	Kakaba	66.33h	118.0h	51.67fgh	93.13b-e	9.33cd	16.87e-g	4.67bc	51.13d-g	15222c-g	34.30def	0.38a	5800.0a-c
3	Local	69.00f	118.0h	49.00ijk	92.13b-e	9.40cd	16.07fg	3.33ef	44.00fg	13333fg	26.68ij	0.11i	1555.6i
4	Shorima	73.0f	120.67fg	47.67jkl	91.37cde	9.20cde	18.47cd	3.80c-f	45.47efg	16333b-f	33.14def	0.29b-e	4577.8de
5	Pavon-76	66.33h	121.3efg	55.00abc	96.30bc	9.53c	18.33cd	3.93c-f	56.20c-f	14667d-g	28.49ghi	0.21f-h	3000.0f-h
6	Honqolo	72.67d	126.33b	53.67b-f	76.77g	8.47e-h	15.20g	3.20f	44.87efg	13444fg	27.55hij	0.14hi	1866.7hi
7	Dursa	67.0gh	113.0i	46.00l	89.33de	7.93gh	16.00fg	3.87c-f	54.40c-f	19889ab	38.27ab	0.30b-e	6000.0a-c
8	Mekele01	62.0j	118.0h	56.00ab	87.67ef	8.33fgh	15.20g	4.33cd	26.07h	11111g	24.51h	0.16hi	1777.8i
9	Boru	71.0e	123.67cde	52.67c-g	97.80b	10.80b	21.40a	6.07a	78.47a	18444b-e	41.32a	0.35abc	6333.3ab
10	Balcha	71.0e	118.0h	47.00kl	95.93bc	9.00c-f	16.27e-g	4.33cd	75.60ab	23111a	38.40ab	0.28b-e	6555.6a
11	Hoggena	80.0a	130.3a	50.333g-i	83.00f	7.87h	15.87g	5.27ab	43.47fg	14333e-g	31.63def	0.21fgh	3000.0f-h
12	Deka	72.0de	124.0bcd	52.00e-h	95.00bcd	9.33cd	20.73ab	3.07f	80.87a	19222abc	42.46a	0.33a-d	6444.4a
13	Biqa	64.0i	121.3efg	57.33a	89.67de	9.53c	17.60d-f	3.33ef	56.8cde	16000b-e	36.74bc	0.22f-h	3444.4e-g
14	Kingbird	68.0fg	119.0gh	51.00g-i	87.87ef	9.13c-f	17.87de	4.13cde	55.33c-f	15778b-e	33.32cde	0.25e-g	3888.9d-f
15	Alidoro	76.33b	126.3b	50.00h-j	105.80a	12.67a	22.07a	6.00a	83.73a	20000ab	33.34cde	0.21f-h	4333.3de
16	Danda'a	75.0c	125.3bc	50.33h-g	97.80b	9.40cd	19.80bc	5.53ab	64.13bc	17000b-e	41.39a	0.40a	6111.1a-c
17	Wane	68.67f	117.67h	49.00i-k	95.80bc	7.93gh	17.80de	4.33cd	59.20cd	19556a-c	35.13bcd	0.25e-g	5111.1b-d

18	Bodena	68.0fg	122.67def	54.67b-d	93.87bcd	8.60d-g	16.00fg	3.53def	43.08g	14111e-g	33.66cde	0.21f-h	3555.6ef
19	Liben	73.0d	125.3bc	52.33e-h	94.53bcd	8.93c-f	19.73bc	3.27ef	79.20a	18889a-d	32.91cde	0.27c-f	3555.6b-d
20	Lemu	75.3bc	129.67a	54.33b-e	91.47cde	8.73c-f	17.60d-f	3.67def	50.80d-g	14333e-g	35.12bcd	0.37ab	5000.0cd
	Mean	69.78	120.02	50.23	93.09	9.15	17.75	4.18	56.98	16422.22	33.95	0.26	4290.00
	CV%	0.95	1.21	3.02	3.19	5.355	5.00	12.66	13.55	16.53	6.81	16.77	15.39
	LSD(0.05)	1.09	2.41	2.51	4.91	0.81	1.47	0.87	12.76	4487.2	3.82	0.071	1091.3

Where, HD=days to heading, DM= days to physiological maturity, GF=grain filling, PH=plant height, SL=spike length, SPS=spiklets per spike, NTPP=number of tillers per plant, NGPP=number of grain per plant, BMY=biomass yield, TGW=thousand grain weght, HI=harvest index, GY= grain yield CV= coefficient of varience, LSD= least significant differences, Trt=treatment

Table 4: Mean performance of bread wheat varieties at Anlemo district in 2013/21 main cropping season

No	Trt	HD	MD	GF	PH	SL	NTPP	NSPS	NGPP	BMY	TGW	HI	GY
1	Dereselgn	53.67k	101.67k	48.00ij	107.40a	8.80bc	4.73a	15.67efg	48.73ef	9583bc	34.37l	0.34ef	3250.0c
2	kakaba	60.00i	107.00i	47.00jk	101.80ab	9.00bc	3.33d-h	17.60bc	59.60bcd	9306c	39.78f	0.44ab	4027.8bc
3	local	68.00e	116.33f	48.33hij	102.67ab	8.40cde	3.27e-h	16.53c-f	48.73ef	10872bc	38.43g	0.34ef	3658.3cd
4	shorima	71.33bc	121.67d	50.33fg	101.13b	9.20b	3.73b-f	16.60cde	55.53b-f	10417bc	39.39f	0.34b-e	4033.3bc
5	pavon-76	66.33f	117.67e	51.33fg	97.87bc	8.53cbd	3.73b-e	16.40d-g	53.67c-f	10278bc	36.13j	0.39b-e	3966.7bc
6	Honqolo	72.00bc	122.00d	50.00fgh	84.13h	7.93def	3.27b-f	16.40d-g	57.53b-e	8333c	35.077k	0.37c-f	3055.6c
7	Dursa	61.33ih	107.00i	45.67l	90.07e-g	7.20fg	3.67b-f	16.40g	51.73def	10417bc	41.51d	0.37c-f	3822.2bc
8	Mekele01	58.33j	105.33j	47.00jkl	81.87h	8.40cde	4.20abc	16.53c-f	63.33bc	8333c	39.33f	0.38c-f	3125.0c
9	Boru	69.00ed	123.00c	54.00cd	90.13d-g	10.20a	4.13a-d	20.67a	79.73a	9678bc	45.72a	0.43abc	4222.2bc
10	Balcha	69.00ed	115.33g	46.33kl	85.73gh	7.20fg	3.00fgh	13.20h	45.53f	13694a	38.16g	0.35def	4811.1ab
11	Hoggena	77.33a	129.00a	51.67ef	86.80e-h	8.80bc	3.27e-h	17.93b	58.20b-e	11111bc	34.39l	0.33f	3652.8bc
12	Deka	71.33bc	123.00c	51.67ef	93.53cd	8.87bc	3.93b-e	17.47bcd	82.20a	12189ab	43.69b	0.46a	5541.7a
13	Biqa	62.00gh	118.00e	56.00b	91.27def	9.20b	4.33ab	15.87efg	55.40b-f	11111bc	37.58h	0.38b-e	4177.8bc
14	Kingbird	63.33g	110.00h	46.67jkl	90.13d-g	7.87def	3.47c-g	16.00efg	54.47b-f	10000bc	37.02i	0.39a-d	3972.2bc
15	Alidoro	68.33e	121.33d	53.00de	102.53ab	10.33a	3.87b-e	19.93a	57.07b-e	10694bc	42.64c	0.36def	3861.1bc
16	Danda'a	71.00c	124.00b	53.00de	94.13cd	9.07bc	3.40c-g	17.93b	63.33bc	9306cc	45.51a	0.37c-f	3405.6bc
17	Wane	60.33hi	115.33g	55.00bc	85.87fgh	7.00g	3.87b-e	16.40d-g	64.60b	9722bc	38.32g	0.39b-e	3811.1bc
18	Bodena	62.00hg	123.00c	61.00a	90.07d-g	7.67efg	2.73h	15.40fg	50.47def	9589bc	40.39e	0.38b-e	3655.6bc
19	Liben	70.33cd	124.00b	53.67cd	92.13de	8.60bcd	2.93gh	16.20efg	60.27bcd	10556bc	34.68kl	0.40a-d	4222.2bc
20	Lemu	73.00b	122.00d	49.00ghi	93.20cd	9.07bc	3.53b-f	16.67cde	55.07b-f	10278bc	38.07gh	0.39a-d	3961.1bc
	Mean	66.40	117.33	50.93	93.12	8.57	3.62	16.73	58.26	10273.33	39.01	0.38	3911.67
	CV%	1.41	0.431	2.14	3.59	4.69	11.46	0.445	9.26	13.83	0.81	8.98	15.63
	LSD(0.05)	0.59	0.778	0.69	5.53	0.26	0.27	4.16	8.92	2349.1	0.52	0.06	1010.7

Where, HD=days to heading, DM= days to physiological maturity, GF=grain filling, PH=plant height, SL=spike length, SPS=spiklets per spike, NTPP=number of tillers per plant, NGPP=number of grain per plant, BMY=biomass yield, TGW=thousand grain weght, HI=harvest index, GY= grain yield CV= coefficient of varience, LSD= least significant differences, Trt=treatment

Conclusions and Recommendations

The analysis of variance for yield and other agronomic traits of the studied bread wheat varieties at both locations showed highly significant differences (P<0.01). Deka (5541.7kg/ha) and Balcha(4811.1kg/ha) revealed greater yield together with other agronomic performances in the Anlemo district similarly, in the Wachemo district these varieties Balcha(6555.6kg/ha) and Deka(644.4kg/ha) scored the highest grain yield with other yield-related characteristics. Both varieties had good performances in both locations which pointed out them to scale up the production in the studied area. Newly improved varieties had good potential in yield performance and other agronomic traits in the studied area indicated farmers give more attention to using newly improved varieties than released before.

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