



## Evaluation of Improved Food Barley (*Hordeum Vulgare* L.) Varieties in the Mid-Land Areas of West and Kelem Wollega Zones of Western Oromia

Dereje Abera\*, Wakgari Raga, Geleta Negash, Abay Guta, Biru Alemu

Oromia Agricultural Research Institute (OARI), Haro Sabu Agricultural Research Center, P.O.Box 10, Kellem Wollega, Dambi Dollo

**\*Corresponding Author:** Dereje Abera, Oromia Agricultural Research Institute (OARI), Haro Sabu Agricultural Research Center, P.O.Box 10, Kellem Wollega, Dambi Dollo

**Abstract:** The field experiment was conducted on six improved food barley varieties and one local check at Haro Sabu Agricultural Research Center during 2014-2016 main cropping season. The main objective of the study was to identify, select and recommend well adaptable and high yielding variety for Kelem and West Wollega. The seed were sown in Randomized Complete Block Design (RCBD) with three replications in the net plot size of 1.2mx2.5m. Number of effective tiller per plant (ETP), Number of spikelet per panicle (SPP), Plant height (PH), Panicle length (PNL), Number of grain per spike (GPS), days to 50% heading (DH), days to 50% maturity (DM), thousand seed weight (TSW) and grain yield (GY) were collected as Agronomic traits. Combined analysis of variance detected significant difference among main effect of variety, year and location for most of agronomic traits considered. The interaction effect of variety by year, variety by location and year by location imposed significant effect on all traits except for PNL, PH and PNL, DM and SPP, respectively. Likewise, variety by year by location had significant influence on all agronomic traits excluding PH. Among evaluated varieties; Dinsho (3.3ton/ha) and Abdane (3.26ton/ha) had significantly higher mean value of grain yield over the rest and followed by Biftu (3.19ton/ha). Moreover, the yield advantage of 14.58%, 13.19% and 10.76% were estimated for Dinsho, Abdane and Biftu, respectively over the local check (2.88 ton<sup>ha</sup>). Therefore, the identified varieties were suggested for further demonstration and popularization in West and Kellem Wollega and areas with similar agro-ecology.

**Keywords:** Adaptability, *Hordeum vulgare* L., Varieties

### 1. INTRODUCTION

Barley (*Hordium vulgare* L.) is recognized as one of the world's most ancient food crop, which is believed to have first domesticated about 10,000 years ago from its wild relatives in the Fertile Crescent of the Near East and Center of diversity in Ethiopia (Bedasa, 2014). In Ethiopia, Barley is the fifth important cereal crop after Tef, Maize, Sorghum and Wheat in both total area coverage and annual production (CSA, 2015). It is cultivated at altitudes ranging from 1500 to 3500 above sea level and predominantly grown at elevation ranging from 2000 to 300 m.a.s.l. (Tamene, 2016). Being the most dependable and desirable crop for the resource poor highland farmers (Ferdissa et al., 2010), in some regions it is cultivated in two district seasons: belg which relies on the short rainfall period from March to April and Meher which relies on the long rainfall period from June to September (Bekele et al., 2005).

In Ethiopia, the national average yield of food barley was estimated to be 1.965 and 1.966 t/ha during 2014/15 and 2015/16, respectively. Similarly, average grain yield of 2.228 t/ha (Oromia), 1.20 t/ha (West Wallaga zone) and 1.613 t/ha (Kellem Wallaga zone) was obtained (CSA,2016), indicating below national productivity of the crop in the zones. The most important biotic and abiotic factors that reduce productivity of barley in Ethiopia include; low yielding varieties, insect, disease, poor soil fertility, soil acidity and weed competition (Bekele et al., 2005). Gradual increasing of these production constraints are held to be important for diminishing productivity of barley in the study areas. Evaluation of different food barley varieties is among alternative intervention approach through which productivity of the crop could be alleviated. Therefore, the main objective of the study was to evaluate performance of improved food barley varieties and to recommend the adaptable and high yielding variety for West and Kelem Wollega Zones and areas with similar agro-ecologies.

## 2. MATERIALS AND METHODS

### 2.1. Description of the Study Area

Field experiment was conducted at Haro Sabu Agricultural Research Center sub-sites (Badesso and Mata) for three consecutive years (2014-2016). The study sites were recognized with an elevation of 2016 m.a.s.l (Mata) and 2054 m.a.s.l (Badesso), having unimodal rain fall distribution pattern. Sandy loam type soil textural class with PH of 4.59 and 5.65 and exchangeable acidity of 0.07 and 0.14 dS/m were among the features describing Mata and Badesso sites, respectively.

### 2.2. Materials

Six improved varieties released from Regional and National Agricultural Research Center were evaluated against to local cultivar for their performance on grain yield and yield contributing agronomic traits (Table 1).

### 2.3. Experimental Design

Randomized Complete Block Design (RCBD) with three replications, having a net plot size of 1.2m x 2.5m was used at the spacing of 1.5m, 0.4m and 0.2m between replications, plot and row, respectively. Seed was sown at the rate of 135 kg/ha with drilling method. Inorganic fertilizer DAP (46 Kg/ha) was used at sowing time, while UREA (41 Kg/ha) applied in split form (each 50% at sowing and 40 days after emergency). All agronomic practices were done uniformly.

### 2.4. Data Collection and Analysis

Plant based data: were collected from number of effective tiller per plant (ETP), number of spikelet per panicle (SPP), plant height (PH), panicle length (PNL) and number of grain per spike (GPS).

Plot based data: were considered for phenological traits including days to 50% heading (DH), days to 90% physiological maturity (DM) and for yield components viz. thousand seed weight (TSW) and grain yield (GY). Plant based data were recorded from ten randomly selected and tagged plants from harvestable rows. The collected data were organized and analyzed using SAS statistical package (SAS, 2006 version 9.03). Mean separation was done by using least significant difference (LSD) at 1% probability level through employing the procedure developed by Gomez and Gomez (1984).

**Table 1.** Description of research materials

Variety	Year of release	Maintainer
Abdane	2011	Sinana Agricultural Research Center/OARI
HB-1307	2006	Holata Agricultural Research Center/EIAR
Biftu	2005	Sinana Agricultural Research Center/OARI
Dafo	2005	Sinana Agricultural Research Center/OARI
Dinsho	2004	Sinana Agricultural Research Center/OARI
Harbu	2004	Sinana Agricultural Research Center/OARI
Local cultivar		Available with Farmers

Whereas, OARI= Oromia Agricultural Research Institute, EIAR= Ethiopia Agricultural Research Institute

## 3. RESULTS AND DISCUSSIONS

### 3.1. Analysis of Variance

Combined analysis of variance detected significant difference of variety for all agronomic traits (Table 2), while individual location analysis revealed significant difference among varieties for most of the traits (Appendix Table 1). Over year analysis explained significant of variety for DH, DM, PH and GPS during 2014-2016 and for GY during 2015 and 2016 consistently (Appendix Table 2). On the other hands, ANOVA exhibited presence of significant interaction effect of variety by year, variety by location, location by year, variety by year by location for most of agronomic traits observed (Table 2). Thus, analysis of variance depicted the existence of significant effect of fluctuating weather condition on mean performance of most of the traits. The finding of the study supported previous report of Badessa (2014).

**Table2.** Combined analysis of variance for evaluated food barley variety

SV	DF	DH	DM	ETP	SPP	PH	PNL	GPS	TSW	GY
Var	6	179.56**	622.44**	3.44**	30.55**	759.08**	5.54**	268.89**	162.61**	2.28**
Rep	2	2.39	21.94**	0.35	1.89	130.61*	3.04*	4.22	2.54	0.06
Year	2	210.58**	44.91**	14.37**	133.14**	3414.90**	21.25**	2496.096**	137.25**	4.48**
Loc	1	208.29**	23.14**	2.43*	12.89*	135.78*	3.70*	1.65	516.88**	2.01*
Var*Year	12	8.86**	18.15**	1.32**	28.34**	64.21*	0.4	123.96**	72.70**	1.29**
Var*Loc	6	3.92*	62.92**	1.52*	10.81**	27.84	0.6	173.16**	98.24**	0.5*
Loc by Year	2	119.64*	2.64	3.99*	168.18	135.78*	5.00**	520.95**	926.69**	2.11*
Var*Year*Loc	14	12.99**	17.31**	1.23**	10.11**	29.87	1.02*	120.95**	200.66**	2.31*

Whereas, DF= degree of freedom, DH= days to heading, DM= days to maturity, ETP= effective tiller per plant, GPS= grain per spikelet, GY= grain yield, Loc= location, PH= plant height, PNL= panicle height, Rep= replication, SPP= spikelet per panicle, SV= source of variation, TSW= thousand seed weight, var= variety.

### 3.2. Mean Separation for Grain Yield and Yield Related Traits

#### 3.2.1. Over Year Mean Performance

Dinsho and Dafo attained the longest and shortest value of DH over all seasons, respectively. Tashome (2017) reported similar result for Dafo on DH and contrasting result for Dinsho. The earliest mean value of DM recorded for Harbu, while the longest DM value obtained from HB-1307 over all seasons (Appendix Table 3). In agreement with this, Girma (2012) reported significant variation of variety for DH and DM. The lowest (3.52) and highest (4.64) mean value of ETP was obtained during 2014 and 2016, respectively. The maximum mean value of ETP was recorded for Dinsho (2016), however, the minimum value was attained by Dinsho and Dafo during 2014. Similarly, HB-1307 had significantly higher mean value of SPP during 2014 and 2015, while the shorter and taller mean value of PH, respectively over all cropping seasons. The minimum and maximum mean value of 22.29 (2015) and 36.13 (2014) for GPS, respectively.

The Minimum (2.95 ton/ha) and maximum (3.62 ton/ha) mean value of grain yield was recorded during 2015 and 2014 cropping season respectively, however, Abdane and Biftu (2014 and 2016) and Dinsho (2014 and 2015) exhibited significantly higher mean value of GY (Appendix Table 3), indicating high influence of over year fluctuating weather condition even on the same trait of single variety. Present study is in agreement with Girma (2012).

#### 3.2.2. Over Location Mean Performance

Dinsho showed significantly longer DH and followed by Abdane at Badesso and Mata sites. In the reverse, Dafo exhibited significantly earlier DH over the two locations. HB-1307 attained significantly longer DM over the two locations, whereas Dafo and Harbu showed significantly earlier DM at both sites (Table 3). The lowest mean value of ETP was attained by Harbu (Badesso) and Biftu (Mata), whereas the highest mean recorded from Local check (Badesso) and Dinsho (Mata).

**Table3.** Over location mean performance of food barley grain yield

varieties	DH		DM		ETP		SPP	
	Badesso	Mata	Badesso	Mata	Badesso	Mata	Badesso	Mata
Biftu	53.44c	51.56cd	91.44c	90.89c	4.36b	3.31d	17.1a	16.07a
Dafo	50.22d	47.56e	88.22d	87.44d	4.08b	4.01c	13.53c	15.41ab
Dinsho	60.67a	57.44a	92.33b	90.33c	4.41b	5.22a	14.7bc	12.09d
Harbu	52.67c	51.33d	87.67d	87.11d	4b	3.8cd	16.96a	15.62ab
HB1307	56b	52.78c	100.44a	109.56a	4.17b	3.82cd	17.38a	16.09a
Local	56.11b	52.22cd	93b	92.89b	5.01a	4.62b	13.77c	14.82bc
Mean	55.06	52.49	92.22	93.08	4.32	4.05	15.55	14.91
CV	1.81	2.88	0.94	1.12	11.79	13.69	8.11	5.81
Lsd	0.95	1.44	0.82	0.99	0.49	0.53	1.2	0.83

Whereas, DH= days to heading, DM= days to maturity, CV= coefficient of variation, Lsd= least significant difference.

Table3. (Continued...)

Variety	GPS		PH		TSW		GY	
	Badesso	Mata	Badesso	Mata	Badesso	Mata	Badesso	Mata
Abdane	32.13c	34.32a	80d	78.69b	46.04c	42.76b	3.49a	3.69a
Biftu	41.19a	28.83c	97.93a	97.08a	42.67d	39.2d	3.58a	3.46a-c
Dafo	27.77d	32.31b	98.17a	98.52a	49.78a	41.07c	2.69cd	3.63ab
Dinsho	27.09d	32.73ab	94.29ab	94.8a	48.66ab	41.67bc	3.55a	3.72a
Harbu	32.74c	31.29b	93.51ab	94.2a	48.03b	39.47d	3.1b	3.21c
HB1307	35.92b	32.74ab	86.83c	83.93b	42.22d	40.29cd	2.55d	2.67d
Local	22.11e	25.12d	90.45bc	92.04a	47.6b	52.2a	3.05bc	3.38bc
Mean	31.28	31.05	91.6	91.32	46.43	42.38	3.14	3.4
CV	7.45	5.8	6.55	7.56	2.8	3.96	12.64	9.39
Lsd	2.22	1.72	5.25	6.58	1.24	1.6	0.38	0.3

The highest mean value of SPP and GPS was recorded at Badesso site, while the highest mean value of PH was recorded at Mata. with this, Biftu, Harbu and HB-1307 had significantly higher mean value of SPP at both locations, while Biftu, Dafo, Dinsho and Harbu showed significant and higher mean of PH at both locations (Table 3). Biftu had significant and higher mean value of GPS at Badesso, however, Abdane, Dinsho and HB-1307 exhibited significant and higher mean of GPS at Mata. Present result supported Girma (2012) who reported that grain per spike was significantly affected by variety. The lower mean of TSW was recorded at Mata, while the higher value attained at Badesso. Similarly, the minimum and maximum mean value of 3.14 ton/ha and 3.40 ton/ha were obtained at Badesso and Mata, respectively for GY. With this, the lowest mean value of GY was exhibited by HB-1307 at both locations. On the contrary, Biftu, Abdane and Dinsho had significantly higher mean value of GY at both locations consistently. Therefore, Girma (2012) reported similar trends of some barley varieties for grain yield, while Wosene et al. (2015) and Tashome (2017) found over year significance ( $p < 0.05$ ) of food barley varieties for grain yield.

### 3.2.3. Combined Mean Performance

Mean value of DH varied from 48.94 (Dafo) to 59.06 (Dinsho) with over all mean value of 53.78. Dinsho and Abdane had the longest DH, while Biftu and Harbu had shorter DH after Dafo. The mean value of DM ranged from 87.39 for Harbu to 105 for HB-1307 with over all mean value of 92.65. HB-1307 had significantly longer mean value of DM (Table 4). The result supported Girma (2012), Wosene et al. (2015) and Tashome (2017) who reported significant variation of variety for DH and DM. The study also found significantly shorter (Abdane and HB-1307) and longer (Biftu and Dafo) mean value of PH which agreed with Badasa (2014) who reported significantly higher mean of PH, SPP, GPS, GY for Biftu. The lowest mean value of 30.38 (Biftu) and the highest mean value of 39.90 (Local check) was recorded for TSW with over all mean value of 34.40 gm. The higher mean value of TSW was obtained from Dafo (35.42 gm) and Dinsho (35.38gm) after Local check. On the other hands, the mean value of GY varied from 2.28 (HB-1307) to 3.30 (Dinsho) with the mean value of 2.94, where Abdane (3.26), Biftu (3.19) and Dinsho (3.3) showed significantly larger mean of GY over the rest varieties (Table 5). HB-130 attained significantly lower mean value of GY which was followed by Harbu and Dafo (Table 4), however, Kemelew (2011) and Girma (2012) reported the largest mean value of grain yield for HB-1307. The yield advantage (%) 14.58%, 13.19% and 10.76% was estimated for Dinsho, Abdane and Biftu, respectively over the local check which had a mean value of 2.88 ton/ha. Therefore, Abdane, Biftu and Dinsho were identified for better mean performance of GY and some yield contributing traits.

Table4. Combined mean performance of grain yield and yield attributing traits

Varieties	DH	DM	PH	TSW	GY	Yad (%)
Abdane	55.44b	92.89bc	80.93d	34.4bc	3.26a	13.19
Biftu	52.5cd	91.22d	98.51a	30.38c	3.19ab	10.76
Dafo	48.94e	87.83e	98.73a	35.42ab	2.83c	-1.74
Dinsho	59.06a	91.33cd	94.98ab	35.38ab	3.3a	14.58
Harbu	52d	87.39e	94.95ab	33.75bc	2.82c	-2.08
HB-1307	54.39bc	105a	86.91c	31.26bc	2.28d	-20.83
Local	54.17bc	92.94b	91.53b	39.9a	2.88bc	0

## Evaluation of Improved Food Barley (*Hordeum Vulgare* L.) Varieties in the Mid-Land Areas of West and Kelem Wollega Zones of Western Oromia

Mean	53.79	92.66	92.36	34.4	2.94	
CV	5.46	2.58	6.94	21.3	15.8	
Lsd	1.95	1.58	4.2517	4.86	0.31	

Whereas, CV =coefficient of variation, Lsd=least significant difference, ton<sup>-ha</sup>=ton/hectare, Yad= percentage of yield advantage over local check

### 4. SUMMARY AND CONCLUSION

Combined analysis of variance revealed significant effect of variety, location, year and their interactions for most of agronomic traits, indicating the significant influence of location and over year fluctuating weather condition on considered observation. The study found that Abdane, Biftu and Dinsho had shown significantly higher mean values of grain yield with the best yield advantage over the local check. On the contrary, Dafo and Harbu showed the desired significantly earlier days to maturity over the two locations and across the three cropping seasons consistently. However, these varieties revealed lower mean values of primarily concerned trait which was grain yield. Therefore, demonstration and popularization of the three identified varieties viz. Abdane, Biftu and Dinsho is the important concern to improve food barley productivity in the study areas and other areas having similar agro-ecology.

### ACKNOWLEDGEMENT

Author would like to thank Oromia Agricultural Research Institute for granting the fund and Haro Sabu Agricultural Research Center for providing the research facilities required, particularly cereal research team for their efforts on trial management and data collection.

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### APPENDIX

**AppendixTable1.** Individual location ANOVA for grain yield and yield related traits

Badeso 2014									
SV	DH	DM	ETP	SPP	PH	PNH	GPS	TKW	GY
Variety	24.63**	16.11**	2.27*	22.20*	89.64	1.06*	239.61**	18.24	0.34

**Evaluation of Improved Food Barley (*Hordeum Vulgare* L.) Varieties in the Mid-Land Areas of West and Kelem Wollega Zones of Western Oromia**

Rep	0.14	0.14	0.90	4.75	55.92	0.97	28.49	410.75*	0.21
Error	0.59	0.59	0.46	6.42	73.09	0.34	23.67	13.01	0.19
Mata 2014									
Variety	23.43**	10.86**	0.75	13.98	96.92	0.87*	25.53	48.84**	0.55*
Rep	1.29	1.29	0.43	5.66	79.18	0.85	11.18	1.75	0.51
Error	0.62	0.62	0.65	7.77	51.90	0.27	77.09	3.16	0.12
Badesso 2015									
Variety	28.54	29891.78	0.68	16.71	107.02**	0.87	86.65**	2.69	0.99**
Rep	4.76	29743.19	1.06	42.27	8.31	0.29	83.19*	0.72	0.15
Error	13.04	30339.47	0.55	11.26	16.54	0.58	8.78	2.42	0.06
Mata 2015									
Variety	28.54	190.00**	1.71	543.71	218.63**	1.89	17.35	6.20	0.23**
Rep	6.33	68.90	0.59	511.00	42.87	4.62	15.22	0.18	0.01
Error	14.44	9.40	1.74	453.17	41.90	1.58	12.09	4.58	0.03
Badesso 2016									
Variety	29.21	179.41**	1.70	39.11	213.75**	1.30	184.21**	224.06	1.78**
Rep	7.48	48.90	0.80	55.13	22.56	2.05	34.11	259.76	1.25*
Error	11.75	7.29	0.54	35.95	17.50	1.22	34.82	248.81	0.27
Mata 2016									
Variety	29.21	179.41**	2.03	15.38*	240.99**	1.66	242.91	299.53**	2.39*
Rep	7.48	48.90	0.66	5.37	67.69	2.94	150.65	5.86	0.60
Error	11.75	7.29	1.40	3.45	51.81	0.93	83.07	6.00	0.51

**AppendixTable2.** Individual Year ANOVA for grain yield and yield related traits

Traits	2014					2015					2016				
	Loc	Rep	Var	Loc*v ar	Mse	Loc	Rep	Var	Loc*v ar	Mse	Loc	Rep	Var	Loc*v ar	Mse
DH	22.88**	2.17	49.10**	1.1	0.6	262.50*	18.17	57.1*	0.1	10.99	Loc	Rep	Var	Loc*v ar	Mse
DM	1.52	1.36	25.15**	3.13*	0.72	10.5	76.6	145.83*	57.17*	7.39	0.02	18.74	57.04**	0.02	11.17
ETP	0.38	1.24	0.75	2.27*	0.52	9.15*	1.13	2.00	0.4	1.1	0.11	95.64	358.54*	0.21	6.92
SPP	4.02	0.2	28.4	7.77	7.33	315.43	138.52	222.85	337.58	246.26	0.89	1.45	3.33	0.39	0.89
PHT	0.29	134.09	183.44*	3.12	57.77	201.53*	17.44	255.62*	70.03	29.57	44.43	45.18	47.47	7.01	<b>19.36</b>
PNH	0.1	1.78*	1.88**	0.05	0.29	0	2.62	1.6	1.16	1.17	42.6	80.24	448.45*	6.28	32.76
GPS	221.26*	31.48	174.26*	90.88	47.13	735.01*	78.73	51.18*	52.83*	11.15	13.60*	4.94*	2.84*	0.11	1
TSW	310.52*	200.69	45.68	21.4	23.76	412.35*	0.39	2.29	6.6	3.27	88.31	150.65	291.93*	135.19	57.03
GYD	0.55	0.42	0.38	0.51*	0.17	3.23**	0.11	0.95*	0.27*	0.05	1592.29	167.89	286.49	237.09	125.12
											24.99*	1.56	3.52**	0.65	0.38

**AppendixTable3.** Analysis of variance for grain yield and yield related traits at Badesso and Mata sites

Traits	Badesso site					Mata site				
	Var	Rep	Year	Var*Ye ar	Mse r	Var	Rep	Year	Var*Ye ar	Mse r
	6	2	2	12		6	2	2	12	
DH	100.18*	2.4	257.73**	11.38**	1	83.29**	0.49	210.58**	1.44	2.29
DM	158.44*	13.44*	17.92**	35.14**	0.74	526.91*	8.78	33.63**	2.10*	1.08

**Evaluation of Improved Food Barley (*Hordeum Vulgare* L.) Varieties in the Mid-Land Areas of West and Kelem Wollega Zones of Western Oromia**

	*	*				*				
ETP	1.02*	0.59	8.55**	1.81**	0.26	3.95**	0.22	9.82**	0.27	0.31
SPP	23.56**	0.29	33.10**	27.48**	1.59	17.80**	2.44*	119.73**	9.38**	0.75
PHT	306.83*	51.57	1365.89*	51.79*	19	480.09*	80.76	2103.33*	38.22	19.82
PNH	2.11*	0.95	23.41**	0.56	0.5	4.03**	2.22*	2.84*	0.2	0.47
GPS	354.88*	7.86	363.88**	77.80**	5.44	87.17**	2.33	2663.05*	98.81**	3.24
TSW	78.18**	0.54	832.72	62.55**	1.69	182.67*	2.53	254.06**	86.00**	2.82
GY D	1.57**	0.15	8.78**	0.77**	0.16	1.21**	0.13	9.10**	1.00**	0.1

**AppendixTable3.** Over Year Mean performance of food barley variety

variety	DH			DM			ETP			SPP		
	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
Abdane	54.17c	58.17b	54.00b	92.50b	93.83b	92.33b	3.67ab	3.65c	4.35cd	16.40b	15.88b-d	12.23cd
Biftu	51.00d	55.50cd	51.00c	90.50c	92.67c	90.33c	3.67ab	3.88bc	3.95d	16.23b	14.90d	18.62a
Dafo	49.67e	50.50e	46.50d	88.50d	90.00d	85.00e	3.17b	4.38b	4.58c	14.73c	15.38cd	13.30c
Dinsho	60.00a	60.50a	56.67a	92.50b	92.83c	88.67d	3.17b	5.28a	6.00a	13.00d	16.28bc	10.90e
Harbu	50.83de	54.83d	50.33c	87.00e	89.50d	85.67e	3.33b	4.28b	4.08cd	17.23b	16.60b	15.03b
HB-1307	56.33b	55.83cd	51.00c	102.83a	104.17a	108.00a	3.50ab	4.28b	4.20cd	20.03a	18.88a	11.28de
Local	55.00c	56.50c	51.00c	93.00b	93.50bc	92.33b	4.17a	5.00a	5.28b	16.80b	15.22cd	10.87e
Mean	53.86	55.98	51.5	92.4	93.79	91.76	3.52	4.4	4.64	16.35	16.16	13.18
CV	1.97	2.35	2.85	0.98	0.82	1.15	16.92	9.94	10.38	7.15	6.02	7.35
Lsd	1.26	1.56	1.74	1.08	0.91	1.25	0.71	0.52	0.57	1.39	1.16	1.15

Whereas, DH= days to heading, DM= days to maturity, CV= coefficient of variation, Lsd= least significant difference.

**AppendixTable3 (... Continued).** Over Year mean performance of food barley variety

variety	PH			HSW			GPS			GY		
	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
Abdane	96.33b	75.35c	71.1d	44.2c	44.13a	44.87c	32.5bc	25.27ab	41.92a	3.73a	3.04bc	4.00ab
Biftu	109.12a	93.45a	92.95ab	40.43d	43.3a-c	39.07d	45.10a	23.27a-c	36.67a	3.52ab	2.88c	4.16a
Dafo	106.23a	93.28a	96.68a	43.27c	42.33c	50.67b	32.10c	20.23cd	36.78a	3.52ab	2.81c	3.16cd
Dinsho	101.67ab	91.28a	91.98ab	46.17b	42.55bc	46.77c	31.43c	21.05cd	37.25a	3.76a	3.56a	3.59bc
Harbu	108.77a	88.5ab	87.58bc	41.27d	43.95ab	46.03c	40.6ab	21.62b-d	33.83a	3.20b	3.26b	3.02d
HB-1307	95.60b	84.22b	80.92c	40.77d	43.23a-c	39.77d	38.9a-c	26.50a	37.27a	3.58ab	2.28d	1.97e
Local	101.70ab	88.75b	89.13b	47.53a	43.9ab	58.27a	32.30c	18.12d	20.10a	4.01a	2.96c	2.67d
Mean	102	87.12	87.19	43.38	43.34	46.49	36.13	22.29	34.97	3.62	2.97	3.22

**Evaluation of Improved Food Barley (*Hordeum Vulgare* L.) Varieties in the Mid-Land Areas of West and Kelem Wollega Zones of Western Oromia**

CV	7.29	6.24	6.56	2.05	2.84	4.26	19	14.98	21.5 9	11.8 7	7.34	12.6 9
Lsd	8.87	6.45	6.79	1.06	1.46	2.35	8.15	3.96	8.96	0.51	0.26	0.49

**Citation:** Dereje Abera, et.al, "Evaluation of Improved Food Barley (*Hordeum Vulgare* L.) Varieties in the Mid-Land Areas of West and Kelem Wollega Zones of Western Oromia" *International Journal of Research Studies in Agricultural Sciences (IJRSAS)*, 2019; 5(8), pp. 1-8, <http://dx.doi.org/10.20431/2454-6224.0508001>

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