

Participatory on Farm Evaluation and Selection of Improved Bread Wheat Varieties in Vertisol Areas of North Western Ethiopia

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Abstract: Twenty bread wheat varieties were evaluated with the objective of selecting adaptable and best performing bread wheat varieties for vertisol areas of North Gondar with the participation of farmers. The trial was conducted at Dembia and Gondar zuria locations of north western Ethiopia during 2007 and 2008 cropping seasons. Single plot observation with farmers' sites as replications was used. At Dembia, the combined analysis of variance over years indicated that varieties Kubsa, Simba, Pavon76 and Taya gave the highest grain yield viz., 2072, 1843, 1832 and 1811 kg haG¹ respectively. Similarly at Gondar zuria, varieties Bobicho, Kubsa and Pavon76 gave the highest grain yield 2618, 2451 and 2363 kg haG¹ respectively. KBG01 was the earliest among the tested varieties. However, the yield of this variety was low. The spearman rank correlation analysis at both locations showed statistically significant correlation ($P < 0.01$) among farmers and breeders with objectively measured quantitative trait (grain yield) as well as between breeders and farmers. This result also indicated that farmers were as competent as breeders in varietal selection. Therefore, based on objectively measured traits (grain yield, days to maturity and yellow rust resistance) and farmers' preference, Simba and Taya for Dembia and Bobicho and Katar for Gondar zuria are recommended with their production packages.

Key words: Grain yield % Farmers' selection criteria % Vertisol soil

INTRODUCTION

Bread wheat is one of the most staple food crops in the world and is one of the most important cereal crop cultivated in Ethiopia. Ethiopia is the largest wheat producer in Sub-Saharan Africa with the cultivated land of 1.1 million ha [1]. It is also one of the most important crops in Amhara region. Many varieties have been developed by the research centers of the nation. It is therefore imperative to introduce and test their adaptability under vertisol conditions of north Gondar, mainly in Dembia and Gondar zuria with the participation of farmers. Participatory varietal evaluation and selection is being conducted in many crops like rice [2], common bean [3] and barley [4, 5]. According to [6], they evaluated the effect of participation of farmers by comparing only the rankings of varieties by farmers and breeders at the same locations and reported a strong concordance between farmers and breeders in environments that have been producing contrasting plant phenotypic performance in rice. [7, 8] reported that farmers selection

criteria vary with environmental conditions, traits of interest, ease of cultural practice, processing, use and marketability of the product, ceremonial and religious values. Creating an option and access to farmers in vertisol is the priority of this research. Therefore, the objectives of the research were to evaluate bread wheat varieties under vertisol conditions with improved management, to identify farmers' selection criteria and to empower farmers in participatory variety selection process.

MATERIALS AND METHODS

The experiment was conducted at Gondar zuria and Dembia. Twenty improved varieties namely, Bobicho (HAR), Katar (HAR-1899), Densa (HAR-2562), ET13A2, Guna (HAR-2029), HAR-3008, Senkegna (HAR-3646), Galamae (HAR-604), Abola (HAR-1522), Jiru (HAR-2896), KBG-01, Pavon-76, Simba (HAR-2536), Sirbo (HAR-2192), Taya, Tuse (HAR-1407), Tura (HAR-1775), Hawi (HAR-2501), Kubsa (HAR-1685) and Megala (HAR-1595)

were included in the study. The trial was laid down in a single plot observation with sites as replications. Each experimental plot had 4 x 4m with a gross area of 16 m². Planting was done by broadcasting at seed rate of 150 kg ha⁻¹. Fertilizer was applied at the rate of 41 and 46 kg ha⁻¹ N and P₂O₅ respectively. Half of the total nitrogen and total phosphorus were applied at the time of planting while the remaining nitrogen was applied at the time of tillering. Breeding data were taken from the whole plot. Weeding and other management practices were done as required. Farmers were invited to set their selection criteria and to select best varieties based on their own selection criteria. Analysis of variance (ANOVA) was computed using the SAS statistical software and Spearman's rank correlation were analyzed using SPSS.

RESULTS AND DISCUSSION

Pooled analysis of variance over years at Dembia revealed significant difference ($P<0.01$) among the varieties, years and their interactions in parameters of plant height, grain yield and days to maturity. However, statistically significant difference was not observed in parameter like spike length (Table 1). The highest grain yield was recorded in Kubsa, (2072 kg ha⁻¹) followed by Simba, Pavon76 and Taya that gave 1843, 1832 and 1811 kg ha⁻¹ respectively. However, Kubsa and Pavon-76 are susceptible to yellow rust. Among varieties, KBG-01 matured early as compared to other varieties. However, the yield of KBG-01 was low as compared to other varieties. Varieties Simba, Kubsa, Pavon76 and Taya showed good yield with early type of maturity, this is especially important in vertisol areas of Dembia for double cropping (Table 2). The varieties preferred by farmers at maturity stage of field evaluation were Kubsa, Bobicho, Katar, Simba and Taya were selected. The spearman rank correlation analysis indicated presence of statistically significant ($P<0.01$) correlation between farmers' selection with the objectively measured quantitative trait (grain yield) and breeders' selection. This indicates that

grain yield was the main selection criteria for farmers and farmers were as competent as breeders in varietal selection (Table 4). Farmers' selection criteria were water-logging resistance, uniformity in terms stand and maturity, spike length, tillering capacity, disease reaction and seed color. This is in agreement with the findings of [5]. According to [6], the presence of significant positive correlation between breeders and farmers reduce the benefits of farmers in varietal selection process. Therefore, based on farmers' preference, breeder's selection, grain yield and resistance to yellow rust, varieties Simba and Taya are recommended for production for Dembia.

The pooled analysis of variance over years at Gondar zuria showed significant difference ($P<0.01$) among the varieties, years and their interaction in parameters of plant height, spike length and grain yield. Days to maturity showed significant difference ($P<0.01$) among varieties and year by variety interaction. However, non-significant difference was observed in between the two years (Table 1). The highest grain yield was recorded in Bobicho (2618 kg ha⁻¹) while the lowest was due to Sirbo (1120 kg ha⁻¹). Varieties Abola, Simba, Pavon76 and Bobicho matured early followed by high yield. Plant height ranged from 64.03cm (Sirbo) to 89.45 cm (ET13A2). Bobicho, Katar and Taya have the highest plant height followed by high grain yield, which may also give high biomass for livestock (Table 3). Farmers' selection criteria were waterlogging resistance, uniformity in terms stand and maturity, spike length, tillering capacity, disease reaction and seed color. Based on their selection criteria, varieties Bobicho, Katar, Senkegna and Simba were selected by farmers during field evaluation at maturity stage. The spearman rank analysis showed significant ($p<0.01$) correlation between farmer's selection and grain yield. The farmers' selection score were significantly and positively correlated with grain yield with correlation coefficients of (0.737). The result of this study showed that farmers were as efficient as breeders in identifying high yielding varieties with desirable traits for their

Table 1: Analysis of Variance (ANOVA) of yield and yield related traits for the twenty bread wheat varieties grown in two years (2007 and 2008)

Source of variation	Dembia				Gondar zuria			
	Days to maturity	Plant height	Spike length	Grain yield	Days to maturity	Plant height	Spike length	Grain
Yield								
Variety	**	**	NS	**	**	**	**	**
Year	NS	**	NS	**	NS	**	**	**
Year* Variety	**	**	NS	**	**	**	**	**

NS. Non significant, **. Significant at the 0.01 level

Table 2: Mean grain yield and agronomic data of bread wheat varieties tested under variety adaptation trial- combined over years (2007 and 2008) at Dembia

Variety	Days to maturity	Plant height (cm)	Spike length (cm)	Grain yield (kg haG ¹)
Abola	95.00	69.83	10.63	1660.00
Bobicho	98.00	79.16	10.32	1788.00
Densa	97.00	71.97	9.62	1599.00
ET13A2	108.00	82.19	9.63	1191.00
Galamae	100.00	68.18	10.55	1528.00
Guna	100.00	61.19	9.14	1316.00
Hawi	94.00	67.30	10.34	1655.00
Jiru	95.00	60.07	11.15	1243.00
Katar	97.00	71.43	10.25	1629.00
KBG01	88.00	61.98	9.98	1509.00
Kubsa	95.00	66.39	9.98	2072.00
Megala	94.00	78.15	10.15	1479.00
Menze	102.00	71.89	9.83	1493.00
Pavon76	95.00	70.75	10.35	1832.00
Senkegna	99.00	82.68	10.36	1786.00
Simba	94.00	66.75	10.70	1843.00
Sirbo	101.00	65.96	9.96	1252.00
Taya	97.00	81.50	10.08	1811.00
Tura	97.00	73.57	10.55	1442.00
Tuse	99.00	69.45	10.04	1374.00
Mean	97.27	71.02	10.18	1575.00
CV (%)	2.28	4.25	8.13	3.57
LSD (5%)	5.22	7.07	NS	132.00

Table 3: Mean grain yield and agronomic data of bread wheat varieties tested under variety adaptation trial- combined over years (2007 and 2008) at Gondar zuria

Variety	Days to maturity	Plant height (cm)	Spike length (cm)	Grain yield (kg haG ¹)
Abola	92.50	79.62	10.16	2363.00
Bobicho	95.33	82.75	10.27	2618.00
Densa	97.67	83.70	10.11	2010.00
ET13A2	101.83	89.45	9.29	1666.00
Galame	98.83	80.88	10.93	1822.00
Guna	99.33	67.62	9.39	1198.00
Hawi	94.17	65.59	9.59	1449.00
Jiru	93.00	67.23	9.89	1595.00
Katar	96.50	82.83	10.49	2122.00
KBG01	86.33	71.97	10.03	1692.00
Kubsa	93.17	71.03	10.63	2451.00
Megala	95.83	81.94	10.53	1696.00
Menze	98.83	80.73	9.32	1640.00
Pavon76	93.00	77.09	10.63	2363.00
Senkegna	96.00	86.08	10.18	2181.00
Simba	92.67	72.45	10.85	2040.00
Sirbo	98.50	64.03	9.19	1120.00
Taya	96.67	84.70	10.04	2031.00
Tura	96.50	80.32	10.14	2044.00
Tuse	96.17	79.96	9.27	1894.00
Mean	95.64	77.50	10.05	1900.00
CV (%)	3.26	5.47	4.93	8.49
LSD (5%)	6.60	8.97	1.05	342.00

Table 4: The spearman's rank correlation coefficients between farmers' and breeder's scores and grain yields measured in twenty bread wheat varieties at Dembia and Gondar zuria.

	Dembia				Gondar zuria		
	Farmers	Yield	Breeder		Farmers	Yield	Breeder
Farmers	-	0.603**	0.981**	-	-	0.703**	0.807**
Yield		-	0.608**			-	0.887**

**Correlation is significant at the 0.01 levels

specific environment. Similar result was also found by [9, 5, 2]. This may be due to the main selection criteria of farmers and breeder based on final grain yield. Based on farmers' preference, breeders' score, grain yield and disease resistance (yellow rust), Bobicho and Katar are recommended for Gondar zuria. In general, the yields of varieties were higher at Gondar zuria than Dembia; this may be due to relatively low temperature and better rainfall distribution at Gondar zuria. The farmers' selection criteria were the same in both locations due to similar cultural practice, use and trait of interest.

CONCLUSIONS

Participatory varietal selection has significant role in technology adaptation and dissemination in short time than conventional approach. Farmers' selection criteria was similar in both locations and Farmers' selection criteria were resistance to water logging, uniformity in terms stand and maturity, spike length, tillering capacity, disease reaction and seed color. Based on farmers' preference, grain yield, days to maturity and yellow rust resistance, varieties Simba and Taya for Dembia while Bobicho and Katar for Gondar zuria are recommended with their full production packages.

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