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RESEARCH ARTICLE

PARTICIPATORY ADAPTABLE VARIETAL SELECTION OF FABA BEAN (*Vicia Faba* L.) IN WOLLO, ETHIOPIA

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ABSTRACT

Most of farmers are using local variety which is low yielder and very susceptible for disease and low moisture stress in faba bean producing area of Wollo. The study was conducted in Wollo at Meket, Akesta and Kutaber on station and farmers site. The objective of the trial to recommend the best performing faba bean released variety in terms of high yielder and farmers' preference. The design was RCBD with three replications by using seven nationally released varieties and local. The harvestable plot size was 4m x 1.6m(6.4m²) with four rows and one meter distance was maintained between replications at all locations. The spacing between plots, rows and plants was 1m, 40cm and 10cm, respectively. The trial executed as Mother (all the three replications are on one site) and Baby (only one replication on one site) trial form. Farmers evaluated and selected the varieties depending on their criteria's from the baby trial. The criteria's were Pod setting, Earliness and free from any diseases. The analysis of variance showed significant difference ($P < 0.05$) for number of pods per plant, hundred seed weight in gm., seed yield and biomass in kg per hectare. But number of seeds per pod has not statistically significant difference among the varieties. The result showed that variety Walki was the best yielder with seed yield 2337kg/ha, 2697kg/ha and 4430kg/ha at Meket, Akesta and Kutaber respectively followed by Hachalu (1975kg/ha, 2984kg/ha and 3882kg/ha). Variety Dosha and Gora were not good at Geregera and legambo but at Kutaber they scored better seed yield performance with 4342kg/ha and 3391kg/ha respectively. These two varieties also were very large seeded with hundred seed weight 78.1gm and 98.3gm. The yield advantage of Walki, Hachalu, Dosha and Gora over local variety was 86%, 64%, 69%, and 32% respectively. During farmers' selection process both female and male farmers had been incorporated so as to avoid gender bias. Variety Dosha, Walki, and Gora were selected by farmers. According to the result for seed yield Walki and Hachalu were better performed at Meket and Akesta. Variety Dosha, Gora and Walki were well performed at Kutaber and selected by farmers in all the three locations. Variety Walki and Hachalu for Meket and Akesta but for Kutaber all the three farmers' selected varieties (very large seeded) will be scale up for the next cropping season at the tested area and similar agro ecology.

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INTRODUCTION

Faba bean is one of the most important cool-season food legumes in the World. The exact geographical origin of faba bean is unknown, but the best information indicates Central Asia and Mediterranean area have been suggested as possible centers (Metayer, 2004). Ethiopia consider as the secondary center of diversity and also one of the nine major agro-geographical production regions of faba bean (Asfaw Telaye et al., 1994). Faba bean is one of the most important cool-season food legumes grown in Ethiopia. It is dominant pulse crop in Ethiopia with 574,060.45 ha of the total arable lands and a total production of 9,439,641.7 tons in Ethiopia (CSA, 2013). In Ethiopia faba bean is major protein source for the

subsistence farmers and used to make various traditional dishes (Senayit and Asrat, 1994). It is a valuable protein supplement to cereals and other starchy root and tuber foods in the human diet, because of their high lysine and tryptophan contents, amino-acids in which cereals are deficit (Giller, 2001). In addition to this, it provides large cash for producers and foreign exchange for the country (Desta Beyene, 1988). Ethiopia is one of the largest faba bean producing countries in the world only second to China (Hebblethwaite et al., 1993). The crop is grown as field crop throughout the highlands and is most common in Woyina Dega between the attitudes 1800m.a.s.l and 2400m.a.s.l (Asfaw Telaye 1985). The crop is very important but its production and productivity is declining through time due to different biotic and abiotic production factors. Of the major production constraints, which contribute for low production and productivity of faba bean at Wollo is lack of improved high yielder, stress and diseases tolerant

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varieties. Farmers at these areas are still using their local variety and backward production management system and usually get very low production, around 0.7 ton/ha. To maximize production and productivity of faba bean at these areas there is a need to recommend improved faba bean varieties which able to withstand the prevailing biotic and abiotic stresses. Participatory variety selection proposed as an option to solve the crop problem for increasing productivity and production in terms of both target environments and users' preferences (Ceccareli et al. 1996). The present study was conducted with the objective of selecting, adapted faba bean varieties through farmer's participation and identifying farmers' variety selection traits to major producing areas Wollo.

MATERIALS AND METHODS

Description of Experimental Sites

The experiment was conducted in the northeast part of Amhara National Regional State; North and South Wollo namely; Meket, Akesta, and Kutaber district which these three locations represent most of highland moisture deficit area and major faba bean grown area of Wollo. In addition, all of them are food insecure districts.

Table 1. Geographical description of study areas

Locations	Altitude	Longitude	Latitude
Meket	2890	38° 40' 16" E	11° 49' 2" N
Akesta	2950	48° 90' 70" E	11° 82' 71" N
Kutaber	2896	51° 06' 56" E	11° 54' 50" N

Experimental materials

Seven improved faba bean varieties (Dosha, Gora, Hachalu, Moti, Tumsa and Walki) including the local variety (check) were evaluated for their adaptation and yield potential during 2014 main cropping season at Meket, Akesta, and Kutaber districts. These varieties were improved and released by Holetta and Kulumsa Agricultural Research Centers.

Experimental Design

The experiment was laid out on Randomized Complete Block Design (RCBD) with three replications. Each experimental plot consisted of six rows with 40cm x 4m long. The harvestable plot size was 4m x 1.6m (6.4m²) with four rows and one meter distance was maintained between replications at all locations. The spacing between plots, rows and plant was 1m, 40cm and 10cm, respectively. Mother (one site with three replications) and Baby (only one replication on one site and three sites per location) trials were followed in the experiment. DAP fertilizer was applied at the recommended rate of 100kg/per hectare.

Data Collected

Agronomic data were collected on plant and plot basis from mother trial. The data of number of pods per plant, number of seeds per pod, hundred seed weight (gm) and Plant height (cm) were recorded from on randomly selected five plants from the middle four rows of each plot. And biological data like biomass yield (gm) and seed yield (gm) were collected from

harvestable plot area of mother trial plot. In addition to these disease data also scored. Farmers' criteria were Pod setting, Earliness and free from any diseases. The ranking procedure was explained for participant farmers and each selection criterion was ranked from 1 to 5 (1= very poor, 2= poor, 3= average, 4=good and 5= very good). Then farmers were given the chance to rank each variety based on the attributes listed by them. During selection process both female and male farmers had been incorporated so as to avoid gender bias. In general 38 (5 females) farmers participate for doing activities and selection process.

Data Analysis

The agronomic data were subjected to the analysis of variance (Gomez and Gomez, 1984) using Gen stat software fifteen editions from mother trial. Farmers' selection data, scoring of Pod setting, Earliness and free from any diseases, were analyzed using simple ranking method in accordance with the given value (De Boef and Thijssen, 2007). Simple ranking is a tool often used to identify best varieties based on farmers' preferences.

RESULTS AND DISCUSSION

According to the analysis of variance (ANOVA) and farmers selection criteria the best variety identified. The analysis of variance showed significant difference ($P < 0.05$) for number of pods per plant, hundred seed weight in gm., seed yield and biomass in kg per hectare. But number of seeds per pod has not statistically significant difference among the varieties. The analysis showed variety Walki was the best yielder with seed yield 2337kg/ha, 2697kg/ha and 4430kg/ha at Meket, Akesta and Kutaber respectively followed by Hachalu (1975kg/ha, 2984kg/ha and 3882kg/ha) (table 3, 4 & 5). Variety Dosha and Gora were not good at Meket and Akesta but at Kutaber they scored better seed yield performance with 4342kg/ha and 3391kg/ha respectively. These two varieties also were very large seeded with hundred seed weight 78.1gm and 98.3gm. The Local variety scored the least for hundred seed weight (37.5gm, 52.3gm and 46gm). The yield advantage of Walki, Hachalu, Dosha and Gora over local variety was 86%, 64%, 69%, and 32% respectively (table 8). Local variety is so early compare to any evaluated varieties. But it is highly attacked by chocolate spot and faba bean gal disease at Meket (table 4). The faba bean gal disease and chocolate spot was not major problem at Akesta and Kutaber but chocolate spot more seen on local variety. For faba bean variety selection farmers focused on diseases resistance and yield performance. All the criteria were set by farmers without contributing the researcher. According to farmers' selection process variety Dosha, Walki, and Gora were selected by farmers (table 7).

Conclusion and Recommendation

Farmers' participation to evaluate in selecting new varieties is an advantage to exploit their potential knowledge of identifying adapted varieties which can support the researchers to decide and select the best one which fulfill the requirements of objectives. According to agronomic data and farmers' selection traits Dosha, Gora and Walki are best performed varieties. In addition to these varieties Hachalu also is better performed at Akesta and Meket.

Table 2. Faba bean varieties character used during variety trials in Holetta and Kulumsa Agricultural Research Centers

Varieties	Year of release	Released centre	Maturity dates	Growth Altitude range	Productivity per ha	
					On research field	On farmers field
Dosha	2009	Kulumsa/Holeta	120 – 130	1900 - 2800	16 - 33	10 - 24
Hachalu	2010	Kulumsa/Holeta	120 – 130	1900 - 2800	20 - 45	18 - 40
Gora	2012	Kulumsa/Holeta	120 – 130	1900 - 2800	20 - 45	18 - 40
Moti	2006	Kulumsa/Holeta	108 – 165	1900 - 2800	28 – 51	23 - 35
Tumsa	2006	Holeta/ Kulumsa	100 - 149	1900 - 2800	25 – 61	21 - 35
Walki	2008	Holeta/ Kulumsa	133 – 146	1900 - 2800	24 - 52	20 – 42

Table 3. Means of yield and yield component characters of faba bean varieties tested in PVS at Meket

VARIETIES	NPP	NSP	PH	HSW(GM.)	ASY(KG/HA)	BM T/HA
DOSHA	11.9BC	2.7	90.60AB	78.60B	1838AB	3.5
GORA	8.9E	2.8	86.53BC	94.37A	1068C	2.2
HACHALU	10.7D	1.9	97.73A	73.23BC	1975A	4.6
MOTI	12.5B	2.7	97.27A	80.10B	1518BC	3.3
TUMSA	9.4E	2.5	98.30A	74.17BC	1484BC	3.2
WALKI	10.7C	2.5	91.43AB	68.63D	2237A	4.3
LOCAL	21A	2.9	81.13C	37.50C	1200C	2.7
GM	12.6	2.56	91.9	72.4	1617.2	3.4
CV	5.4	14	5.5	6.6	14.6	21
DMRT(0.05)	*	NS	*	**	**	NS

Key words: NPP= Number of pods/plant; NSP= Number of seeds/pod; PH= Plant height; HSW= Hundred seed weight; ASY= Adjusted Seed yield; BM= Biomass

Table 4. Means of yield and yield component characters of faba bean varieties tested in PVS at Akesta

VARIETIES	NPP	NSP	PH	HSW(GM.)	ASY(KG/HA)	BM T/HA
DOSHA	10.1BC	3.8	95	86.23B	1993A	5.1
GORA	8.2BC	3.3	105.7	107.10A	2191A	5.9
HACHALU	11.7AB	4.1	108.3	79.23B	2984A	6.7
MOTI	8.2BC	3.5	101.3	84.63B	2160A	4.9
TUMSA	6.7C	2.8	84.8	78.20B	1008B	3.7
WALKI	11.5AB	2.9	106.3	74.40B	2697A	6.2
LOCAL	14.5A	3.0	101.5	52.53C	2349A	5.2
GM	10.2	3.3	100.4	80.3	2197.4	5.4
CV	21.7	28.4	10	8.3	24.4	20
DMRT(0.05)	*	NS	NS	**	*	NS

Key words: NPP= Number of pods/plant; NSP= Number of seeds/pod; PH= Plant height; HSW= Hundred seed weight; ASY= Adjusted Seed yield; BM= Biomass

Table 5 Means of yield and yield component characters of faba bean varieties tested in PVS at Kutaber

VARIETIES	NPP	NSP	PH	HSW(GM.)	ASY(KG/HA)	BM T/HA
DOSHA	15.3B	2.9	76.13B	4342AB	15.3B	10.7BC
GORA	10.1C	2.9	98.33A	3391BCD	10.1C	11.3BC
HACHALU	15.1B	3.1	74.4B	3882ABC	15.1B	16.9AB
MOTI	11.3C	3.2	71.17B	3126CD	11.3C	11.9BC
TUMSA	12.4C	2.4	78.77B	1951E	12.4C	11.3BC
WALKI	16.5B	2.7	68.07B	4430A	16.5B	18.8A
LOCAL	21.2A	2.3	46.07C	2571DE	21.2A	8.1C
GM	16.5	2.93	73.3	3384.6	16.5	12.69
CV	6.3	5.3	10.7	15.3	6.3	19.4
DMRT(0.05)	**	NS	**	**	**	*

Key words: NPP= Number of pods/plant; NSP= Number of seeds/pod; PH= Plant height; HSW= Hundred seed weight; ASY= Adjusted Seed yield; BM= Biomass

Table 6. Diseases Severity Score at Meket

VARIETIES	FABA BEAN GALL DISEAS (0 – 5)	CHOCOLATE SPOT (0 – 5)
DOSHA	0	1
GORA	0	1
HACHALU	0	1
MOTI	1	2
TUMSA	1	2
WALKI	0	1
LOCAL	6	6

Table 7. Farmers' selection of faba bean at Akesta, Meket and Kutaber

SN	VARIETY	NPP(0.2)	ER(0.2)	DR(0.6)	TOTAL	RANK
1	DOSHA	2.6	3	12	17.6	1
2	GORA	1.8	2.4	12	16.2	3
3	HACHALU	1.8	1.6	12	15.4	5
4	MOTI	1.6	1.2	12	14.8	6
5	TUMSA	2.4	1.2	12	15.6	4
6	WALKI	4	0.8	12	16.8	2
7	LOCAL	0.8	4	2.4	7.2	7

DR= diseases resistance (0.6), ER= Earliness (0.2), NPP= Number of pods per plant (0.2).

Table 8 Yield advantage of the varieties over Local (in %)

VARIETIES	MEKET	AKESTA	KUTABER
DOSHA	53	-15	69
GORA	-11	-7	32
HACHALU	64	27	50
MOTI	26	-8	45
TUMSA	24	-57	-24
WALKI	86	15	72

Therefore Variety Walki and Hachalu for Meket and Akesta but for Kutaber all the three farmers' selected varieties (very large seeded) will be scale up for the next cropping season at the tested area and similar agro ecology.

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