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Participatory variety selection and promotion of improved faba bean varieties in Wollo, Ethiopia

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ABSTRACT

The production and productivity of faba beans in Wollo have been constrained by the wider use of local cultivars, which are low yielders and susceptible to biotic and abiotic stresses. This needs to provide farmers with a basket of improved varietal options. The study's objective was to evaluate and recommend faba bean varieties that are most preferred by farmers and show better biological performance for promotion. Seven improved faba bean varieties plus one local cultivar was evaluated in participatory variety selection (PVS). The mother trial was conducted using an RCBD design with three replications, while the baby trial was laid out by the farmer as a replication. The analysis of variance in each testing district showed significant differences among the tested varieties for most of the measured traits including grain yield. The combined analysis of variance across the testing districts also revealed substantial differences among the tested varieties in grain yield, biomass yield, hundred seed weight, and amount of pods/plant. Ashebeka gave the highest grain yield (2.96 t ha-1) followed by Walki (2.91t ha-1) and Hachalu (2.84t ha-1). In terms of farmers' varietal preference ranking, Ashebeka followed by Hachalu and Walki were farmers' most preferred varieties both in Jamma and Legehida districts while in Woreilu district, Ashebeka followed by Gora and Dagem were farmers most preferred varieties. Hence, Ashebeka, Hachalu and Walki were recommended for promotion in 2021 for Jamma and Legehida districts

Keywords: Faba bean, participatory, selection, variety and yield.

INTRODUCTION

Faba bean is the most important cool-season food legume grown in the highlands of Ethiopia. The crop has multiuse and is consumed as dry seeds, green seeds, or processed food. Its products are rich in protein in the human diet, while dry seeds, green haulm, and dry straw are used as animal feeds (Ayenew *et al.,* 2023). Faba bean is one of the most important cool-season food legumes grown in Ethiopia where it covers about 504,570 ha annually from which about 1,091,609.4 tons are harvested with an average productivity of 2.1 t ha-1 (CSA, 2022). In the Amhara region, it is also the dominant pulse crop that covers about 186,562 ha annually from which about 352,204.9 tons are harvested with an average productivity of 1.9 t ha $^{-1}$ (CSA, 2022). Amhara region contributes about 35% and 32% of the country's total area coverage and total production of faba bean, respectively. South Wello zone is one of the major faba bean-producing zones in the Amhara region where annually faba bean covers about 28,583ha of land from about 46,565.6 tons are harvested with an average productivity of 1.63ha-1 (CSA, 2021).

In Ethiopia, the crop has multiuse and is consumed as dry seeds, green seeds, or processed food. Its products are rich in protein in the human diet, while dry seeds, green haulm, and dry straw are used as animal feeds (Ayenew *et al.,* 2023). Faba bean, like other pulse crops, contributes to soil fertility improvement and serves as a source of cash for the producers and as a source of foreign currency for the country through export (Ayenew *et al.,* 2023).

Despite of its multiple merits, the production and productivity of faba bean is declining due to different constraints one of the most crucial bottlenecks constraining the production and productivity of faba bean is the widespread use of low-yielding and disease susceptible local cultivars coupled with traditional crop management practices by the majority of the farming community. To maximize the production and productivity of faba bean, there is a need to provide farmers with improved varieties that can withstand the prevailing biotic (diseases, insect

and weed) and abiotic (drought, frost and high rainfall), stress; stable, farmers' most preferred, and give high grain yield.

Although about 38 improved faba bean varieties have been evaluated and released through the research system in the country by national and regional agricultural research centers. However, farmers do not grow improved high-yielding varieties, disease and pest resistance as these varieties were released without the participation of farmers (Ayenew *et al.,* 2023). And, they have no sufficient information about agronomic practices and the economic importance of the released Fababean varieties. Variety development by itself has nothing to bring a difference unless it is adopted by the growers. The reasons for the low adoptability of the released varieties by farmers include; many farmers may not have access to or information about seeds of new varieties, variety testing programs are often conducted on-station, which does not represent farmers' fields, varietal release systems give more emphasis to grain yield whereas farmers consider other traits when selecting varieties and farmers' needs and criteria for selection may not match with the varieties developed by plant breeders (Amanu and Jembre, 2021).

To address many of these problems in many crops, one approach that has been practiced is participatory varietal selection (PVS). PVS is the selection by farmers on their fields of finished or near-finished products from plant breeding programs and involves a range of actors including farmers, breeders, scientists, and other stakeholders. In PVS, farmers are provided with a basket of genotypes to match their selection criteria. It is well-documented that PVS is a more rapid and cost-effective approach in identifying farmers' preferred varieties and accelerating their adoption, dissemination, and increasing cultivar diversity (Amanu and Jembre, 2021). The importance of the PVS approach is becoming well recognized in Ethiopia as it has been implemented in many crops including, faba bean (Amanu and Jembre, 2021). However, selecting farmers' preferred varieties through PVS may not guarantee their adoption unless they are pre-scale up to address many farmers to harvest their benefits. Therefore, this study was conducted to assess and identify the most important farmers' varietal selection criteria for use in future breeding programs, to increase farmers' awareness and their access to improved faba bean varieties, and to recommend and pre-scale up varieties that are most preferred by farmers and showed better agronomic performance in major faba bean producing areas of South Wollo zone.

MATERIALS AND METHODS

Description of the experimental locations:

The study was conducted in Jamma, Woreilu, and Legehida districts of the South Wello zone, Amhara, Ethiopia during 2020 and 2021 main cropping seasons. These districts represent the major faba bean-producing areas of the zone. Descriptions of the geographical coordinates; climate and soil types of the testing locations in each district are shown in Table 1**.**

Table 1. Descriptions of the study locations

Locations	Altitude (masl)	Longitude	Latitude	Mean annual rainfall (mm)	Mean temperature		Soil Type
					Max. (^{0}C)	Min. (^{0}C)	
Jamma	2630	39^0 16' E	10^0 27′N	988.3	20.7	9.6	Vertisol
Woreilu	2662	39^0 26′ 19′E	10^0 40 60′N	873	21.6	10.3	Vertisol
Legehida	2683	39^0 21 29′E	10^0 43 40′N	929	21.4	10.2	Vertisol

Experimental materials and trial management:

Seven improved faba bean varieties, plus a local cultivar were evaluated in the participatory variety selection (PVS). The passport data of the varieties is indicated in Table 2.

Table 2. Passport data of faba bean varieties included in PVS

Varieties	Year of release	Centre of release	Days to maturity	Yield t ha^{-1}		Adaptation altitude (masl)
				Research field	Farmers field	
Ashebeka	2015	Kulumsa	120 - 165	2.3 – 4.5	2.4 – 3.5	1900 - 2800
Dosha	2009	Holeta	120 - 165	2.8 – 6.2	2.3 – 3.9	2050 - 2800
Hashengie	2015	Alamata	106 - 129	2.1 – 5		2200 - 2800
Hachalu	2010	Holeta	122 - 156	2.3 – 4.5	2.4 – 3.5	1900 - 2800
Gora	2013	Kulumsa	151 - 158	3.7 – 4.3	2 – 3	2000 - 2800
Dagim	2002	Debre berhan	122 - 156	2.3 – 4.5	2.4 – 3.5	1900 - 2800
Walki	2008	Holeta	133 - 146	2.4 – 5.2	2 – 4.2	1900 - 2800
Local						

The PVS was conducted following the mother-baby trial approach and managed by the researcher. The mother trial was executed on a research station and/or farmers' training center (FTC) while the baby trial was conducted on three farmers' farms in each district. The mother trial was laid out in a randomized complete block design (RCBD) with three replications while the baby trial was laid out as a replication. The plot size was 4m by 2.4m with spacing of 40cm and 10cm between rows and seeds, respectively. NPS fertilizer at a rate of 121kg ha^{-1} was applied at planting and seed at a rate of 200 kg ha^{-1} was used.

Biological data collection and analysis:

Biological data on the number of pods per plant, number of seeds per pod, hundred seed weight (gm.) plant height (cm), days to maturity, number of tillers per plant, biomass yield (gm.) grain yield (gm.) harvest index (%) and disease severity (using 0-9 scoring scale) were collected from harvestable rows of the mother trial and subjected to analysis of variance using SAS software version 9.0.

Farmers' participation in a variety of evaluations and selection:

Farmers: varietal evaluation and selection were done on baby trials. In consultation with kebele development agents, a group of male and female farmers were invited to participate in variety evaluation and selection. Before the actual evaluation and selection session in the field, the participants were oriented about the objective of the PVS and their role during the varietal evaluation and selection session. Before varietal evaluation and selection started, farmers were made to set their varietal selection criteria. The selection criteria were given 1 to 5 score based on their importance; 1 refers to excellent; 2 refers to very good; 3 refers to good; 4 refers to medium and 5 refers to fair in faba bean variety selection. Then, the selection criteria were ranked as the following (Assefa *et al.,* 2021) and the rank of each selection criterion was considered as the weight of the criterion. The number of participants involved in PVS in each district is indicated in Table 3.

Table 3. Number of participants involved in PVS in each district

Districts	Farmers		
	Male	Female	Total
Jamma	27	8	35
Legehida	19	7	26
Woreilu	11	4	15

Ranking of farmers' varietal preference based on their varietal selection criteria

To find out farmers' preferred varieties, (Assefa *et al.,* 2021) ranking method was adopted. According to this method, the preference value of each variety for each varietal selection criterion is calculated as (score * weight). The score is the rank given by farmers for each variety based on its performance to the given selection criterion while weight is the rank given by farmers for each selection criterion during the varietal selection criteria comparison session. Then, the preference value of each variety at each varietal selection criterion is added and gives the total preference score. Finally, the rank of acceptability is done from the total preference score. The lower the total preference score, the higher the rank of acceptability.

Pre-scaling up of the selected improved faba bean varieties

The pre-scaling of the selected varieties was conducted in the study districts in 2021. Host farmers were selected and supplied with seeds of the selected varieties. The success of the technology promotion program depends on appropriate prior orientation given to participants on technologies and the stepwise implementation of subsequent activities. Accordingly, before the commencement of the pre-scaling activity training was given to the host farmers, kebele development agents, and woreda-level agricultural office experts on recommended faba bean seed production and management package by a team of researchers. A multi-disciplinary team of researchers and agricultural experts made regular field visits to observe the progress, fix problems, and give advice on proper field and crop management practices starting from land selection to harvesting.

RESULTS

Biological performance of the tested varieties:

Jamma district:

The mean performance of the tested varieties for the measured traits at the Jamma indicated in (Table 4). Among the tested varieties, Walki gave the highest grain yield (3302 kg ha-1) followed by Ashebeka (3278.7kg ha-1) and Hachalu (3264.3kg ha-1) (Table 4). Having a big seed size was one of the farmers' varietal selection criteria.

Ashebeka was found the boldest seeded variety with a hundred seed weight of 106gm which was more than two times that of the local cultivar (42.7gm). The most bottleneck diseases of faba bean such as gal disease and chocolate spot were not observed in the Jama district. The environmental conditions did not favor the diseases.

Table 4. Mean of grain yield and yield related traits of faba bean varieties evaluated in PVS mother trial in Jamma district in 2020

Varieties	DM	PH	NTP	NPP	NSP	HSW	GY	BM	HI
Ashebeka	150	82.3	3.9	26.2	3.0	106	3278.7	5707.1	57.7
Dosha	148	78.3	3.6	26.8	3.3	87.9	2457.3	5303	46.5
Hashengie	151	78.1	3.4	23.3	3.1	92.8	2948.1	5151.5	58.4
Hachalu	148	85.5	3.3	36.1	3.1	79.1	3264.3	6363.6	51.3
Gora	149	80.1	3.6	23.1	2.8	99.5	3168	5404	44.5
Dagim	145	81.4	4.5	32.7	3.1	53.7	2890.8	5606	51.7
Walki	149	81.2	4.8	33.7	3.1	80.7	3302	5757	57.5
Local	144	74.1	3.3	35.5	3.1	42.7	2402.9	5959.6	53.9
Mean	148	80	3.8	30	3.1	80.3	2964.2	5656.6	52.7
CV(%)	3.5	6.2	20.2	14.8	7.4	8.7	6.8	11.1	10.5
P-level	*	NS	NS	*	NS	**	**	NS	NS
LSD	4.2	10.7	2.0	7.7	1.0	12.2	301.8	1455	15.4

Note: NS= Non-Significant;=Significant; **= highly Significant; DM= Days to maturity; PH= Plant height (cm); NTT= Number of tillers/plants; NPP= Number of pods/plant; NSP= Number of seeds/pod; HSW= Hundred seed weight (gm.); GY= Grain yield (kg ha^{-1}) BM= Biomass (kg ha^{-1}) and HI= Harvest index (%)*

Woreilu district:

At Woreilu district, significant variations were observed among the tested varieties for all measured traits except days to maturity and number of seeds/pod (Table 5). Among the tested varieties, Ashebeka gave the highest grain yield (2174.4 kg ha-1) followed by Dosha (1718 kg ha-1) and Hachalu (1486 kg ha-1). Ashebeka was also found to be the boldest seeded variety with a hundred seed weight of 99 gm. followed by Gora (94.7gm) and Dosha (79.5gm) (Table 5). The hundred seed weight of the local cultivar was low (42.6 gm). Faba bean diseases such as gal chocolate spot and frost were found the major bottlenecks of faba bean production and productivity in the Woreilu district. As compared to the other evaluated varieties, Ahebeka was found relatively tolerant to chocolate spot; On the other hand, the local cultivar was found the most susceptible to both biotic (diseases, insect and weed) and abiotic (drought, frost and high rainfall), stress he overall performance of the tested improved faba bean varieties in Woreilu district was found poor as compared with Jamma and Legehida districts

Table 5. Mean of grain yield and yield-related traits of faba bean varieties evaluated on PVS mother trial in Woreilu district in 2020

Varieties	DM	PH	NTP	NPP	NSP	HSW	GY	BM	HI	CS	GD
Ashebeka	126	89.2	3	19.1	3	99	2174.4	7230	30.1	0d	0.48
Dosha	120	80.2	1.2	10.4	3	79.5	1718	6458	26.6	0.16	0.55
Hashengie	121	79.8	2.3	7.3	3	77.2	1176.4	4714	24.9	0.48	0.72
Hachalu	120	81.3	2	11.2	2.6	73.9	1486.8	5282	28.1	0.16	0.39
Gora	122	85.4	2.3	11.7	2.9	94.7	1271	4682	27.1	0.159	0.48
Dagim	120	64.1	2	17.9	2.7	40	953.7	3446	27.7	0.747	0.95
Walki	121	87.1	1.6	16.2	2.9	78.7	1480	5096	29	0.39	0.62
Local	119	67.1	2.3	23.1	2.7	42.6	894.4	3842	23.1	0.845	0.954
Mean	121	79.3	2.1	14.6	2.8	73	1394.4	5093.6	27	0.367	0.644
CV (%)	4.1	4.7	15	14	10.2	5.7	8.8	12.4	8.3	36.2	28.6
P-level	NS	**	*	**	NS	**	**	**	*	*	*
LSD	6.4	6.4	0.5	3.6	1.0	4.5	215.7	307.5	3.9	0.393	0.299

Note: NS= Non Significant;=Significant; **= highly Significant; DM= Days to maturity; PH= Plant height (cm); NTP= Number of tillers/plant; NPP= Number of pods/plant; NSP= Number of seeds/pod; HSW= Hundred seed weight (gm); GY= Grain yield (kgha^{-1}); BM= Biomass (kgha^{-1}), HI= Harvest index (%) CS= Chocolate Spot and GD= Gall disease*

Legehida district:

Among the tested varieties, Walki gave the highest grain yield (3941.2kg ha-1) followed by Ashebeka (3775.3kg ha-1) and Hachalu (3700kg ha-1) (Table 6). The hundred seed weight ranged from 46.9gm which was scored by Dagem to 112.2gm which was scored by Asheneka. The hundred seed weight of the local cultivar was 49.7gm which was second to the last. The most important diseases of faba bean such as gall and chocolate spot were not observed because the environmental conditions did not favor the diseases to appear.

Table 6. Mean of grain yield and yield related traits of faba bean varieties evaluated in PVS mother trial in Legehida district in 2020

Varieties	DM	PH	NTP	NPP	NSP	HSW	GY	BM	HI
Ashebeka	139	88.6	3.1	27.1	3	112.2	3775.3	6364	53.9
Dosha	136	90	2.7	32.7	3	80.5	3194.3	6033.3	53
Hashengie	141	84.8	2.3	18.9	3	89.4	1593.7	4475	35.5
Hachalu	136	96.9	4	38.7	3	85.3	3700.2	6959.3	54.2
Gora	135	111.1	1.7	18.8	2.5	103.1	3351.1	5956.7	56.4
Dagim	137	82.6	3.1	34.6	2.9	46.9	3212.2	6039	53.3
Walki	137	88.3	2.7	32.8	3	84.1	3941.2	6164.7	64
Local	136	84.6	2.8	34.7	3	49.7	3429.7	6771.3	54.6
Mean	137	90.8	2.8	30	2.9	81.4	3274.7	6095.5	53.1
CV (%)	4.2	11.2	18	15.8	6.4	5.3	10.6	12.5	5.9
P-level	*	Ns	*	*	ns	**	**	**	**
LSD	3.1	18.3	1.0	10.5	1.0	7.7	232.6	377.8	4.2

Note: NS= Non Significant;=Significant; **= highly Significant; DM= Days to maturity; PH= Plant height (cm); NTP= Number of tillers/plant; NPP= Number of pods/plant; NSP= Number of seeds/pod; HSW= Hundred seed weight (gm.); GY= Grain yield (kgha^{-1}); BM= Biomass (kgha^{-1}), HI= Harvest index (%)*

The combined analysis of variance for grain yield, biomass yield, harvest index, and number of pods/plant of eight faba bean genotypes across three environments revealed significant to highly significant variations due to genotype (G), environment (E) and genotype by environment interaction (GEI) effects. The significance of the environmental effect indicated that environments varied in terms of genotype performance. On the other hand, the significance of GEI showed that the performance of the genotypes varied from one place to another (Table 7).

Table 7. Combined mean performance of 8 faba bena genotypes for grain yield and yield related traits as evaluated across Jamma, Woreilu and Legehida districts in 2020

Varieties	DM	PH	NT	NPP	NSP	HSW	GY	BM	HI
Ashebeka	138	87	3.2	24.1^{c}	3	105.3	2960.9^{a}	6433.8^{a}	47.2^{ab}
Dosha	135	83	2.6	23.3^{c}	3.1	82.6	2456.8^{bc}	5931.6^{bc}	42^{cd}
Hashengie	138	81	2.7	16.5^{d}	3	86.5	1606^{d}	4780.3^{f}	39.6^{d}
Hachalu	135	88	3.1	28.7^{a}	2.9	79.4	2842.2^{a}	6201.5^{ab}	44.6^{bc}
Gora	136	92	2.5	17.9^{d}	2.8	99.1	2352.2^{c}	5347.4^{de}	42.7^{cd}
Dagim	134	77	3.3	28.4^{a}	2.9	46.8	2341.7^{c}	5030.2^{ef}	44.2^{bc}
Walki	136	86	2.9	27.6^{ab}	3	81.2	2907.6^{a}	5672.6^{cd}	50.2^{a}
Local	133	75	2.8	31.1^{a}	2.9	45	2587.8^{b}	5524.4^{d}	43.9^{bc}
Mean	135	83.4	2.9	24.7	2.9	78.2	2544	5615.2	44.3
CV(%)	4.5	8.4	16.4	18.1	8	6.4	6.7	7	8.4
Genotype(G)	*	**	Ns	**	Ns	**	**	**	**
Environment(E)	**	**	**	**	**	**	**	**	**
G*E	NS	NS	NS	*	NS	NS	**	**	**

Note: NS= Non Significant;=Significant; **= highly Significant; DM= Days to maturity; PH= Plant height (cm); NTP= Number of tillers/plant; NPP= Number of pods/plant; NSP= Number of seeds/pod; HSW= Hundred seed weight (gm.); GY= Grain yield (kgha^{-1}); BM= Biomass (kgha^{-1}), HI= Harvest index (%)*

Farmers made varietal preferences using their varietal selection traits. The result of farmers' varietal preference ranking analysis showed that Ashebeka was found farmers 'first preference in the three districts. On the other

hand, Hachalu and Walki found the second and third preference of farmers in both Jamma and Legehida districts, respectively.

Ranking of farmers' varietal preference criteria:

Farmers set four varietal selection criteria including seed size, number of pods/plans, number of tillers/plants, and disease resistance, and these criteria were ranked using a pairwise ranking method. Accordingly, disease resistance, seed size, number of pods/plants, and number of tillers/plants were ranked as 1st, 2nd, 3rd, and 4th, respectively (Table 8). The rank of each criterion was considered as the weight of the criterion

Table 8. Pair-wise ranking of farmers' varietal selection criteria

No.	Selection criteria	SS	PNPP	TNPP	DR	Total score	Rank	Weight
1	Seed size (SS)	---	SS	SS	DR	2	2	2
2	Pod no. per plant(PNPP)		---	PNPP	DR	1	3	3
3	Tiller No. per plant(TNPP)			---	DR	0	4	4
4	Disease resistance (DR)				---	3	1	1

Farmers' varietal preferences:

Farmers' varietal preference ranking in Jamma, Woreilu, and Legehida districts is indicated in (Tables 9, 10 and 11), respectively. Farmers made varietal preferences using their varietal selection traits as indicated in (Table 8). The result of farmers' varietal preference ranking analysis showed that Ashebeka was found farmers 'first preference in the three districts. On the other hand, Hachalu and Walki found the second and third preference of farmers in both Jamma and Legehida districts, respectively.

Table 9. Farmers' varietal preference ranking in Jamma district (N=35)

Variety	Preference value (Score X Weight)				Total preference score	Rank of acceptability
	SS (2)	PNPP (3)	TNPP (4)	DR (1)		
Ashebeka	2	6	4	1	13	1
Dosha	12	24	24	6	66	7
Hashengie	4	12	16	3	35	4
Hachalu	10	3	8	2	23	2
Gora	6	15	20	4	45	5
Dagm	14	18	12	5	49	6
Walki	8	9	8	4	29	3
Local	16	21	28	7	72	8

Note: SS=seed size, PNPP=pod number. Plant, TNPP=tiller number/ plant, DR=disease resistance

Table 10. Farmers' varietal preference ranking in Woreilu district (N=15)

Variety	Preference value (Score X Weight)				Total preference score	Rank of acceptability
	SS (2)	PNPP(3)	TNPP (4)	DR (1)		
Ashebeka	2	3	4	1	10	1
Dosha	14	24	24	6	68	6
Hashengie	16	21	28	7	72	7
Hachalu	6	12	16	3	37	3
Gora	4	6	8	2	20	2
Dagm	10	15	8	4	37	3
Walki	8	9	20	4	41	4
Local	12	18	12	5	47	5

Note: *SS=seed size, PNPP=pod number/plant, TNPP=tiller number/ plant, DR=disease resistance*

Table 11. Farmers' varietal preference in Legehida district (N=26)

Variety	Preference value (Score X Weight)				Total preference score	Rank of acceptability
	SS (2)	PNPP(3)	TNPP (4)	DR (1)		
Ashebeka	2	6	4	1	13	1
Dosha	12	18	20	5	55	6
Hashengie	10	15	8	4	37	5
Hachalu	6	3	8	2	19	2
Gora	4	12	16	3	35	4
Dagm	14	24	24	6	68	7
Wolki	8	9	12	4	33	3
Local	16	21	28	7	72	8

Note *SS=seed size, PNPP =pod number/plant, TNPP=tiller number/plant, DR=disease resistance*

DISCUSSION

Sirinka Agriculture Research Centre has been carrying research activities to recommend new production technologies, mainly genetically improved faba bean varieties which were released by other national and regional research centers for high producing areas of Wollo because of the adoptions and dissemination of improved faba bean variety was very limited in this area. To improve this problem, one of the best options was doing participatory variety selection of faba bean in different Wollo districts (Anteneh Ademe *et al.,* 2018).

The varieties highly expressed their potential at Legehida and Jamma than other testing locations. The reason of this was due to the presence of favorable environmental conditions for faba bean production in the cropping season. The overall performance of the tested faba bean varieties was found to be better in these districts as compared to Woreilu district. At these locations, Walki and Asheeka varieties were better compared to others tested varieties based on their yield performance and seed size. The same results reported by (Amanu and Jemberu, 2021). Seed size was one of farmers' interested trait to select better variety, so Asheeka variety was best for this trait like (Ayenew *et al.,* 2023). The most bottleneck diseases of faba beans such as gal disease and chocolate spots were not observed in the Jama district. The environmental conditions did not favor diseases.

At Woreilu location, the overall performance was so weak compared to the two locations due to faba bean diseases such as gal and chocolate spot diseases however Ashebeka was found relatively tolerant to these diseases. The grain yield performance of the tested varieties in this study agrees with the research findings reported by (Robsa *et al.,* 2021). On the other hand, the local cultivar was found the most susceptible to those diseases.

Farmers' feedback is the major tool to do an effective participatory variety selection approach to select better improved varieties for increasing production and productivity of the crop. Farmers set their criteria including seed size, number of pods, number of tillers, and disease resistance, and the same traits with (Robsa *et al.,* 2021). Accordingly, disease resistance, seed size, number of pods, and number of tillers were ranked as 1st, 2nd, 3rd, and 4th, respectively. This rank was also similar with (Ayenew *et al.,* 2023).

Besides, it allows varietal selection in targeted areas at cost-effective and in less time, which helps for easy adoption and dissemination of released varieties in larger areas (Gutu, 2021). One of the major components of participatory variety selection is to scale up variety/varieties that are most preferred by farmers and show the best biological performance to harvest their advantages (Assefa *et al.,* 2021 and Ayana *et al.,* 2016). Based on the results of biological data and farmers' varietal preference analysis, Ashebeka followed by Hachalu and Walki were recommended for pre-scaling up both in Jamma and Legehida locatios, the same recommendations (Amanu and Jemberu, 2021).

CONCLUSION AND RECOMMENDATION

Farmers' participation 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 fulfills the requirements of objectives. According to biological data and farmers' selection traits Ashebeka, Walki and Hachalu are best-performed varieties. In general, farmers' selection processes, Ashebeka, Hachalu, Gora and Walki are highly preferred by farmers in the districts. Therefore, in the coming season, these demand-lead technologies should be multiplied with their seed and popularized at the tested and similar agro-ecology of faba bean producing areas. Based on the lessons learned from this study, it can be recommended that for plant breeders, it may be difficult to predict which traits or trait combinations are of prime importance for a particular target group of farmers. Therefore, future breeding programs should include the participation of farmers and their selection preferences early during the varietal development program. Participatory variety selection is found cost-effective and fast-track delivery of new and existing technologies.

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