

Research Article

Performance Evaluation of New Faba Bean(*Vicia faba* L.) Variety “Matti” in Ethiopia

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Abstract

The name Matti was given to newly released faba bean (*Vicia faba* L.) variety with the pedigree of EH94005-OV3-1-3 x ILB3395 which was developed by Bore Agricultural Research Center. The genotypes were formerly introduced from HOLETA Agricultural Research Center and evaluated in order to identify high yielding and stable faba bean genotypes. Accordingly, fourteen (14) faba bean genotypes were evaluated in multi-location trial for two consecutive years (2019/20-2020/21) during main cropping season. Out of tested genotypes, Matti (EH03071-1-2006) was found to be superior in grain yield, stable in performance and tolerant to major faba bean diseases and also possessed other desirable characteristics (large seed size) associated with high protein contents. The Matti variety recorded means grain yield ranged from 4.51 to 6.66 tons ha⁻¹ on research field and 3.62 to 4.85 tons ha⁻¹ on farmers field and it showed 18.66% and 67% grain yield advantage over the standard and local checks, respectively. The variety submitted to National Variety Release Committee (NVRC) were further evaluated for one season in on-farm verification trials under farmers management practices before a final release. The NVRC members and other specialists were examined on variety performances for DUS and VCU through field visits and officially released an independent variety Matti on June 2022 for wider production in the highlands of Guji zones and similar agro-ecologies.

Keywords: Faba bean; Grain yield; Matti; Stable performance; Registration

Introduction

Faba bean (*Vicia faba* L.) is a diploid ($2n = 2x = 12$) crop which is a grain legume of the family *Fabaceae* and belonging to the genus *Vicia* [9]. Faba bean is one of the major pulses grown in the highlands of Ethiopia (Musa and Gemechu, 2006). Ethiopia is the second largest faba bean producing country in the world next to People's Republic of China and the first in Africa followed by Egypt and Morocco [3,8]. The crop is popularly known as the 'poor man's meat' plays an important role in the world agriculture; owing to its high protein content, source of alternative cash income to the farmers and foreign currency to the country [1,4]. It is also a very valuable legume crop that contributes to the sustainability of cropping systems through its ability of biological N₂ fixation, diversification of cropping systems leading to decreased disease, pest and weed build up [6-8] and used as a suitable rotation crop with cereals [5]. Faba bean could be used in different forms. The fresh green seeds are cooked and eaten as a vegetable, the dry seeds had been cooked for “*nifro*” or boiled with mixed with sorghum or maize and also can be consumed as to ‘*shiro wot*’ and ‘*kik wot*’ with cereal ‘*injera*’.

In 2020/21 cropping season, the total area under cultivation is estimated to be 504,569.99 ha of land from which 10,706,365.38 qt are nationally produced [2]. In Guji zone, out of total land allocated for legume crops (34,398.96 ha), 13,393.92 ha was allocated for faba bean production. The total production obtained was 250,731.58 qt (18.72 qt/ha) [2].

Variety releasing is an ongoing process since a given variety has performed well for specific period of time and reduces its production potential after a while due to segregation, becoming susceptible to diseases, and to some degree due to out crossing. Therefore, rather than trying to develop new variety after the given variety become out of production due to different factors, it is a must to have stable and widely adapted with different merits over the previously released variety before a given variety become out of production. Therefore, due to the significance of having released variety, the present study was undertaken with the objective of to evaluate and release high yielding, stable/wider adaptation and resistant to major faba bean diseases for the highlands of Guji zones and similar agro-ecologies.

Materials and Method

Testing Sites

Field experiments were carried out for two consecutive years (2019/20-2020/21) main cropping season from July to January at Bore, Abayi Kulture, Dama and Anna Sorra. The multi-location regional variety trial was conducted at each location on Nitosol clay loam soil under heavy rainfall conditions. The verification trial was conducted from July to January during the 2021/22 main cropping season.

Experimental Materials

Matti and other genotypes were formerly introduced from

Holeta Agricultural Research center and developed through selection breeding method. A total of 14 selected genotypes were evaluated at multi-locations against the standard checks (Gebelcho and Alloshe) and local check. The two genotypes, *Matti* (EH03071-1-2006) and EH99005-2-2005 gave above ten percent (>10%) yield advantages and had preferable performances over the standard and local checks. However, *Matti* showed better performance for grain yield and resistant to major diseases and possessed large seed size than all the tested genotypes and checks.

Varietal Characteristics

Morphological and Agronomic Characters

The newly released *Matti* variety is indeterminate growth habit has an average plant height of 133.7cm. Variety *Matti* requires ranged from 52 to 61 days for flowering and from 136 to 157 days can reached stage of physiological maturity. This variety had higher thousand seed weight of 828.3g with cotyledon color of yellow and seed color of light green. The summary description of the released variety is presented in Table 1.

Yield and Quality Performances

In multi-location evaluation trial, the average grain yield of variety *Matti* was 4.96 tons ha⁻¹, which has showed a yield advantage of 18.66% as compared to the standard check used, Gebelcho which gave an average yield of 4.18 tons ha⁻¹ (Table 2). Under research field, *Matti* gave grain yield ranging from 4.51-6.66 tons ha⁻¹ while on farmer's field it ranges from 3.62-4.86. tons ha⁻¹. In addition to grain yield, '*Matti*' variety is mainly characterized by a heavier seed that is comparable or higher than the check variety Gebelcho that was nationally released as large seeded faba bean a few years ago.

Table 1: Summary of the description of agronomic and morphological characteristics of new faba bean variety '*Matti*'.

Variety name: " <i>Matti</i> " (EH94005-OV3-1-3 x ILB3395)	
Adaptation area: Highland areas of Guji zones and similar agro-ecologies	
Altitude (m.a.s.l): 2200 - 2900	
Rainfall(mm): 950-1500	
Soil type: Nitosols (Clay-loam)	
Seed rate (kg/ha)	
• Row planting:	180-200
Spacing (cm)	
• Between plants:	10
• Between row:	40
Planting date: from mid-July to Early August	
Fertilizer rate (kg/ha)	
• NPS:	121
• UREA:	-
Days to flowering (days): 52 - 61	
Days to maturity (days): 136 - 157	
Plant height (cm): 133.7	
Growth habit: Indeterminate	
Flower color: White with black spot	
1000 seed weight (g): 828.3	
Yield (qt/ha):	
• Research field:	45.1 - 66.6
• Farmers' field:	36.2 - 48.5
Seed color: Light green	
Cotyledon color: yellow	
Seed size: Large	

Stability Performances

Using different stability models, yield stability analysis was carried out to evaluate 14 faba bean genotypes considered in multi-location trial with the objective of identifying stable genotype. Based on the results of stability analysis, *Matti* variety showed stable yield performance across tested locations and over years (Figure 1). It performs well if it is produced with recommended fertilizer rate, seed rate and other management practices in the recommended agro-ecologies.

Reaction to Major Diseases

Developing resistant or tolerant varieties to major faba bean diseases such as chocolate spot (*Botrytis fabae*), aschochyta blight (*Aschochyta fabae* Speg.) and rust (*Uromyces viciae-fabae*) is among the major objectives of the national and regional faba bean breeding program. The released variety '*Matti*' showed moderately resistant to major diseases existing in the areas such as chocolate spot, aschochyta blight and faba bean rust (Table 2).

Adaptation and Agronomic Recommendation

Newly released *Matti* variety is recommended for the highlands of Guji zones and similar agro-ecologies of Ethiopia. It is well adapted in areas having altitude ranges from 2200 to 2900 meters above sea level and annual rainfall of 950 to 1500mm. *Matti* performs best if it produced with the recommended fertilizer rate of 121 kg NPS/ha and seed rate of 200 kg/ha in clay-loam soil. Recommended planting time is started from the middle of July to early August in Meher cropping season.

Conclusion

Throughout the varietal development process, *Matti* variety was officially released in June 2022 for the mid-highland areas of Guji zones and similar agro-ecologies in Ethiopia, because of its high grain yield, stable in performance across the tested environments, resistant to major faba bean diseases and had good agronomic traits. Therefore, smallholder farmers, seed enterprises and other faba bean producers in Guji zones and similar agro-ecologies can produce *Matti* with its full recommended managements.

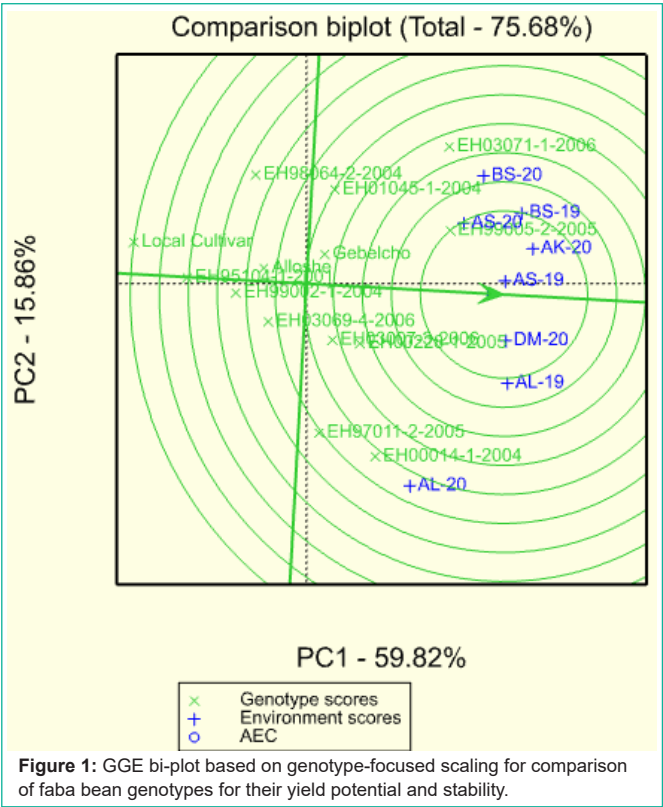


Table 2: Mean grain yield (tons/ha) performances and diseases severity of 14 faba bean genotypes during the 2019/20 and 2020/21 main cropping season.

Code	Genotypes	Overall Grain Yield (tons ha ⁻¹)	(%) Yield advantage	Disease's reaction (%)		
				Chocolate spot	Ascochyta blight	Rust
G1	Matti (EH03071-1-2006)	4.96 ^a	18.66%	23.41	22.58	5.51
G2	EH98064-2-2004	3.80 ^{b-d}		33.75	31.18	10.17
G3	EH03007-3-2006	4.41 ^{ab}		36.25	33.82	10.20
G4	EH00014-1-2004	4.65 ^{ab}		36.20	27.88	10.92
G5	EH97011-2-2005	4.39 ^{a-c}	ca-c	37.80	35.27	10.48
G6	EH01045-1-2004	4.31 ^{a-c}		33.83	34.74	7.81
G7	EH00228-1-2005	4.52 ^{ab}		35.57	30.27	10.19
G8	EH03069-4-2006	3.94 ^{b-d}		49.09	41.76	9.36
G9	EH99005-2-2005	4.90 ^a		27.16	28.34	7.55
G10	EH95104-1-2001	3.47 ^{c-d}		43.51	36.79	9.61
G11	EH99002-1-2004	3.87 ^{b-d}		44.22	37.43	7.65
G12	Alloshe (check-1)	3.79 ^{b-d}		46.82	44.70	10.35
G13	Gebelcho (check-2)	4.18 ^{a-c}		39.03	36.74	11.46
G14	Local Cultivar	3.15 ^d		52.30	43.65	21.74
	Means	4.17		38.50	34.80	10.20
	LSD (5%)	0.94		7.98	8.58	4.81
	CV (%)	39.5		36.5	22.8	35.7

Author Statements

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