

Registration of Mieso, a Newly Released Field Pea (*Pisum sativum*) Varieties for Highlands of Bale, Southeast Ethiopia

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Abstract: Field pea (*Pisum sativum* L.) variety named Mieso with the pedigree designation of Acc 32003-2 has been officially released by Sinana Agricultural Research Center in 2021. The variety is best adapted to altitudes ranging between 2300 to 2600 meters above sea level in the country. Mieso variety evaluated along sixteen Field pea genotypes including the standard check “Harena and T/Shenene” under a regional variety trial for three years (2016 to 2018) at Sinana, Sinja and Agarfa districts. Promising genotype, “ACC32003-2” were selected and promoted to variety verification trail with the standard check during the 2020/21 cropping season. Finally, the National Variety Release Technical Committee decided “ACC32003-2” genotype for release. This Field pea variety showed superior performance particularly in terms of productivity and resistance/tolerance level to disease across the years and locations. The released variety out-yielded the other tested Field pea genotypes on both research plots and farmers’ fields. Based on most stability parameters, Mieso showed relatively better grain yield performance (3570kg/ha) and stability across a range of environments and years than the standard checks (Harena and Tulu Shenene) and could be cultivated across a number of locations in the highlands of Bale and other similar agro-ecologies for increasing productivity of the crop.

Keywords: Disease Resistance, Grain Yield, Out-yielded, *Pisum sativum* L., Stability

1. Introduction

Field pea (*Pisum sativum* L.) is diploid species ($2n=2x=14$) belonging to the Leguminosae family. Field pea is a self-pollinating cool season crops and an annual climbing, herbaceous plant, showing very considerable variation in form and habit [4]. It is the fourth most important legume crop in Ethiopia in terms of both area and total amount of production accounts for 13% of the total grain legume production [11].

According to CSA., 2020/21 report field pea is grown by 1,639,756 households on 219,927.59 hectares of land from which produced 3,762,368.83 Qts of grain with the national average of 1.71 t/ha. It requires evenly distributed a rainfall (800-1000 mm/annual) with altitudes ranges 1800-3000 m.a.s.l and cultivated in wide range of soil type with PH

range 5.5- 6.5 provided that the drainage is good [7].

Field pea is nutritious food staff when fully matures and they are valuable food legume in different forms particularly in Ethiopia [5]. Pea is very important for the nutritional quality of its seeds. Pea protein is low in sulfur containing amino acids, cysteine and methionine but rich in lysine and other essential amino acids [6]. Moreover, some important minerals such as calcium, phosphorus and iron are present in abundant quantities in pea which are lacking in cereals [3]. Pea contains 20-25% starch, 4-10% sugar, 0.6-1.5% fat and 2-4% minerals [10]. The crop has important ecological and economic advantages in the highlands of Ethiopia, as it plays a significant role in soil fertility restoration and also serves as a break crop suitable for rotation especially with barley and

wheat, which serves to restore soil nitrates and minimize weeds, insect pest and disease of cereals [1, 2].

Despite its Ecological and its Economic importance, the productivity of the crop was low 1.71 t/ha and even if the potential yields of the crop extend up to 2.5-7.5 t/ha [5]. The reason for low productivity of field pea in Ethiopia is due to less improved technology available which is widely adopted, lack of emphasis and other factors resulted for less field pea productions and economic benefits. Therefore, the development of cultivars, which are adapted to a wide range of diversified environments, is the ultimate aim of plant breeders in a crop improvement program [3]. The adaptability of a variety over diverse environments is commonly evaluated by the degree of its interaction with different environments in which it is grown. A variety is considered to be more stable if it has a high mean yield but a low degree of fluctuation in yielding ability when planted over diverse environments [8, 9]. Therefore, the objective of this study was to register stable high yielding and disease resistant/tolerant Field pea variety for highlands areas of Bale and other similar agro-ecologies in the country.

2. Materials and Methods

After conducting of multi-location trials for Sixteen Field pea collections from Ethiopian Biodiversity Institute for three consecutive years at Sinana, Sinja and Agarfa from 2016 to 2018 using RCBD designs with 4 replications across testing site with plot size of 3.2m², one Field pea genotype, Acc 32003-2 were selected due to significantly better mean grain yield and reaction to Field pea disease (Powdery mildew, Downey Mildew and Aschocyta Blight) across all test environments, as a candidate genotype and verified along with check varieties, Harena' and Tulu Shenene at nine locations (at on-station and two on-farms at each location) in

2020/21 for official release. Farmers and NVRC evaluated all trials across on stations and on-farms and the committee decided the Acc 32003-2 and named "Mieso", for official release for production in the highlands of Bale, Southeastern Ethiopia and similar agro-ecologies.

3. Result and Discussions

3.1 Varietal Characteristics and Descriptions

Mieso is a commercial name given for a newly released Field pea variety with the pedigree name Acc 32003-2. Mieso is characterized by its gray and Light-yellow seed coat and cotyledon colors, respectively and that was evaluated for its agronomic traits across test locations and years. The average number of days required by the variety to reach its 50% flowering and 95% physiological maturity were 66 and 136, correspondingly, with the average plant height being 131 cm (Table 3). The average thousand seeds weight of 151.1g. On average, it produces 16 pods with medium length (Table 3). The appropriate planting date for this variety would range from end of July to early August. For a better harvest the variety must receive 46 kg P₂O₅ ha⁻¹ and 18 kg ha⁻¹ N at sowing (Table 1).

3.2. Yield and Quality Performance

The mean grain yield of Mieso combined over locations and over years is 3570kg/ha which is higher than standard checks, Harena (3226kg/ha), and Tulu Shenene (3226kg/ha) (Table 2). The variety gives grain yield of 48 to 50 Qt/ha on the research field whereas it gives 30 to 32Qt/ha on farmer's field. This variety has grain yield advantages of the new variety over the high yielder standard checks, Harena variety of the respective locations were 10.67%. Mieso variety is preferred to a greater extent for shiro rather than kiki.

Table 1. Agronomical and Morphological Characteristics and Agro-ecological Zones of Adaptation of Mieso, Field pea variety.

Variety name:		Mieso (ACC 32003-2)
Adaptation area		Sinana, Goba, Agarfa, Goro (Meliyu), Gassera, Adaba, Dodola (west Arsi) other similar agro-ecologies
Altitude (m.a.s.l.)		2300-2600
Rainfall (mm)		750-1000
Seed Rate (Kg/ha)		75
Planting date		End of July to early August
Days to Flower		66
Days to Maturity		136
Plant Height (cm)		131
Purpose		Shiro
1000 Seed Weight (gm)		151.1
Seed Color		Dark Gray
Cotyledon Color		Light yellow
Flower Color		Pink
Yield (Qt/ha)	Research Field	48-50
	On-farmer's field	30-32
Disease reaction		Tolerant to Aschochyta blight, Powdery Mildew, Downey Mildew
Year of Release		2021
Breeder and Maintainer		SARC/IQOO

Table 2. Mean grain yield (kg/ha) of 16 Field pea genotypes across locations and years.

Entry	Agarfa			Sinja			Sinana			Means	Yield Adv. over St. check
	2016	2017	2018	2016	2017	2018	2016	2017	2018		
ACC 32518-1	787	3564	1791	3401	3862	3557	2460	4084	3788	3033	10.67%
ACC32021-2	900	3722	1583	2759	2465	3203	2152	3705	4062	2728	
ACC 32197-4	945	3393	1758	2332	3840	3748	3129	3652	4226	3003	
ACC32003-2	1734	3727	1993	3129	3542	4414	3741	4828	5021	3570	
ACC 32509-1	1254	3840	1965	2857	3923	4311	3304	4283	4678	3379	
ACC 32399-4	736	3360	1588	2272	2637	4144	2581	3991	4422	2859	
ACC 32225-1	828	3268	1094	2164	3127	3533	2718	4112	4101	2772	
ACC32178-4	517	3186	1176	1834	3225	3288	2049	3314	3596	2465	
ACC 32512-4	490	2745	1196	2186	3530	3118	1765	3511	2933	2386	
ACC 32487-3	999	3356	1048	2876	3449	3207	2249	3244	3863	2699	
ACC 32180-4	840	3196	1267	2251	2612	3767	2020	3527	3615	2566	
ACC32488-4	845	2750	1342	1836	3297	2754	2345	3063	3550	2420	
ACC 32363-3	855	3418	1362	3077	3203	3146	2261	3789	3802	2768	
Harena	1181	3600	1867	3309	3505	3655	3480	3979	4454	3226	
T/Shenene	961	3944	1526	2624	3937	2901	3111	3735	4847	3065	
Local check	880	3122	1943	1842	3166	3293	2649	3151	3375	2602	
MEANS	922	3387	1531	2547	3333	3502	2626	3748	4021	2846	
LSD (<0.05)	458.3	530.9	659.8	723.4	1180.0	883.0	578.5	831	624.5	276.6	
C.V.	21.5	11.0	23.0	20.0	25.0	18.0	15.0	16	11.0	21.0	

Table 3. Mean seed yield and other Agronomic traits of 16 field pea genotype tested in Regional Variety Trial combined at four sites (Agarfa, Sinja and Sinana) over three years from 2016 to 2018.

Entry	DF	DM	Stand %	PH (cm)	NPP	NSP	TSW (g)	GY (kg/ha)
ACC 32518-1	67	133	82	133	14	4	148.9	3033
ACC32021-2	66	136	82	139	13	4	155.4	2728
ACC 32197-4	63	135	83	131	15	4	148.9	3003
ACC32003-2	66	136	83	131	16	4	151.1	3570
ACC 32509-1	66	135	83	126	15	4	148.9	3379
ACC 32399-4	67	136	83	135	12	4	152.2	2859
ACC 32225-1	66	136	82	131	15	4	128.9	2772
ACC32178-4	67	136	83	134	15	4	140.9	2465
ACC 32512-4	67	136	83	139	12	4	143.3	2386
ACC 32487-3	66	136	81	125	18	4	130.9	2699
ACC 32180-4	65	136	83	131	12	4	150.6	2566
ACC32488-4	66	137	81	134	12	4	161.3	2420
ACC 32363-3	66	136	82	137	13	4	143.3	2768
Harena	64	135	83	132	13	4	184.1	3226
T/Shenene	64	135	81	128	13	4	152.8	3065
Local check	62	135	82	137	15	4	137.2	2602
Mean	66	135	82	133	14	4	148.7	2846
LSD (<0.05)	0.9	2.7	2.0	8.0	3.1	0.4	5.1	276.6
C.V.	3.0	4.2	5.3	13.0	24.7	24.1	7.4	21.0

Note: DF = days to 50% maturity, DM, days to 90% maturity, PH = plant height (cm), NPP = Number of pods per plant, NSP = Number of seed per plant, TSW = Thousand seed weight (g), GY = grain yield (kg).

Table 4. Mean grain yield, agronomic traits and disease reaction of 'Mieso' along with two standard checks tested in three environments at varietal verification levels during 2016-2018 cropping seasons.

Entry	Agronomic traits							Disease Reaction (1-9 scale)			
	DF	DM	Stand %	PH (cm)	NPP	NSP	TSW (g)	GY (kg/ha)	PM	DM	AsB
ACC32003-2	66	136	83	131	16	4	151.1	3570	4	4	4
Harena	64	135	83	132	13	4	184.1	3226	6	4	4
T/Shenene	64	135	81	128	13	4	152.8	3065	6	5	6
Local check	62	135	82	137	15	4	137.2	2602	6	5	6

Note: DF = days to 50% maturity, DM, days to 90% maturity, PH = plant height (cm), NPP = Number of pods per plant, NSP = Number of seed per plant, TSW = Thousand seed weight (g), GY = grain yield (kg), PM = Powdery mildew, DM = Downey Mildew, AsB = Aschocyta Blight.

3.3. Reaction to Major Diseases

The major field pea diseases according to their importance

in the growing areas are powdery mildew (*Erysiphe polygoni*), Downey mildew (*Peronospora pisi*) and Aschochyta blight (*Mycosphaerella pinodes*) (Asfaw *et al.*,

1993). Accordingly, above mentioned disease is among the major bottleneck for Field pea production in Southeastern part of the country, Bale. Disease data across location and years were scored and analyzed. Mieso variety showed resistance to moderate resistance to the above-mentioned diseases throughout the field evaluation periods (Table 4).

3.4. Performance Stability and Adaptation Domain

The variety 'Mieso' was released for high altitude agro-ecologies of the country receiving 750-to-1000 mm average annual rainfall. It is well adapted to an altitude range of 1800 – 2600 meters above sea level such as Sinana, Goba, Agarfa, Goro (Meliyu), Gassera, Adaba, Dodola (west Arsi) other similar agro-ecologies (Table 2). Mieso variety showed stable yield performance across tested location over years. It performs best if it is produced with recommended fertilizer, seed rate and other recommended fertilizer rate in the recommended ecologies. The grain yield performance and stability parameters of Mieso (Acc 32003-2) and the checks are summarized in Table 4.

3.5. Variety Maintenance

The breeder and foundation seed will be maintained by Sinana Agricultural Research Center/ Oromia Agricultural Research Institute.

4. Conclusion

The development of cultivars, which are high yielder and adapted to a wide range of diversified environments, is ultimate aim of breeders in crop improvement program. A variety is considered to be more stable if it has high mean yield but a low degree of fluctuation in yielding ability when planted over diverse environments. The field pea varieties, Mieso, had above average grain yield performance in all environments out yielding the standard check, Harena, Tulu Shenene and local check. Mieso is characterized by its gray and light-yellow seed coat and cotyledon colors respectively with better yield stability. These varieties are resistance to moderate resistance powdery mildew, Downey mildew and Aschochyta blight. Hence, Mieso was verified and officially released for large scale production in major Field pea growing areas of Bale highland and other similar agro-ecologies.

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References

- [1] Asfaw, T., Tesfaye, G. and Beyene, D., 1993, December. Genetics and breeding of faba bean. In Coos-season Food Legumes of Ethiopia. Proceeding of the first national cool-season food legumes review conference (pp. 16-20).
- [2] B. J. Shirazy, M. M. Islam, M. A. Haque, M. M. Mahbub and T. A. Somee, Influence of Combined Effect of Nitrogen and Micronutrients on Yield and Yield Contributing Characters of Sesame (*Sesamum indicum* L.), Bot. Res. Intl., 8 (4): 73-76, 2015.
- [3] Bekele, B., Muhammad, G., Galano, T. and Belayneh, T., 2003. Faba bean and field pea diseases research in Ethiopia. Food and Forage Legumes of Ethiopia: Progress and Prospects, p. 221.
- [4] Ben Ze'ev, N. and Zohary, D., 1973. Species relationships in the genus *Pisum* L. Israel Journal of Botany.
- [5] Central Statistical Agency (CSA), "Report on area and production of major crops (private peasant holdings, meher season)," Statistical Bulletin, vol. 590, pp. 19-21, 2020/21.
- [6] E. Ceyhanand M. A. Avci, Combining Ability and Heterosis for Grain Yield and some Yield Components in Pea (*Pisum sativum* L.), Pakistan Journal of Biological Sciences, 8 (10): 1447-1452, 2005.
- [7] Kay, D. E., 1979. Food legumes. Food legumes., (3).
- [8] M. M. Mahbub, M. M. Rahman, M. S. Hossain, F. Mahmud and M. M. Mir Kabir, Genetic Variability, Correlation and Path Analysis for Yield and Yield Components in Soybean, American-Eurasian J. Agric. & Environ. Sci., 15 (2): 231-236, 2015.
- [9] Purchase, J. L., 1997. Parametric analysis to describe genotype x environment interaction and yield stability in winter wheat (Doctoral dissertation, University of the Free State).
- [10] R. K. H. Makasheva, The pea, Oxinion press pvt. Ltd., New Delhi, p. 267, 1983.
- [11] Yirga, H. and Tsegay, D., 2013. Characterization of dekokko (*Pisum sativum* var. abyssinicum) accessions by qualitative traits in the highlands of Southern Tigray, Ethiopia. African Journal of Plant Science, 7 (10), pp. 482-487.