

Research Article

Pre-extension Demonstration of Released Field Pea Varieties in Targeted Districts of West and Southwest Shewa Zones of Oromia, Ethiopia

Endale Mekonnen* , Mamaru Tesfaye , Hana Amare, Chernet Asefa

Ethiopian Institute of Agricultural Research (EIAR), Holetta Agricultural Research Center (HARC), Holetta, Ethiopia

Abstract

A pre-extension demonstration of improved field pea varieties was conducted in the west, southwest, and Finifine special zones of Adaberga, Welmera, Ejere, and Woliso districts of Oromia regional state. The main objective of the study was to demonstrate and evaluate the recently released (Jeldu) variety along with standard checks (Burqitu). The trial was conducted for two consecutive years (2021/22-2022/23). The demonstration was undertaken on a single plot of 15mx20m area for each variety with the spacing of 5 cm between plants and 20 cm between rows and recommended seed rate of 180kg/ha and fertilizer rate of 121kg/ha NPS. A mini-field day involving different stakeholders was organized at each respective site. Yield data per plot was recorded and analyzed using descriptive statistics, while farmers' preference for the demonstrated varieties was identified using focused group discussion and summarized using pairwise ranking methods. The demonstration result revealed that Jeldu variety performed better than the standard check (Burqitu variety) with an average yield of 37.21qt/ha, while that of the standard check was 32.09qt/ha. Jeldu variety had a 19.94% yield advantage over the standard check. Thus, Jeldu variety was recommended for further scaling up.

Keywords

Pre Extension, Field Pea, Demonstration, Technology

1. Introduction

Field pea (*Pisum sativum* L.) is one self-pollinated diploid ($2n=14$) annual of the most important annual cool season pulse crop and is valued as high protein food [1].

It is widely grown in the cooler temperate zones and in the highlands of tropical regions of the world. The crop is cultivated in a wide range of soil types from light sandy loams to heavy clays but it does not tolerate to saline and waterlogged soil conditions [2] The soil pH optimum is 5.5-6.5. Field pea is one of the most important pulse crops in Ethiopia which is

produced for a long time in high- and mid-altitude areas by smallholder farmers. It covers an area of about 25147.69 hectares with an annual production volume of 21406364 kg [3]. Field pea is nutritious food staff when fully matures and they are valuable food legume, often being ground into four and used extensively in the manufacture of soups. Fresh green peas are almost universally accepted as a nutritious vegetable [4].

Nutritionally, field peas contain all the essential amino ac-

*Corresponding author: endaleaman95@gmail.com (Endale Mekonnen)

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ids and are rich in high-quality vegetable protein [5]. Therefore, this crop can substitute high protein containing animal meat products in the developing countries including Ethiopia. The crop has an important role in the highlands of Ethiopia by playing a significant role in soil fertility improvement occupying a unique position in cereal-based cropping systems [6], the crop is considered environmentally friendly and economical feasible from soil improvement point of view. Recent studies highlight the continued importance of field pea in sustainable cropping systems and its contribution to nitrogen fixation in Ethiopian agriculture. [7, 8].

In Ethiopia, pulses rank second next to cereals in terms of production volume and cultivated land out of the total grain production and cultivated land [9]. Pulses are produced mainly by smallholder farmers usually under rain-fed conditions. According to Ethiopian Statistical Agency's annual report of 2017/18, the share of Pulses production was around 9.73%. In the same period, pulses occupied around 12.61% of the total cultivated area. Current research emphasizes the need for improved water management strategies and drought-resistant varieties to enhance pulse production under rain-fed conditions [10, 11].

Among the highland pulses, field pea is the third most important crop in volume of production and cultivated area next to faba bean and chickpea. The crop plays an important role in the economic lives of the farming communities in the highland of Ethiopia. It serves as a source of food and feeds with a valuable and cheap source of protein. It plays a signif-

icant role in soil fertility restoration as a suitable rotation crop that fixes atmospheric nitrogen. It is also a good source of cash for farmers and foreign currency for the country. Furthermore, recent market analyses. [12] demonstrate the increasing demand for field pea, both domestically and for export, highlighting its economic potential.

Despite its importance, the national average yield of 1.67 t/ha⁻¹ [9] of field pea is very low due to various factors like the low yield potential of landraces, lack of improved varieties, their susceptibility to biotic and abiotic stresses, and poor management practices. Constraints in disease management, especially Ascochyta blight, remain a significant challenge. [13]. Highland pulse research program in the 2018 season released one high-yielding field pea variety with a yield range of 20-48 qt/ha in the research field and 19-34 qt/ha under farmers' field conditions. This variety has also better quality in thousand seed weight (210 gm/1000 seed weight) and is moderately resistant to ascochyta blight and powdery mildew diseases [14]. Therefore, an introduction, as well as a demonstration of improved field pea variety in the target area, is critical. Thus, the purpose of this research was to increase the production and productivity of field peas through participatory demonstration, selection, and transfer of improved high yielding varieties with desirable agronomic and quality traits in the study area. Studies on participatory variety selection have shown the benefits of involving farmers in the breeding process to ensure adoption and improve yields [15].

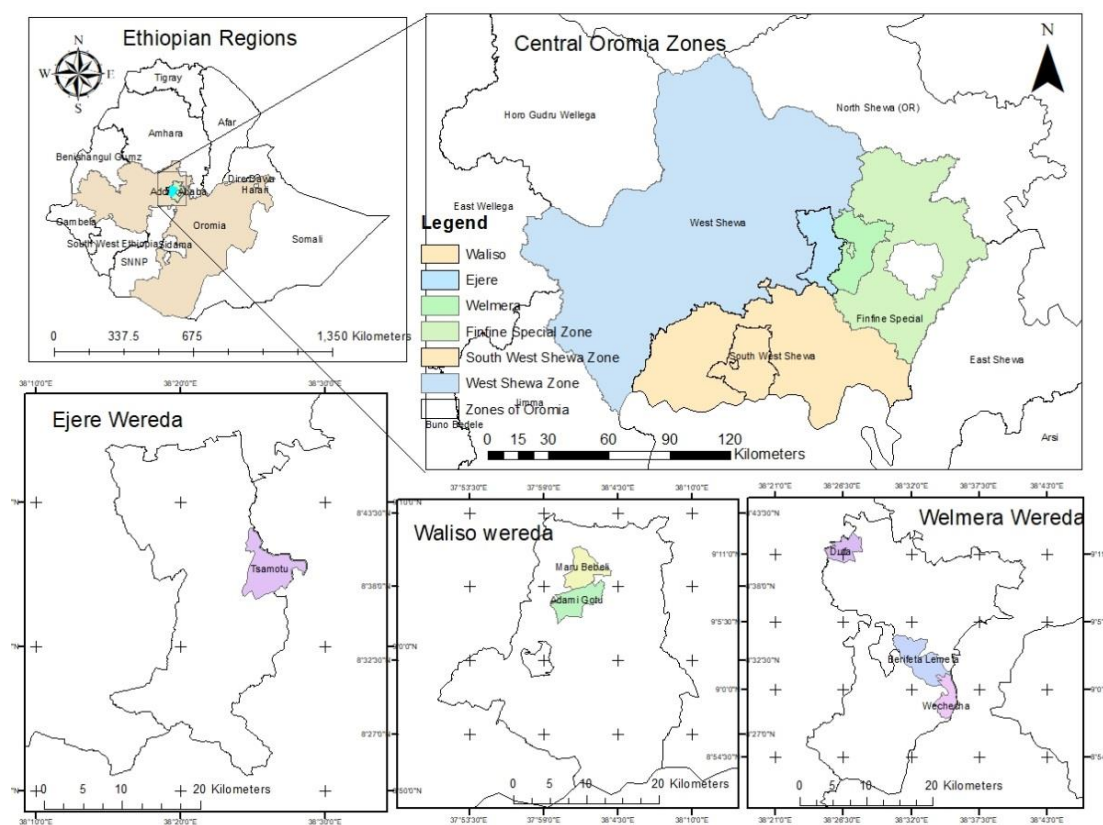


Figure 1. Map of the study area (Source: Ethio-geospatial data).

2. Material and Methods

2.1. Description of the Study Area

West Shewa: is one of the zones of the Oromia Regional state of Ethiopia. The zone geographically lies between 9° 09' 60.00" N to 37° 49' 59.99" E. (wikipedia 2020). Ejere, Adaberga, Meta Robi, Chob, Ejersa lefo, Dendi, and Wolmera are among the field pea potential districts found in the west shewa zone were selected as potential districts during the implementation cropping years 2020/21-2021/22.

Southwest Shewa is one of the zones of the Oromia in Ethiopia. This zone takes its name from the kingdom or former province of Shewa. Between 2002 and 2005, several districts were separated from the West Shewa Zone to create the Southwest Shewa Zone. Towns in it include Waliso (the capital) and Tulu Bolo. The zone geographically lies between 8° 33' 33" N to 38° 23' 53" W. Woliso is among the field pea wheat potential districts found in the southwest shewa zone selected as a potential district during the implementation cropping years 2020/21-2021/22.

2.2. Research Design

A Pre-extension demonstration of field pea varieties was conducted in west, southwest, and Finifine special zones at Adaberga, Wolmera, Ejere, and Woliso districts of Oromia regional state. First, the districts were selected purposively due to their potential in field pea production. The appropriate site was selected in collaboration with district agricultural experts and Kebele DAs. Finally, six volunteer farmers and three FTC sites were selected to implement the trail. The demonstration was conducted based on soil test analysis for soil acidity. The experimental plot that has a problem of soil acidity was treated with the recommended amount of lime.



Figure 2. Lime application and planting.

Farmers allocated their land for the trail voluntarily free of charge and fully participated in farm operations. The center provides seed, fertilizer, training, and technical advice for farmers. Two improved field pea varieties/ technologies of Jeldu and Burqitu were planted using the full recommended package with a seed rate of 180 kg/ha, fertilizer NPS 121 kg/ha, and spacing between plants and between rows was 5 cm and 20 cm respectively. Each variety was planted using a plot size of 300 m² (15m*20m).

2.3. Data Collection

Quantitative and qualitative data like grain yield, farmers' perception, and other agronomic performance data were collected from 15 demonstration sites. Practical training on field pea production and field management practices was provided to farmers and Kebele DAs at different plant growth stages.

2.4. Data Analysis

Data analysis was done using SPSS software. Farmers' preference data was collected using selection criteria set by farmers and analyzed using direct matrix ranking methods. Grain yield data was evaluated by using simple descriptive statistics of the mean for each variety. At the grain-filling stage, village-level field days were organized to evaluate the performance of the variety and create demand for the technology, and collect feedback from the participants.

3. Result and Discussion

3.1. Farmers' Preference

The newly released field pea variety Jeldu was evaluated against the standard check variety Burqitu. The host and neighboring farmers set selection criteria based on their long experience in field pea production to evaluate the demonstrated varieties. In total 81 farmers, agricultural experts, and researchers have participated in the evaluation process to select the most preferred varieties. The rate of scaling used to score each parameter was 1 is good; 2 is medium and 3 is poor.



Figure 3. Variety evaluation by the participants.

Farmers play a major role in the process of evaluating and selecting the best-performed varieties based on their selection criteria, while the researchers played only a facilitative role. The selection criteria set by farmers to evaluate the performance of the varieties were branching, disease resistance, pod setting, sweetness of green seed, and earliness. Farmers, Kebele DAs, and researchers participated to evaluate the performance of variety Jeldu against the standard check Burqitu based on the selection criteria set by farmers. The two years result of farmers' preference data in Table 1 showed that the variety Jeldu was more preferred by farmers than Burqitu and ranked first.

Table 1. Summary of two years Farmers' preference evaluation results of field pea varieties, 2020/21 and 2022/23 cropping season. (N=81).

S/N	Parameter	Average score (1-3)	
		Jeldu	Burqitu (Std check)
1	Stand	1.0	1.7
2	Branching ability	1.3	2.2
3	Disease resistance	1.8	2.0
4	Pod setting	1.4	2.1
5	The sweetness of green seed	1.6	1.6
6	Early maturity	2.1	1.9
7	Seed size	1.2	1.6
8	Seed color	1.0	1.0
9	1000 seed wt gm	1.0	2.0
10	Marketability	1.2	12

S/N	Parameter	Average score (1-3)	
		Jeldu	Burqitu (Std check)
Total score		13.6	17.3
Rank		1	2

3.2. Field Pea Yield Comparison (2021-2023)

The First-year grain yield data result in Table 2 revealed that the highest yields 4530 kg was recorded by the variety Jeldu at Ejere district, while the lowest grain yield of 1900 kg/ha was recorded by the variety Burqitu at Wolmera district. The overall mean yield of variety Jeldu across locations was 3559 kg/ha while Burqitu gave a mean yield of 3078 kg/ha. The recently released Jeldu varieties have a 481.2 kg/ha yield advantage and a 13.13% yield increment over the check. The second-year yield data in Table 3 showed that the maximum yield of 6000 kg/ha was recorded at the Damotu FTC site by the Burqitu variety, while the lowest grain yield of 2900 kg/ha was obtained from Adamegotu Kebele at Woliso district. The overall average yield of variety Jeldu and Burqitu for the second year was 3883.2 kg/ha and 3339.8 kg/ha, respectively with a yield advantage and percentage yield increase of 543.4 kg/ha and 14.16% (Table 2). The two years mean grain yield data in Table 4 revealed that variety Jeldu gave 37.21 qt/ha with a yield advantage of 512 kg/ha and a percent yield increase of 13.76% over the check.

The result also showed that the demonstrated variety Jeldu has a yield advantage greater than 16qt/ha and a 44% of yield increment over the national, regional, and zonal average yield recorded in the production year. Variety Burqitu also gave a yield advantage and percent yield increase of greater than 11qt/ha and 35% over the national, regional, and zonal averages, respectively.

Table 2. The mean grain yield of the two varieties demonstrated across districts in 2021/22.

Location	Mean grain yield kg/ha		Yield advantage kg/ha	% Yield increase
	Jeldu	Burqitu (Std check)		
Adaberga (farmer)	4370	3810	560	12.81
Adaberga (FTC)	3496	3366	130	3.72
Ejere	4530	3685	845	18.65
Wolmera	2133	1900	233	10.92
Woliso	3267	2629	638	19.53
Mean	3559	3078	481.2	13.13

Table 3. The mean grain yield of the two varieties demonstrated across districts in 2022/23.

Location		Mean grain yield kg/ha		Yield Advantage over check	Percent (%) yield increase
		Jeldu	Burqitu (stdck)		
Ejere	Damotu FTC	6000	5333	667	11.12
Wolmera	Robegebeya FTC	4333	4233	-100	-2.31
	Adamegotu FTC	3250	2533	717	22.06
Woliso	Adamegotu (F1)	2933	2300	633	21.6
	Adamegotu (F2)	2900	2300	600	20.69
	Mean	3883.2	3339.8	543.4	14.16

The average yield results of both varieties, Jeldu and Burqitu showed that there is a greater yield advantage and percent yield increase over the national, regional, and zonal av-

erage yield of field pea varieties grown in the country (see Table 4).

Table 4. Summary of yield performance of field performance at different level in 2021 and 2022 production season.

Variety	Mean grain yield qt/ha					Yield advantage qt/ha				% yield increase			
	Actual	Nat.	Reg.	WS	SWS	Nat.	Reg.	WS	SWS	Nat.	Reg.	WS	SWS
Jeldu	37.21	17.27	19.62	20.76	18.86	19.94	17.59	16.45	18.35	53.59	47.27	44.2	49.31
Burqitu	32.09	17.27	19.62	20.76	18.86	14.82	12.47	11.33	13.23	46.18	38.86	35.3	41.23
Mean	34.65	17.27	19.62	20.76	18.3	17.38	15.03	13.81	15.79	49.86	43.07	39.7	45.27

4. Conclusions and Recommendations

The pre-extension demonstration of field pea technology produces positive results and provides researchers an opportunity to demonstrate the productivity potential and profitability of the latest technology under farmers' real conditions. The productivity gain from the recently released variety Jeldu over the check variety Burqitu created greater awareness and motivation to non-host farmers to adopt field pea production technologies in the study area. The two improved varieties had also a great yield advantage and percent yield increase over the national, regional, and zonal average yield of field peas recorded in the crop production year. Farmers' perception data result also showed that variety Jeldu was more preferred by the participants than variety Burqitu. Therefore, to enhance the production and productivity of field pea crops, these improved varieties should be popularized on a large scale with their recommended crop package particularly in area where field pea crops potentially growing.

Abbreviations

CSA	Sentral Statistic Agency
DA	Developmental Agent
EIAR	Ethiopian Institute of Agricultural research
FAO	Food and Agriculture
FTC	Farmers Training Center
HARC	Holeta Agricultural Research Center
SPSS	Statistical Package For social Science

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Author Contributions

Endale Mekonnen: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Supervision

Mamaru Tesfaye: Data curation, Supervision

Hana Amare: Data curation, Supervision

Chernet Asefa: Data curation, Supervision

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Kent, M. B. S., & Endres, G. 2003. Field pea production. *North Dakota State University, Fargo, North Dakota*.
- [2] FAO. (2012). Food and Agricultural Organization of the United Nations, Rome, Italy.
- [3] CSA (Central Statistical agency). 2015. Agricultural Sample Survey. 2015/2016 Volume I Report on Area and Production of Major Crops, Statistical Bulletin, and Addis Ababa, Ethiopia.
- [4] Rezene Yayis, Fitsum Alemayehu, Fikadu Gurmu, Fisseha Negash, Bahilu Banteyirgu, and Yasin Goa. 2015." Registration of 'AMBERICHO' a newly released field pea (*Pisum sativum* L) variety for the Southern Highlands of Ethiopia." *Journal of Plant Studies*; Vol 4, no. 2 (2015).
- [5] Kandel, H., Mcphee, K., Akyüz, A., Main, N. E., Schatz, S. T. and Jacobs, J. E. 2016. North Dakota Dry Pea Variety Trial Results for 2016 and Selection Guide. NDSU Extension Service.
- [6] Fikere Mulusew, DJ Bing, Tadele Tadesse, and Amsalu Ayan. 2014. "Comparison of biometrical methods to describe yield stability in field pea (*Pisum sativum* L.) Under south eastern Ethiopian conditions." *African Journal of Agricultural Research* 9, no. 33 (2014): 2574-2583.
- [7] Alemaw, G., Adie, A., Assefa, F., & Woldeyes, F. (2021). Effects of blended NPS fertilizer rates and rhizobium inoculation on nodulation, growth and yield of field pea (*Pisum sativum* L.) at Dabat District, Northwest Ethiopia. *East African Journal of Sciences*, 15(2), 119-127.
- [8] Mulugeta, D., & Gorf, D. (2023). Nitrogen fixation potential of different pulse crops in the central highlands of Ethiopia. *Ethiopian Journal of Agricultural Sciences*, 31(1), 45-58.
- [9] Central Statistical Agency (CSA). 2017. The Federal Democratic Republic of Ethiopia. Central Statistical Agency Agricultural Sample Survey 2015/2016 (2008 E. C.): Report on Area and Production of Major Crops (Private Peasant Holdings, Meher Season), Volume I. Addis Ababa.
- [10] Abera, H., & Abegaz, M. (2022). Assessment of the impact of climate change on pulse crops production in Ethiopia: A review. *Cogent Food & Agriculture*, 8(1), 2037076.
- [11] Assefa, T., & Mekonnen, A. (2024). The role of water harvesting techniques in improving pulse crop production in drought-prone areas of Ethiopia: A review. *Journal of Water and Climate Change*, 15(2), 600-615.
- [12] Tadesse, F., Bekele, A., & Elias, E. (2021). Value chain analysis of pulses in Ethiopia: The case of faba bean and field pea. *Journal of Agribusiness and Rural Development*, 61(3), 285-302.
- [13] Ahmed, S., Kemal, S., & Dawd, A. (2022). Integrated management of Ascochyta blight of field pea (*Pisum sativum* L.) in the highlands of Ethiopia. *Plant Pathology Journal*, 38(5), 401-410.
- [14] Ethiopia Ministry of agriculture and natural resources, Crop variety registry book (2018).
- [15] Gebre, H., et al. (2023). Farmer participatory evaluation and selection of improved field pea varieties for enhanced adoption and yield in northern Ethiopia. *Experimental Agriculture*, 59(4), 550-565.