

Pre-Extension Demonstration of White and Red Common Bean Varieties in West Belesa District of Amhara Region, Ethiopia

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| Received: 21.12.2024 | Accepted: 27.01.2025 | Published: 30.01.2025 |

Abstract: In Ethiopia, common bean is grown predominantly under smallholder farmers for household consumption, cash crops and to improve soil fertility status. The crop has health benefits being rich in protein and a good source of iron and zinc. In the Amhara region, the crop had many constraints which are limited improved seed supply, poor extension service resulting in quality deterioration, price volatility, the prevalence of white common bean diseases, and rainfall scarcity. Also, the consumption and production of common beans in the West Belesa district weren't well known. To improve production constraints and consumption problems Gondar Agricultural Research Center (GARC) conducted a demonstration trial in West Belesa district. The main objective was to provide the best adaptive and high-yielder common bean variety; to assess farmers' and extension workers' reactions to the technology, and to enhance demand-driven technology dissemination. During the experiment, 3 common bean varieties (SER-119, Awash-1, and local) were demonstrated on a 300 m² plot of land. To evaluate the technology Farmer Research and Extension Group (FREG) was established. The FREG members got training about common bean production, consumption, and crop management as well as the FREG concept and participatory research approaches. The FREG members evaluated the demonstrated technology based on their selection criteria. The selected varieties were SER-119 and Awash-1 varieties were given a mean grain yield of 2200 kg ha⁻¹ and 2783 kg ha⁻¹ respectively. The technology is also visited by farmers and stakeholders. Because of food taste farmers were motivated to produce SER-119 variety in the coming season. So SER-119 variety with a full production package should be promoted to improve income and consumption habits in the district and similar agroecology.

Keywords: Common Bean, Income, Consumption, Evaluation, FREG.

INTRODUCTION

Common bean (*Phaseolus Vulgaris* L), locally known as 'Boleqe' also known as a dry bean, common bean, kidney bean, and field bean is a very important legume crop grown worldwide. It is an annual crop that belongs to the family Fabaceae. Haricot bean has been an important export commodity for the Ethiopian economy for the last 40 years. It is produced by the smallholder farmers in the low and mid-attitude zones of the country. It is used not only as a source of income but also as a source of food (Wogayehu and Tewodros, 2015).

As a result the crop rapidly expands and provides an essential part of the daily diet and foreign currency for most Ethiopians (Daniel, 2012). Common beans has also health benefits being rich in protein content (about 23% for dried shelled beans and about 6% for green beans) and serving as a good source of iron and

zinc (both of which are key elements for mental development) (Bekele *et al.*, 2019). Consumption and production of common beans in the West Belesa district weren't well known.

There are three main common bean types grown in Ethiopia, based on color: red, speckled beans, and white beans, within each color type beans are further sub-classified according to size classes; for example, red beans are subdivided into small red, medium red, and large red types (Berehanu *et al.*, 2018). The red bean types are typically grown for food security by the poorer farmers in the southern Rift Valley areas of the country, whereas white beans are produced almost exclusively for the export market in central-eastern Rift Valley (Ferris and Kaganzi, 2008).

Common bean production had many constraints which limit improved seed supply, poor extension

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Citation: Beyadegie W, Eshetu M, Mesfin F, Fentanesh S, Aragew A, Abebe H (2025). Pre-Extension Demonstration of White and Red Common Bean Varieties in West Belesa District of Amhara Region, Ethiopia. *Cross Current Int J Agri Vet Sci*, 7(1), 16-19.

service resulting in quality deterioration, price volatility, the prevalence of white common bean diseases, and rainfall scarcity, basically affecting productivity and quality of white common bean ultimately leading to low competitiveness and inability to offer a premium price for quality in the ECX market (Alemitu, 2011; Wogayehu and Tewodros, 2015; Samrawit, 2017).

In addition to the above production constraints that limit the volume of production, the lack of high-yielding varieties with improved resistance to diseases and other biotic and abiotic constraints has been the major production constraint of common bean in Ethiopia in general (Wogayehu and Tewodros, 2015).

To improve the production and productivity of common beans in the district, Gondar Agricultural Research Center (GARC) conducted adaptation research in the 2018/19 cropping season at West and East Belesa district and got a better yield from white and red varieties. On average, 21.71 qt^{ha} and 21.32 qt^{ha} yield, were able to produce from red and white common bean varieties respectively.

But the generation of the best variety is not a guarantee for improving the production and productivity rather awareness creation is irreplaceable task to promote and benefit wider community with the variety. To create awareness and promote the new varieties in the district, a pre-extension demonstration activity was conducted at West Belesa district.

Objectives

The objectives of this activity were to demonstrate common bean varieties to farmers and extension workers and assessing their perception and reaction to the variety in the West Belesa district.

METHODOLOGY

Description of the Study Area

The study was conducted at West Belesa district Central Gondar Zone of Amhara Region Ethiopia in 2021/22. West Belesa is one of the moisture-stress areas in the Central Gondar Zone. The capital city of the woreda is Arbaya which is 82km far from the historic town, Gondar. Its altitude ranges from 1100 to 2350 m above the sea level, while the annual temperature ranges between 130°C and 350°C. The mean annual rainfall ranges from 800 to 1200 mm Yasin *et al.*, (2013). The district has 32 kebeles. Of which, 12 kebeles are food insecure and supported by Sefty Net program and the remaining 20 kebeles are not supported by the food security program. Agriculture is the major livelihood in the district. Chickpea, teff, and sorghum are the major crops grown in the area. They raise livestock like cattle, donkeys, goats, and poultry (West Belesa Woreda Office of Agriculture, 2021).

The Demonstrated Technologies

To demonstrate the technology two common bean production potential kebeles were selected randomly (Kalay and Abay Tera) and 7 volunteer farmers were selected purposively who have lands that are suitable for common bean production. Each selected farmer allocated a 30m by 10m land size for the trial without a land compensation fee. For this demonstration trial, Awash-1, SER-119, and local varieties were used. Their planting spacing was 40cm and 20cm between rows and plants respectively. The rates of seeding and fertilizer (NPS) application of the trial were 80kg ha⁻¹ and 121kg ha⁻¹, respectively.

Awareness Creation Activities

To evaluate the demonstrated technology two FREGs were established at Kalay and Abay Tera Kebeles and evaluated the technology based on their selection criteria.

Table 1: FREG Establishment, 2022

District	Kebele	FREG members			FREG Name
		M	F	T	
W/Belesa	Kalay	31	2	33	Beletech
	Abay Tera	27	3	30	Lema

Training was given to participant farmers and stakeholders about common bean production and management as well as the Farmer Research and Extension Group (FREG) concept and participatory research approach. The field day was conducted on the

demonstrated technology with the collaborations of WOA and Gondar Agricultural Research Center. The field day participants were given feedback about the demonstrated technology.

Table 2: Training participants, 2022

District	Kebele	FREG members			Agri. expert			Researcher		
		M	F	T	M	F	T	M	F	T
W/Belesa	Kalay	31	2	33	5	2	7	3	0	3
	Abay tera	27	3	30	5	3	8	3	0	3
Total		58	5	63	10	5	15	6	0	6

Data Collection and Analysis Method

Both qualitative and quantitative data were collected. The collected data were analyzed by descriptive statistics like mean, standard deviation, minimum, and maximum, and also narrate the qualitative data based on contextual meanings. Partial budget analysis was done.

RESULT AND DISCUSSION

Technology Evaluation

The FREG members evaluated the demonstrated technology by their selection criteria. The criteria's were given weight by pairwise ranking method. The selected criteria's were the number of pods per plant,

maturity date disease and pest occurrence, food taste, and plant height. As indicated in Table 3, number of pod per plant, maturity date and pest and disease occurrence were 1st, 2nd and 3rd ranked important criteria selected by farmers, respectively. This implies that farmers gave prior for better yield under stress situation, like drought, pest and disease outbreaks. It was because the area is drought prone and food insecure. When the variety has much more pods per plant, the farmers expect that, the variety could give better grain yield. Farmers in the district need a short season varieties because the time of rainfall in the district is short. Farmers were interested in consuming the red type variety in their homes because the red type has a better food taste than the white variety.

Table 3: Ranking the importance of selection criteria using pairwise ranking, 2022

Selection criteria	1	2	3	4	5	total	rank	weight
Number of pods per plant (1)	1	1	1	1	1	5	1	5
Plant height (2)		2	3	4	5	1	5	1
Disease and pest occurrence (3)			3	3	5	3	3	3
Food Taste (4)				4	5	2	4	4
Maturity date (5)					5	4	2	2

Based on the above selection criteria, farmers selected SER-119 and Awash-1 varieties as the first and second-ranked varieties respectively. According to

result of FGD with FREG members and the farmers were highly interested to grow the varieties and harvest better yield for household consumption and income generation.

Table 4: Common bean Technology Evaluation

Selection criteria	SER-119	Awash-1	Local (Tate)
Number of pods per plant	5*5=25	5*5=25	3*4=12
Plant height	4*1=4	4*1=4	5*1=5
Disease and pest occurrence	5*3=15	5*3=15	5*2=10
Maturity date	5*4=20	5*4=20	2*3=6
Taste	5*2=10	3*2=6	5*2=10
Total	74	70	43
Rank	1	2	3

NB: 5=very good, 4=good, 3=medium, 2=not good, 1=not important

Grain Yield

Farmers got mean grain yield of 2783kg ha⁻¹, 2200kg ha⁻¹, and 969kg ha⁻¹ from Awash-1, SER-119, and local varieties respectively. Straw is a very important

byproduct that is used for animal forage. The local variety (*Tate*) gave higher biomass than improved varieties.

Table 5: Mean grain and straw yield in W/Belesa, 2021

Yield	Variety		
	SER-119	Awash-1	Local (<i>Tate</i>)
Mean Grain yield (Kg ha ⁻¹)	2200	2783	969
Straw yield (kg ha ⁻¹)	250	250	400

Yield Advantage

Table 6 indicates that the Awash-1 variety had a better yield advantage than the other varieties. Producing Awash-1 variety had a 20.95% (883kg ha⁻¹) and 58.7% (1632.6 kg ha⁻¹) yield advantage over SER-

119 and local varieties respectively. SER-119 variety had a 50.36% (1108kg ha⁻¹) yield advantage over the local one. Both Awash-1 and SER-119 varieties were productive and selected by farmers so the varieties should be promoted in the district.

Table 6: Yield Advantage

Yield advantage kg ha ⁻¹	SER-119 over Awash-1	SER-119 over Local	Awash-1 over Local
	-583	1108	1632.6

Partial Budget Analysis

The partial budget analysis result indicated that Awash-1 and SER-119 varieties were given a Marginal Rate of Return (MRR) of 4241.55 and 2929.8

respectively. The MRR result showed that when investing one birr in Awash-1 and SER-119 varieties the investment should cover one birr cost and get an additional birr of 42.44 and birr of 29.29 respectively.

Table 7: Partial budget analysis

Criteria	SER-119	Awash-1	Local (Tate)
Mean grain yield (kg ha ⁻¹)	2200	2783	969
Adjusted grain yield (10%)	1980	2504.7	872.1
Farm gate price for grain(birr)	25	25	20
Straw yield (kg ha ⁻¹)	250	250	400
Farm gate price for straw Birr kg ⁻¹	5	5	10
Gross benefit (grain + straw)	50750	63867.5	21442
Costs that vary (only seed cost)	40	40	30
Net benefit (Et birr)	50710	63827.5	21412
Marginal cost (Et.birr)	10	10	
Marginal benefit	29298	42415.5	
MRR	2929.8	4241.55	

CONCLUSION AND RECOMMENDATION

By demonstrating the technology awareness was created trust was built. Better grain yield was obtained from Awash-1 and SER-119 varieties. Because of their early maturing ability, both varieties can escape from the early rainfall termination problems. Farmers were motivated to grow the crop for the coming cropping season on a cluster approach. For household consumption, common bean food preparation methods should be organized (Farmers consumed as a form of *Nefro*). Pre-scaling-up activities should be proposed for the coming season in West Belesa and similar agroecologies.

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