# Participatory Technology Evaluation of Field Pea in West Belesa Woreda, Amhara Region

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***Abstract***

*The study area has a vast potential for field pea production. However, the production and productivity of field pea in Ethiopia, specifically in the West Belesa woreda, fall significantly below that of other countries. This is due to various factors such as limited access to improved seeds and varieties, biotic and abiotic stresses, as well as the inherently low yield potential of indigenous cultivars. Additionally, declining soil fertility, poor cultural practices, inadequate land management, and lack of fertilizer use further contribute to the subpar performance of field pea production in the region.*

*In order to address the challenges faced in field pea production, Gondar Agricultural Research Center (GARC) conducted participatory technology evaluation activities in West Belesa woreda. After careful assessment, Agrit and Senk varieties were recommended based on their high yield and related components.*

*To raise awareness and create demand for these technologies, an experiment was carried out in West Belesa woreda at Kalay and Senki kebeles. The primary goal was to identify the most suitable and productive field pea variety, gauge the reactions of farmers and extension workers to the technology, and enhance the dissemination of demand-driven technology.*

*During the participatory technology evaluation trial, three field pea varieties (Agrit, Senk, and local) were showcased on a 300 m2 plot of land. To evaluate the technology, a Farmer Research and Extension Group (FREG) was established. FREG members received training on field pea production, consumption, crop management, as well as the FREG concept and participatory research. The members then assessed the demonstrated technology based on specific selection criteria.*

*The selected varieties were Senk and Agrit which gave a mean grain yield of 1805 kg ha-1 and 1675 kg ha-1 respectively. The technology was visited by farmers and stakeholders’. Finally Senk variety was selected by yield advantage while Agrit variety was selected by farmers by its taste for their household consumption so both varieties with a full production package should be promoted to improve production and productivity of the crop in the Woreda and similar Agroecology.*

***Keywords****: Pulse, variety evaluation, farmer participation, adoption*

**INTRODUCTION**

Field pea (*Pisum sativum* L.) Is one of the most important annual legume crops. . It is widely grown in the Highlands and performs well at an altitude of 1800-3000 meter above sea level. In addition, the crop also better adapted under low rainfall environments as compared to other pulses such as Faba bean, lentil, and chickpea. Field pea has moisture requirements similar to those of cereal grains. Field pea crop plays an important role in the lives of the farmers in the highlands of Ethiopia; it serves as a source of food and feed with a valuable and cheap source of protein. It plays a significant role in soil fertility restoration as a suitable rotation crop that fixes atmospheric nitrogen (Gerum *et.al*., 2022).

In Ethiopia, field pea is mainly used to prepare “shiro wet”, a stew eaten with local bread made of teff, i.e. “Injera”. The crop commonly grows in association with faba bean (*Vicia faba*), and is important food, cash and "hunger break" crop in highlands of the country. Field pea supplies 344 calories, 20.1 g protein and 64.8 g carbohydrates/100g edible portion. Field pea has the largest share of area and total national production of all pulses grown in Ethiopia (Ertiro, and Haile, 2022).

The productivity of field pea in Ethiopia particularly in West Belesa woreda is far below the potential due to several factors. The limited factors were limited improved seeds, varieties, biotic and abiotic stresses, and inherent low yielding potential of the indigenous cultivars declining soil fertility status, poor cultural practices, land management and lack of fertilizer use. Aphids, lodging, diseases (ascochyta blight, powdery mildew), and pod shattering (Gadissa *et al*., 2022).

To alleviate such production constraint in the woreda GARC was conducted adaptation trials in the woreda and recommended senk and Agrit varieties based on its yield and yield related components. On the adaptation trials Sank and Agrit were given the mean grain yield of 1805kg/ha and 1650kg/ha respectively. During field day event the variety was selected by farmers and motivated to produce the variety. The variety has a 26.59 % yield advantage over the local one. The main objective of the experiment was providing farmers with a menu of field pea varieties. That is why this participatory technology evaluation activity was proposed.

**Objective**

The objectives of this activity were provided a menu of field pea varieties to farmers and extension workers and assess the perception and reaction of farmers and extension workers in West Belesa woreda.

**MATERIALS AND METHODS**

**2.1 Area Descriptions**

The experiment was carried out in West Belesa woreda, central Gondar administrative zone. The study area is geographically located between 12⁰ 13' 11" to 12⁰ 41' 4" N latitude and 37⁰ 37' 9" to 38⁰ 3' 8" E longitude (Fig 1). According to Ahmed *et al*. (2022), Agroecology is predominantly lowland, covering 59.8% followed by a midland 38.7%and highland 1.5%. The altitude ranges from 1100 to 2350 m above sea level, while the annual temperature ranges from 13 °C to 35 °C. The mean annual rainfall ranges from 700 to 900 mm, and the rainy season starts in June and ends in September, where the rainy months are July and August. The farming system in the woreda is a mixed crop-livestock production system. The woreda has 32 cables. Of which, 12 cables are food insecure and supported by Safety Net program and the remaining 20 cables are not supported by the food security program. Agriculture is the major livelihood in the woreda. 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 awardee has a suitable environment for field pea production, but farmers have not yet produced improved field pea technologies.

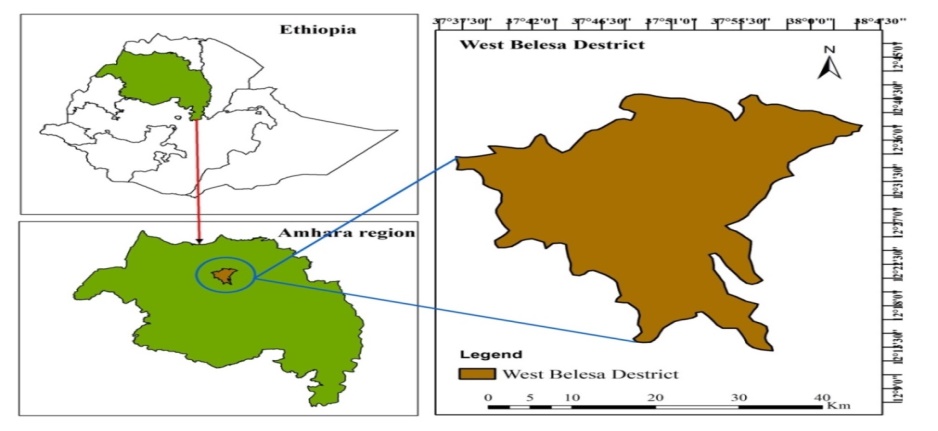
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Fig 1: Location of Experimental Area

**2.2 Site Selection**

As a target area, West Belesa woreda was selected for the implementation of the trials due to its potential for field pea production and the high demand for the crop. Selection of potential Kebeles was carried out in collaboration with DAs and Agricultural experts. Accordingly, Kalay and Senki Kebeles were selected as experimental sites of the technologies based on accessibility and potentiality for the crop.

**2.3 Farmers Research and Extension (FREG) Establishment**

Selection of FREGs members from Kalay and Senki kebeles were based on farmers' willingness to be held as a member, accessibility for supervision of activities, good history of compatibility with groups and genuineness and transparency to share innovations to other farmers. Consequently, one FREG having 30 members established.

**2.4 Training**

After establishment of the FREG, a theoretical training session was arranged to farmers and Agricultural experts in Arbaya town. Multidisciplinary team of researchers from GARC delivered training to a total of 35 participants on the following topics: field pea production and management as well as the FREG concept and participatory research approach.

Table 1. Training participants, 2022

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Woreda | FREG members | | | Agri. exp | | |
|  | M | F | T | M | F | T |
| West Belesa | 25 | 5 | 30 | 3 | 2 | 5 |

**2.5 Selection of host farmers**

Having suitable and sufficient land to accommodate the trials, willingness to contribute the land without fee, proximity to main roads so as to facilitate the chance of being visited by many farmers, good in field management and willingness to explain the technologies to others was the criteria used to select 6 hosting farmers.

**2.6 Implementation design and material used**

Two improved field pea varieties (Senk and Agrit) and standard check (Local) were used for the evaluation trials by using each farmer's field as replication. The varieties were planted on farmers’ land with simple plot design (32 m X 10 m). Row planting method was employed and spacing of 20 cm by 10cm between rows and plant respectively with a recommended seed rate of 75 kgha-1. The recommended rates of 100 kgha-1 DAP were used to conduct the experiment. The trials were weeded two times; first at one month after sowing and second in two months after sowing of the varieties. Farm operations (land preparation-ploughing two times using an oxen plough, harvesting, and threshing) were carried out by hosting fanners without fee, whereas activities such as land leveling, planting, first and second weeding, and agrochemical spray were handled by the researchers.

**2.7 Farmers’ Preferences and Selection Criteria**

The varieties were evaluated at crop maturity stage and validated by farmers, agricultural experts, development agents, and researchers based on the following selection criteria. The criteria were numbered of pods per plant; plant height, disease and pest occurrence, and maturity date of the crop. Each selection and evaluation criteria were rated using the following rating scale; 5= Very good, 4= Good, 3= Medium, 2=Poor and 1=Very poor.

**2.8 Data Collection**

Both qualitative and quantitative data were collected using appropriate data collection methods such as focused group discussion (FGD), direct field observation and measurements, agronomic data and grain yield per plot were recorded. Total number of farmers participated in technology evaluation events. Feedback assessors on farmers’ preference to the demonstrated varieties and farmers’ perception towards the performance of the technologies were also identified.

**2.9 Data analyses**

The collected data were analyzed using descriptive statistics such as mean, maximum, minimum and standard deviation. Besides, pair wise ranking matrix was used to evaluate and select best performing varieties and rank the varieties in order of their importance. To select best and profitable variety Cost benefit analysis was conducted.

**RESULT AND DISCUSSION**

3.1 Awareness Creation and Technology Evaluation

Based on the given training, farmers and extension agents had got a better understanding about the field pea technology. Members of the Farmer Research and Extension Group (FREG) determine the criteria for selecting varieties themselves. Among the criteria identified are the number of pods per plant, plant height, disease and pest resistance, and maturity date. The FREG members have chosen the number of pods per plant and maturity date as the first and second criteria, respectively. Farmers prioritize these criteria because a higher pod count typically results in a better grain yield, and a shorter maturity date helps to avoid issues caused by early rainfall termination.

Table 2: Selection criteria and pairwise ranking, 2022

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Selection Criteria | 1 | 2 | 3 | 4 | Total | Rank | Weight |
| Number of pods per plant | 1 | 1 | 1 | 1 | 4 | 1 | 4 |
| Plant height (2 |  | 2 | 3 | 4 | 1 | 4 | 1 |
| Disease and pest occurrence |  |  | 3 | 4 | 2 | 3 | 2 |
| Maturity date |  |  |  | 4 | 3 | 2 | 3 |

Based on the above selection criteria Senk, A grit and local varieties were selected as 1st, 2nd, and 3rd ranked varieties respectively.

Table 3: Rank of varieties based on farmers selection criteria

|  |  |  |
| --- | --- | --- |
| Variety | Rank | Reason |
| Senk | 1 | The variety had medium number of pods per plant, plant height, disease and pest resistance, maturity date as compared to the other variety |
| Agrit | 2 | The variety had medium number of pods per plant, plant height, disease and pest resistance, but had a longer maturity date as compared to the other variety |
| Local | 3 | The variety had medium number of pods per plant, plant height but had low disease and pest resistance, and also had long maturity date |

Table 4: Technology evaluation, 2022

|  |  |  |  |
| --- | --- | --- | --- |
| Selection criteria | Agrit | Senk | Local |
| Number of pods per plant | 3\*4=12 | 3\*4=12 | 3\*4=12 |
| Plant height | 3\*1=3 | 3\*1=3 | 3\*1=3 |
| Disease and pest occurrence | 3\*2=6 | 3\*2=6 | 2\*2=4 |
| Maturity date | 2\*3=6 | 3\*3=9 | 1\*3=3 |
| Total | 27 | 30 | 22 |
| Rank | 2 | 1 | 3 |

**3.2 Grain Yield**

The overall mean grain yield of Senk and Agrit on farmer's field had 1805kgha-1 and 1675kgha-1 respectively, while the local variety gave a mean yield of 1325kgha-1. This result was similar to the yield obtained during adaptation trial result that conducted by (Fentanesh *et, al*, 2022) at West Belsesa woreda.

Table 5: Mean grain yield in W/Belesa, 2022

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variety | Minimum | Maximum | Mean | Std. D |
| Agrit | 1325 | 2150 | 1675 | 2.89 |
| Senk | 150 | 2200 | 1805 | 2.47 |
| Local | 85 | 1700 | 1325 | 2.84 |

Statistical Yield Comparison

The statistical test result revealed that Senk variety had highly significant yield difference over A grit and local varieties while Agrit variety had high significant yield difference over the local variables.

Table 6. Statistical yield comparison, 2022

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variety | Mean difference | Std. D. | T-value | Sig. |
| Senk - Agrit | 1.3 | 0.43 | 7.40 | 0.00 |
| Senk - Local | 4.8 | 1.88 | 6.25 | 0.00 |
| Agrit -Local | 3.5 | 1.94 | 4.41 | 0.01 |

3.3 Benefit analysis

The demonstrated varieties were given it. Birr ha-1 97470, Et. Birr ha-1 90450 and Et. Birr ha-1 47700 from Sun, a grit and local varieties respectively.

Table 7: Benefit analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Criteria | Agrit | Senk | Local |
| Mean grain yield kg ha-1 | 1675 | 1805 | 1325 |
| Adjusted grain yield (10%) kg ha-1 | 1507.5 | 1624.5 | 1192.5 |
| Farm gate price for grain Et. Birr kg-1 | 60 | 60 | 40 |
| Gross field benefit it. Birr ha-1 | 90450 | 97470 | 47700 |

3.4 Yield Advantage

The result in the table 8 reveals that variety Senk had a 26.59% yield advantage over the local one while Agrit also had a 20.90% yield advantage over the local. This figure was competent with the potential yield of the varieties of research field since participatory variety selection (PVS) was employed (Fentanesh *et, al*, 2022).

Table 8: Yield advantage

|  |  |  |  |
| --- | --- | --- | --- |
| Yield advantage % | Agrit over Local | Sank over Agrit | Sank over Local |
| 20.90 | 7.20 | 26.59 |

4. CONCLUSION AND RECOMMENDATION

Number of pods per plant; plant height, disease and pest occurrence, and maturity date of the crop and yield were the best selection criteria identified by the evaluators. The overall harvested mean yield of Senk and Agrit on farmer’s field had 1805kgha-1 and 1675kgha-1 respectively, while farmers got a mean yield of 1325kgha-1 from local variables.

Agronomic data result shows that Senk and Agrit varieties were selected as compared to the standard check (Local) variety. Participatory evaluation and validations of newly recommended field pea technology under farmers' condition is important to make our research demand-driven and enhance field pea production and productivity.

Farmers were selected Agrit and Senk varieties as the first and second best varieties. Senk variety had better grain yield and yield advantage over the other. Because of their early maturing ability, both Agrit and Senk varieties can escape from the early rainfall termination problems. Farmers’ preferences should be considered and taken into consideration in breeding program in order to save resources in terms of preferred variety promotion/dissemination, time and make technology adoption faster. Based on agronomic and farmers selection data Senk variety with production package should be further scaled up in the woreda and similar agro-ecology.

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