

Pre Extension Demonstration and Evaluation of Chickpea Varieties (*Cicer arietinum* L.) Varieties at Adami Tulu Jido Kombolcha District, Central Rift Valley of Oromia, Ethiopia

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Abstract: The demonstration and evaluation activity was conducted at Adami Tulu Iddo Kombolcha district of East Shewa zone, Oromia, Ethiopia. Improved chickpea varieties (Minjar and Habru) were demonstrated as a follow up of participatory variety selection activity. The objectives were to demonstrate and evaluate the performance of selected varieties along with their management practices under farmers' circumstances, to see the financial return of chickpea production in the study area and to raise farmers' knowledge and skill on chickpea production and management practices. Sites were selected in collaboration with respective district office of agriculture experts and Development Agents. Trainings were given for farmers, Development Agents, experts and other stakeholders. The Participating farmers were also capacitated through follow up exchange visits and field days. Recommended seed and fertilizer rate were used for the demonstration trial establishment. Accordingly, the results indicate no statistically significant yield difference at ($P < 0.05$). Numerically, the mean grain yield harvested was 24.92 ± 1.97 and 23.33 ± 2.20 qt/ha from minjar and Habru varieties, respectively. In terms of financial return the results indicated that an average return of 62,326.00 Birr can be obtained from minjar chickpea variety in one production season in the study area. Thus, Minjar variety is recommended for future scaling up works.

Keywords: Chickpea, Demonstration, Pre-Extension, Adami Tulu, East Shewa Zone

1. Introduction

Chickpea as a one of the most important food legume which has been commonly used for human nutrition [9]. It is the second most important among pulses in the world and being cultivated on more than 11 million hectares with annual production of 9 million tons [10]. It is a high-value pulse crop that is adapted to deep black soils in the cool semi-arid areas of the tropics, sub-tropics as well as the temperate areas [11][12]. Ethiopia has suitable agro-climatic conditions for production of both Desi and Kabuli type chickpeas. The crop is highly integrated into the farming system and ecologically friendly for growing in many areas that suffer from soil nutrient depletion [3]. The chickpea in Ethiopia, occupied about 239,755 hectares of land with estimated production of 4,586,822 qt in 2014/15 [4]. In

2015/16 it was about 225,607.53 hectares of land with estimated production of 4,441,459.26qt [5]. Currently, it is estimated to cover 220,719 ha of land with estimated production of 3.7million quintals [6].

Chickpea is the second major export commodity among pulse crops by generating nearly 25% of the total pulse export earnings. Ethiopia has exported a total of 329.70 thousand tons chickpea during the period 2010-2015 with a total income of 3.70 Billion Birr [15].

In Ethiopia the major chickpea producing regions are Amhara and Oromia [13]. According to Ethiopian statistical report [6], the total area allocated for chickpea production in Oromia region was 81,286.46 ha with estimated production of 1,816,060.62 quintals; out of which 16.4 was in East Shewa zone. In the same production season in East Shewa zone of Oromia the total estimated production of chickpea

was about 380.1 quintals. The current average chickpea productivity (1.9 t/ha) still remains below the attainable yield (3-4 t/ha) that could be achieved through adoption of improved chickpea production technologies [1].

Within East shewa zone the major chickpea producing district are Ada'a and Gimbichu. In other districts, such as Adami Tulu Jiddo Kombolcha the production of chickpea is very limited despite its potential contribution towards alleviating mono cropping of maize and improving soil fertility and hence improving production and productivity. Chickpea production in the area is challenged by different constraints. Some of the constraints include moisture stress, rainfall variability, limited knowledge about its production and unavailability or lack of improved varieties [7]. As its production is still new to most of the farmers in the area other agronomic management for improved productivity are also considered as constraints. Despite the constraints there are

opportunities for chickpea production and improving its productivity. The national agricultural research system of the country has also released different varieties though not yet well adopted by farmers [12, 16]. Table 1 below describes some of the released chickpea varieties recommended for moisture stress areas along with their characteristics.

Basing this opportunity and to alleviate the problem of the dominance of maize in the dry land production system a project with an objective of introducing non-traditional crops in the dry land Agricultural Production System using participatory variety selections (PVS) was conducted by Adami Tulu Agricultural Research center in collaboration with ICARDA. One of the crops included in the PVS was chickpea. The PVS has tested five chickpea varieties namely *Minjar*, *Teketay*, *Ejere*, *Habru* and *Arerti*. The varieties and their characteristics are described on the table below.

Table 1. Characteristics of chickpea varieties used for the PVS.

Characteristics	Arerti	Habru	Tektay	Minjar	Ejere
Type	Kabuli	Kabuli	Kabuli	Desi	Kabuli
Days to 50% maturity	105-155	91-150	85-150	86-143	118-129
Areas of adaptation					
Altitude	1800-2600	1800-2600	1800-2600	1800-2600	1800-2600
Rainfall	700-1200	700-1200	700-1200	1200-1400	700-1200
Yield (tha ⁻¹)	18-47	14-50	20-23	20-40	12-15

From the study, though the time the PVS conducted was affected by severe shortage of rainfall caused by El Nino effect, promising results were found. In addition, with all the challenges, farmers have shown great interest in chickpea production and on the varieties tried. To see farmers' preferences among the tried varieties matrix ranking was used. The ranking was done in such a way that farmers were let to rank preferred characteristics they look for in chickpea varieties first. After ranking the characteristics the farmers then selected the tried varieties. Accordingly, basing on their characteristics farmers selected *Minjar* and *Habru* varieties respectively. Therefore this study was proposed with objectives of demonstrating and evaluating the yield performance of selected varieties along with their management practices under farmers' circumstances, to see the financial return of chickpea production in the study area and to raise farmers' knowledge and skill on chickpea production and management practices Objectives.

2. Material and Methods

2.1. Description of the Study Area

The study was conducted at Adami Tulu Jiddo Kombolcha (ATJK) district of East Shewa zone, Oromia, Ethiopia where previous participatory variety selection of barley varieties was done. ATJK district is one of the districts in central rift valley of Oromia, Ethiopia. Most of the district ranges at an altitude from 1500 to 2300 meters above sea level; Mount Aluto is the highest point. Rivers found in the district include the Bulbula, Jido, Hora Kalio and Gogessa. A survey of the land in this

district shows that 27.2% is arable or cultivable, 21.6% pasture, 9.9% forest, 15.7% swampy and the remaining 25.6% is considered degraded or otherwise unusable (https://en.wikipedia.org/wiki/Adami_Tullu_and_Jido_Kombo_lcha). The crops produced in the area are mainly maize, harociat bean, wheat, teff and barley.

2.2. Site and Farmers Selection

The trial was conducted in two kebele's where the previous PVS was conducted. Trial farmers were selected in collaboration with Development agents. Farmers' research group (FRG) approach was followed to select and organize farmers. One group per kebele consisting of 15 farmers was organized considering gender. From each FRG 3 trial farmers were then selected for the trial establishment. The trial farmers were selected taking into consideration their interest to provide a land, previous production history of the crop, interest to involve in group and share his/her experiences.

2.3. Planting Material

Two adaptable early maturing Chickpea varieties (*Minjar* and *habru*) were used. Planting material (Seed) was prepared in advance before planting.

2.4. Experimental Design and Procedures

The experiment was conducted on two Kebele's of Adami Tulu Jido Kombolcha district. The demonstration fields were laid out on six farmer's field in both Kebeles, each having three trial farmers. Both varieties were planted side by side on a plot size of 100m² per variety. Farmers were used as

replication. Packaged production technologies (seed rate, seed treatment, spacing, fertilizer management and weed management) recommended for chickpea production were used to establish the trials.

Land was prepared by farmer using oxen plow and Plots were kept free of weeds to produce a successful crop stand. Seeds were sown at the recommended rate of 110kg ha^{-1} in rows 40cm and 10cm between plants. No fertilizer applications were done to the field and other agronomic managements were done as per the recommendation.

2.5. Capacity Development

As studies indicate capacity building on agronomics practices and disease management are very important for improving production of chick pea productions [2]. To this end, After group formation, different capacity development activities were undertaken. Training was given for the groups of farmers, DAs and SMS to improve their level of knowledge about Chickpea production. Field visits and field day were conducted for farmers to observe each other's field and understand the difference between their management.

2.6. Data Collected

Grain yield, costs involved and income gained were collected.

2.7. Data Analysis

The collected yield and financial data were analyzed

using SPSS and presented using table. The technology gap and technology index were calculated using the formulas as given by [14]. The technology gap shows the gap in the demonstration yield over potential yield. The yield gaps can also be further categorized into technology index which is used to show the feasibility of the variety at the farmer's field. The lower the value of technology index the more the feasibility of the varieties. The formulas are as follows.

Technology gap = Potential yield qt/ha – demonstration yield

Technology index % = $\frac{(\text{Potential yield} - \text{demonstration yield}) \times 100}{\text{Potential yield}}$

3. Result

3.1. Yield Performance of the Two Demonstrated Chickpea Varieties

The combined analysis result shows that a mean yield of 24.92qt/ha and 23.33qt/ha was gained for *Minjar* and *Habru* varieties, respectively. The varieties have no statistically significant yield difference at ($P < 0.05$).

The demonstration result obtained was higher than what was reported during their PVS stage (ATARC horticulture team, unpublished report). Furthermore the yield was found to be comparable with similar activity conducted with AGP-II project in similar agro-ecology [8].

Table 2. Grain Yield performance of demonstrated Chickpea varieties.

Variety	N	Mean Grain Yield	SD
Minjar	6	24.92 ± 1.97027	3.41260
Habru	6	23.33 ± 2.20479	3.81881

3.2. Training and Field Day

A total of 33 participants have participated in this demonstration activity, through trainings and 40 on mini field day.

Table 3. Number of participants on training.

Training topic	No of participants											
	Farmers			DA'S			SMS			Others		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Chickpea production and management	15	3	18	1	1	2	2	0	2	10	1	11
Overall total												33

Table 4. Number, age and sex of participants attended field day.

Age and sex of participating Farmers on field day			
		Frequency	Percent
AGE	Young up to 18	2	5.0
	Adult 18 - 35	12	30.0
	Adult 35 -50	15	37.5
	Adult above 50	11	27.5
	Total	40	100.0
SEX	M	37	92.5
	F	3	7.5
	Total	40	100.0

Financial Analysis/ha: Demonstrated chickpea varieties at Adami Tulu Jiddo Kombolcha

In terms of profitability the financial analysis result show that an average return of 62,326.00 and 57,846.00 Ethiopian Birr per hectare can be gained by using Minjar and Habru varieties, respectively.

Table 5. Financial analysis result.

Location: ATJK	Variety	
Parameters	Minjar	Habru
Yield qt/ha (Y)	24.92	23.33
Price (P) per quintal	2800	2800
Total Revenue (TR)= YxP	69,776	65324
Variable costs		
Seed cost (including transport)	3300	3300
Fertilizer cost	0	0
Chemicals	400	400
labour cost	1000	1000
Cost of transport, sacks	250	250
Total variable costs (TVC)	4950	4950
Fixed costs		
Cost of land	2500	2500
Total fixed costs (TFC)	2500	2500
Total Cost (TC) = TVC+TFC	7450	7450
Gross Margin (GM) = TR-TVC	64,826	60374
Profit= GM-TFC	62,326.00	57,874

Table 6. Technology gap and index for Minjar and Habru Chickpea varieties at Adami Tulu Jido Kombolcha District.

Parameter	Varieties	
	Minjar	Habru
Yield gap (qt/ha)	5.08	13.67
Technology index (%)	16	36

As it can be calculated from the above table the technology index percentage is 16% for Minjar and 36% for Habru varieties, respectively. Similarly both varieties show lower average yield gap (5.08 qt/ha and 13.67qt/ha for Minjar and Habru varieties, respectively).

4. Conclusion and Recommendation

As a follow-up of participatory variety selection (PVS) activity, the demonstration activity created an opportunity for farmers to evaluate the performance of the chickpea varieties. Furthermore, through the trainings awareness has been created for all participating farmers, DA's and other stakeholders on how to produce and manage chickpea. The results indicated that both varieties demonstrated gave promising yield. They were also found to be highly profitable. However, there is a lack of agronomic management practices recommended for this specific area. There is still a lot to be improved in making this varieties feasible to the farming communities by decreasing the gap between demonstration yield and potential yield of the varieties. Therefore the research system has to work on releasing more adaptable moisture stress chickpea varieties along with their appropriate agronomic management practices. Yet, basing farmers' feed backs, yield and financial returns Minjar is recommended for further scaling up.

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