

# Performance Evaluation of Desi Chickpea (*Cicer arietinum* L.) Varieties Through Participatory Variety Selection South Gonder Zone, North Western Ethiopia

Yasin Taye, Alamir Ayenew\*

Ethiopian Institute of Agricultural Research (EIAR), Fogera National Rice Research and Training Center, Addis Ababa, Ethiopia

## Email address:

alamiray12@gmail.com (Alamir Ayenew), allahakiber@gmail.com (Yasin Taye)

\*Corresponding author

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**Abstract:** Chickpea is a multi-functional crop, has an important role in the diet of Ethiopian small-scale farmers' households, and also serves as a protein source for the rural poor who cannot afford to buy animal products. Though many improved chickpea varieties were released by different research centers depending on breeding objectives. Participatory Variety Selection was conducted during 2019/2020 in both Simada and Libokemkem districts of south Gonder Zone, Ethiopia. To assess the performance of chickpeas varieties and to evaluate farmers' selection criteria for chickpeas. Seven desi-type chickpea varieties with one local check were laid out in a randomized complete block design with three replications. The combined Analysis of Variance for stand count at germination, stand count at harvest, days to flowering, days to maturity, plant height, number of pods per plant, number of seeds per pod, grain yield per hectare, and hundred seed weight showed high significant ( $P < 0.01$ ) difference for genotypes and the combined analysis of variance for stand count at germination, stand count at harvest, days to flowering, plant height, number of seeds per pod, and grain yield revealed significant ( $P < 0.01$ ) difference for location. The study also revealed that in some cases the researchers' selection criteria were identical to farmers' preferences. These parameters include Disease reaction, Branch number, pod size, adaptability, and early maturity. Hence, including farmers' preferences in a variety selection process is paramount important. Therefore, based on attentively measured parameters, farmers' favorites, and the agro-ecologies of the site the varieties Minjar and Fetenech are selected for the area. The varieties Minjar and Fetenech should also be considered by farmers for their preference in the study area.

**Keywords:** Desi Type Chickpea, Grain Yield, Simada, Libokemkem

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## 1. Introduction

Cultivated chickpea, is a self-pollinated, diploid ( $2n = 2x = 16$ ) annual pulse crop with a relatively small genome size of 738Mb [21]. It belongs to Family=Fabaceae, Genus= *Cicer* and Species=*C. arietinum*. The crop is herbaceous, a small bush with diffused spreading branches from the base, which reach a height of 20 -150 cm depending on the cultivar and suitability of the growing environment.

Chickpea (*Cicer arietinum* L.) is the third most important pulse crop with a total annual global production of 9.7 million tons from 11.5 million ha. In Ethiopia, chickpea is

mainly grown in the central, northern and eastern highland areas of the country at an altitude of 1400-2300 m.a.s.l., where annual rainfall ranges between 700 and 2000 mm [3]. It is the major cool season food legume ranked second next to the Faba bean, which occupies about 239,747.51 hectares of land annually with an estimated production of 4,586,822.55 quintals. The national average seed yield is 1.913 tons/ha [4].

Chickpea, a multi-functional crop, has an important role in the diet of Ethiopian small-scale farmers' households and

also serves as a protein source for the rural poor who cannot afford to buy animal products [5]. Chickpea seeds are eaten fresh as green vegetables, parched, fried, roasted, and boiled and it is valued for their nutritive seeds with high protein content, 25.3-28.9%, after dehulling [14]. Chickpea seed has 38.59% carbohydrate, 3% fiber, 4.8-5.5% oil, 3% ash, 0.2% calcium, and 0.3% phosphorus [14]. Despite its importance, the national (19.13 qt/ha) as well as regional average yields (16.58 qt/ha) of chickpeas are low due to various production constraints including Low yield potential of landraces, lack of superior varieties, their susceptibility to biotic and abiotic stresses and poor cultural practices are some the serious constraints in chickpea production in Ethiopia [7, 11]. Chickpea varieties were released by the various national and regional research centers of the country. Farmers have no ample information about the released desi type chickpea varieties because they were released with poor involvement of farmers and the released varieties had not yet been tested in the study area. In the country, efforts have been made through PVS to develop and popularize improved varieties of some crops. A participatory approach is being carried out in many crops like bread wheat [9], common bean [12] and maize [20]. According to [8] reported that farmers' preferences vary with environmental conditions, traits of interest, ease of cultural practice, processing, use and marketability of the product, and ceremonial and religious values. However, the farmers' selection criteria for improved chickpea varieties were not adequately assessed and well documented, especially in the Northeast parts of Ethiopia. Therefore, the objectives of this study were to evaluate the performance of the released Desi chickpea varieties through PVS and to assess farmers' selection criteria for future chickpea improvement work with the participation of farmers in Northern Ethiopia.

## 2. Material and Methods

### 2.1. Description of the Study Area

The trial was conducted in Libokemkem and Simada districts in the South Gondar Zone of Amhara Region of Ethiopia during the 2019/2020 main cropping season. The two locations are 167 km apart and are among the promising chickpeas growing areas in the zone. Simada is located at 11 290 59.9900 N latitude and 38 140 60.0000 E longitude (<https://latitude.to/articles-by-country/et/Ethiopia/229186/Simada>) with elevations ranging from 1196 to 3525 m above sea level and divided into three climatic zones: middle altitude (40%), highland (10%), and lowland (50%) [19]. Annual rainfall for Simada ranges from 1000 to 1500 mm and seasonal climatic detail of the site in the year of the experiment is presented in Figure 1.

The main soil types in Simada are red, brown, black, and gray, which account for about 30%, 30%, 25%, and 15% of the total area, respectively, with red and brown soils being the most common [18]. According to the World Reference

Base for Soil Resources, 2014 (update 2015), the soil type of Simada is classified into Lithic Leptosol (50%), Eutric Leptosol (30%), and Eutric Cambisol (20%) which is mapped by [10] and generated from using the location's latitudinal and longitudinal coordinate values [15].

The major crops grown in Simada include cereals and pulses, such as beans. Libokemkem is found between 12 190 60.0000 N latitude and 37 390 59.9900 E longitude [13] with an altitude ranging from 1800 to 2850 m above sea level (6). The rainfall ranged from 73-372 mm from May to October of the growing season and annual rainfall and temperature distribution for the growing season is presented in Figure 1. The soil type of Libokemkem is 60% clay loam, 14% silt loam, and 26% clay soil [16]. Farmers in the district grow local bean varieties for double cropping, where chickpea is planted after beans are harvested to take advantage of the soil moisture reservoir.

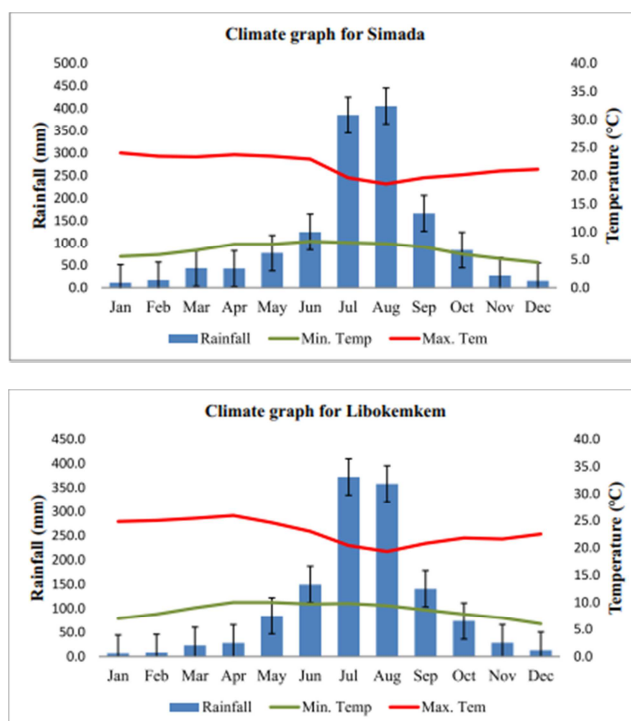


Figure 1. Seasonal climatic detail of the site in the year of the experiment.

### 2.2. Experimental Design

Seven desi-type chickpeas and one local check variety were evaluated in Simada and Libokemkem districts. Participatory varietal selection of chickpea trial was conducted in Simada and Libokemkem of South Gondar zone, Amhara region, Ethiopia, in the 2019/2020 Meher cropping season. A randomized complete block design using eight chickpea varieties with three replications was used for this research. Each variety was grown with a plot size of 5.4 m<sup>2</sup> represented by 6 rows of 3-meter length with an inter- and intra-row spacing of 30 cm and 10 cm, respectively. The eight chickpea varieties were scored (1=poor, 5=very good) based on overall ranks by consensus reached by representative farmers, and the mean values of the ranks for

each variety were calculated.

**Table 1.** List of Desi-type chickpea varieties tested.

Entry.no	Variety Name
1	Dalota
2	Teketay
3	Minjar
4	Akaki
5	Natoli
6	Kutaye
7	Fetenech
8	Local check

### 2.3. Data Collected

**Days to 50% flowering:** Days to flower were recorded as the number of days required from planting to the time when 50% of plants in plots produced at least one flower.

**Days to maturity:** Days to maturity were recorded as the number of days required from planting to the time when 95% of plants showed a yellow colour in each plot before senescence.

**Plant height:** Plant height was recorded from ten randomly taken plants from four central rows at physiological maturity from the ground to the tip of the main stem and then the mean was recorded as height per plant (cm).

**Number of pods per plant:** The number of total pods in ten randomly taken plants from four of the central rows was counted at physiological maturity and the means were recorded as the number of pods per plant.

**The number of seeds per pod:** The number of total seeds from the above pods was counted and then the total number of seeds was divided by the total number of pods to get an average number of seeds per pod.

**Hundred seed weight:** Hundred seed was counted from the harvested bulk and their weight (g) was recorded and adjusted at 10% seed moisture.

**Grain Yield:** Plants harvested from the four central rows and for above-ground dry biomass were threshed to determine grain yield, and the grain yield was adjusted to the moisture content of 10%.

### 2.4. Statistical Analysis

The combined analysis of variance was done after the test of homogeneity of variance for each location using Levene's Test.

The linear mixed model was used in the analysis of variance combined over locations.

$$Y_{ijk} = \mu + g_i + e_j + b_k(j) + (ge)_{ij} + \epsilon_{ijk}$$

Where:  $Y_{ijk}$  = the response of Y trait from the  $i^{th}$  genotype, grown in the  $k^{th}$  block of  $j^{th}$  location.

$\mu$  = Grand mean.

$g_i$  = The effect of the  $i^{th}$  genotype.

$e_j$  = The effect of  $j^{th}$  location.

$b_k(j)$  = The effect of  $k^{th}$  block/rep in  $j^{th}$  location.

$(ge)_{ij}$  = The interaction between the  $i^{th}$  genotype and  $j^{th}$  location.

$\epsilon_{ijk}$  = Pooled error.

All measured quantitative parameters were subjected to Analysis of Variance (ANOVA) by using R.4.0.3 software to assess the significance of the difference between the varieties. Mean separation was carried out using the Least Significance Difference test (LSD) at a 5% probability level.

## 3. Result and Discussion

Levene's test result implies the error variance was homogeneous for grain yield and yield-related traits for every two locations and allowed to proceed further for combined analysis of variance across locations.

The combined Analysis of Variance for stand count at germination, stand count at harvest, days to flowering, days to maturity, plant height, number of pods per plant, number of seeds per pod, grain yield per hectare and hundred seed weight showed high significant ( $P < 0.01$ ) difference for varieties and the combined analysis of variance for stand count at germination, stand count at harvest, days to flowering, plant height, number of seeds per pod, and grain yield revealed significant ( $P < 0.01$ ) difference for locations and the genotype by location interaction was also highly-significant for stand count at germination, stand count at harvest, days to maturity, plant height and number of pods per plant (Table 2).

### 3.1. Grain Yield (kg/ha)

Combined analysis of variance revealed that Varieties and locations were significant in the grain yield of eight desi-type chickpea varieties. The presence of significant variations among the varieties indicates the differences in the inherent genetic potential of the varieties that make it easy for selection, while differences among the locations showed the variability in yield potential suitability of the test locations for chickpea production. The mean grain yield ranged from 1921.5 kg ha<sup>-1</sup> for the variety Kutaye to 2606.3 kg ha<sup>-1</sup> for the variety Minjar and 907.33 for the variety Local check to Minjar 2301.33 kg ha<sup>-1</sup> for the variety Minjar at Simada and Libokemkem, respectively (Table 4 and Table 5).

Varieties Minjar (2453.79 kg ha<sup>-1</sup>) and Fetenech (2199.39 kg ha<sup>-1</sup>) were the top yielders across locations whereas; variety Local checks (844.64 kg ha<sup>-1</sup>) had the lowest mean grain yield (Table 3). The local check was not performed for grain yield at both locations. Variety Minjar, Fetenech, Akaki, Teketay and Natoli were recorded as 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> highest grain yields respectively at Simada (Table 4) and Minjar was recorded the highest grain yield at Libokemkem district (Table 5). Accordingly, the highest grain yield at Simada was revealed by Minjar, Fetenech, Akaki, Teketay and Natoli consecutively while Minjar variety was the only highest yielder at Libokemkem. So from the two locations, Simada is the potential area for the production of desi type check pea variety while Libokemkem is relatively low. Similar results were obtained from Fetenech and Akaki (1).

### 3.2. Days to Flowering

Days to flowering ranged from Kutaye (72.33) to Natoli (79.00) and local check (64.67) to Natoli (76.33) days for Simada and Libokemkem Districts respectively (Tables 4 & 5). Varieties Natoli (77.67 days) was the longest days to flowering across locations whereas; Variety local check (68.83 days) had the shortest mean days to flowering (Table 3). Variety Natoli took the longest days to flower both at Simada and Libokemkem districts, whereas Variety local check scored the shortest days to flowering at Libokemkem and kutaye scored early days to flowering at Simada (Tables 4 & 5).

### 3.3. Days to Maturity

Variety Dalota took the longest days to maturity, whereas Variety Fetenech scored the early days to maturity at Libokemkem (Table 5).

### 3.4. Plant Height

The highest plant was observed in Minjar variety (46.33cm) while the shortest was observed in the Fetenech variety (37.27) at Simada and the highest plant was observed in Dalota (56.70) while the shortest in the local check variety (36.67cm) at Libokemkem. The past research work reported plant height in chickpeas similarly to the present finding [23].

### 3.5. The Number of Seeds Per Pod

The highest number of seeds per pod was recorded for the variety Fetenech (1.4) followed by Natoli (1.2) at Simada and variety local check scored (1.6) at Libokemkem (Tables 5 & 6). Variety Dalota (1.00) scored the lowest number of seeds per pod at Libokemkem.

### 3.6. Number of Pod Per Plant

The highest number of pods per plant was recorded for the variety Natoli (84.33) followed by a local check (85.0) at Simada and variety Minjar (87.0) followed by Kutaye (73.33) at Libokemkem (Tables 5 & 6). Variety Teketay (45) scored the lowest number of pods per plant at Simada and Natoli variety scored the lowest number of pods per plant at Libokemkem.

### 3.7. Hundred Seed Weight

Variety Akaki (33.33gm) recorded the most significant hundred seed weight, while variety Natoli and local check scored the smallest hundred seed weight at Simada. At Libokemkem, variety Minjar (33.0gm) scored the biggest hundred seed weight and variety local check (15.0gm) scored the smallest hundred seed weight.

**Table 2.** Mean squares from combined analysis of variance for yield and other traits of Desi chickpea varieties evaluated Over two locations in the 2019 Cropping Season.

SOV	SG	SH	DF	DM	PH	NPP	SPP	GY	HSW
VAR	1299.38**	967.35**	41.1**	117.83**	147.55**	636.33*	0.13**	1431997**	314.45**
LOC	1485.19**	2310.19**	172.5**	22.69 <sup>ns</sup>	111.32**	0.33 <sup>ns</sup>	0.22**	739532**	0.52 <sup>ns</sup>
VAR:LOC	342.24**	593.95**	11.2 <sup>4ns</sup>	148.8**	81.96**	542.57*	0.025 <sup>ns</sup>	67069 <sup>ns</sup>	2.38 <sup>ns</sup>
LOC: REP	131.56 <sup>ns</sup>	105.9 <sup>ns</sup>	8.8 <sup>ns</sup>	5.17 <sup>ns</sup>	3.35	49.21 <sup>ns</sup>	0.023 <sup>ns</sup>	3506 <sup>ns</sup>	14.1 <sup>ns</sup>
ERROR	62.47	124.05	7.77	6.5	6.48	199.33	0.014	75513	6.23
GM	98.43	78.47	72.81	106.52	43.17	66.66	1.24	1782.12	26.02
CV	8.02	14.19	3.82	2.39	5.89	21.17	9.49	15.41	9.58
LSD	4.67	6.58	1.64	1.5	1.5	8.45	0.069	162.49	1.47

GM=grand mean, CV=coefficient of variation, LSD=Least Significant Difference, \*\*, \*, <sup>ns</sup>= highly Significant at P < 0.01, significant at P < 0.05 and non-significant respectively, VAR=Variety, LOC=location, VAR:LOC= Variety combined by location, LOC:REP=location combined by block or replication, SG=Stand count at germination, SH=Stand count at harvest, PH=plant height, DF= days to flowering, DM=days to maturity, PPP= number of pods per plant, SPP= number of seeds per pod, HSW=hundred seed weight, GY=grain yield

**Table 3.** Mean separation from combined analysis of variance for yield and other traits of Desi chickpea Varieties evaluated over two locations in the 2019 Cropping Season.

VAR	SG	SH	DF	DM	PH	NPP	SPP	GY (kg/ha)	HSW
Dalota	67.5 <sup>c</sup>	53.17 <sup>d</sup>	72 <sup>bcd</sup>	110.83 <sup>a</sup>	49.02 <sup>a</sup>	58.67 <sup>cd</sup>	1.03 <sup>d</sup>	1508.89 <sup>d</sup>	28.83 <sup>b</sup>
Teketay	102.83 <sup>bc</sup>	80.83 <sup>abc</sup>	70.83 <sup>cd</sup>	102.67 <sup>cd</sup>	42.82 <sup>b</sup>	47.67 <sup>d</sup>	1.32 <sup>b</sup>	1808.61 <sup>cd</sup>	31.83 <sup>a</sup>
Minjar	114.17 <sup>a</sup>	89.17 <sup>a</sup>	73 <sup>bc</sup>	106.5 <sup>b</sup>	47.17 <sup>a</sup>	73.0 <sup>abc</sup>	1.27 <sup>bc</sup>	2453.79 <sup>a</sup>	31.83 <sup>a</sup>
Akaki	98.5 <sup>cd</sup>	83.17 <sup>cd</sup>	74 <sup>bc</sup>	111.67 <sup>a</sup>	40.83 <sup>bc</sup>	61.17 <sup>bcd</sup>	1.13 <sup>cd</sup>	2053.71 <sup>bc</sup>	32.17 <sup>a</sup>
Natoli	110 <sup>ab</sup>	91.5 <sup>a</sup>	77.67 <sup>a</sup>	112 <sup>a</sup>	49.67 <sup>a</sup>	68 <sup>abc</sup>	1.25 <sup>bc</sup>	1724.99 <sup>d</sup>	14.83 <sup>c</sup>
Kutaye	91.83 <sup>d</sup>	74 <sup>bc</sup>	72 <sup>bcd</sup>	104.67 <sup>bc</sup>	40.43 <sup>bc</sup>	69.83 <sup>abc</sup>	1.17 <sup>cd</sup>	1663.01 <sup>d</sup>	27.83 <sup>b</sup>
Fetenech	108.33 <sup>ab</sup>	86.83 <sup>ab</sup>	74.17 <sup>b</sup>	101 <sup>d</sup>	35.80 <sup>d</sup>	78 <sup>a</sup>	1.25 <sup>bc</sup>	2199.39 <sup>ab</sup>	26 <sup>b</sup>
Local check	94.33 <sup>cd</sup>	69.17 <sup>c</sup>	68.83 <sup>d</sup>	102.83 <sup>cd</sup>	39.65 <sup>c</sup>	777 <sup>ab</sup>	1.53 <sup>a</sup>	844.64 <sup>e</sup>	14.83 <sup>c</sup>
GM	98.43	78.47	72.81	106.52	43.17	66.66	1.24	1782.12	26.02
CV	8.02	14.19	3.82	2.39	5.89	21.17	9.49	15.41	9.58
LSD	4.67	6.58	1.64	1.5	1.5	8.45	0.069	162.49	1.47

GM=grand mean, CV=Coefficient of variation, LSD= Least Significant Difference, SG=Stand count at germination, SH=Stand count at harvest, PH=plant height, DF= days to flowering, DM=days to maturity, PPP= number of pods per plant, SPP= number of seeds per pod, HSW=hundred seed weight, GY=grain yield.

**Table 4.** Mean separation from Separate analysis of variance for yield and other traits of Desi chickpea Varieties evaluated at Simada in 2019 Cropping Season.

VAR	SG	SH	DF	PH	PPP	SPP	GY	HSW
Dalota	71.67 <sup>c</sup>	53.33 <sup>c</sup>	74.00 <sup>bc</sup>	41.33 <sup>ab</sup>	61.33 <sup>abc</sup>	1.07 <sup>b</sup>	1710.00 <sup>b</sup>	28.67 <sup>ab</sup>
Teketay	105.33 <sup>ab</sup>	82.33 <sup>b</sup>	74.00 <sup>bc</sup>	41.07 <sup>ab</sup>	45.00 <sup>c</sup>	1.13 <sup>b</sup>	1955.60 <sup>ab</sup>	31.67 <sup>ab</sup>
Minjar	116.67 <sup>a</sup>	99.67 <sup>ab</sup>	73.33 <sup>bc</sup>	46.33 <sup>a</sup>	59.00 <sup>abc</sup>	1.13 <sup>b</sup>	2606.30 <sup>a</sup>	30.67 <sup>ab</sup>
Akaki	107.00 <sup>ab</sup>	100.67 <sup>a</sup>	76.67 <sup>ab</sup>	41.67 <sup>ab</sup>	52.33 <sup>bc</sup>	1.06 <sup>b</sup>	2090.00 <sup>ab</sup>	33.33 <sup>a</sup>
Natoli	111.33 <sup>ab</sup>	99.00 <sup>ab</sup>	79.00 <sup>a</sup>	43.33 <sup>ab</sup>	84.33 <sup>a</sup>	1.2 <sup>ab</sup>	1926.40 <sup>ab</sup>	14.67 <sup>c</sup>
Kutaye	114.67 <sup>ab</sup>	98.00 <sup>ab</sup>	72.33 <sup>c</sup>	39.73 <sup>ab</sup>	66.33 <sup>abc</sup>	1.13 <sup>b</sup>	1921.50 <sup>b</sup>	27.67 <sup>ab</sup>
Fetenech	106.67 <sup>ab</sup>	86.33 <sup>ab</sup>	75.33 <sup>abc</sup>	37.27 <sup>b</sup>	79.33 <sup>abc</sup>	1.46 <sup>a</sup>	2257.60 <sup>ab</sup>	26.00 <sup>b</sup>
Local check	98.67 <sup>b</sup>	64.00 <sup>c</sup>	73.00 <sup>bc</sup>	42.47 <sup>ab</sup>	85.00 <sup>a</sup>	1.2 <sup>b</sup>	781.90 <sup>c</sup>	14.67 <sup>c</sup>
GM	104	85.41	74.71	41.65	66.58	1.18	1906	25.91
CV	9.02	12.22	3	8.62	23.97	14.2	20.39	13.61
R <sup>2</sup>	0.79	0.82	0.61	0.47	0.57	0.53	0.74	0.87

GM=Grand mean, CV=coefficient of variation, SG=Stand count at germination, SH=Stand count at harvest, PH=plant height, DF= days to flowering, DM=days to maturity, PPP= number of pods per plant, SPP= number of seeds per pod, HSW=hundred seed weight, GY=grain yield.

**Table 5.** Mean separation from Separate analysis of variance for yield and other traits of Desi chickpea Varieties evaluated at Libokemkem in the 2019 Cropping Season.

VAR	SG	SH	DF	DM	PH	PPP	SPP	GY	HSW
Dalota	63.33 <sup>d</sup>	53.00 <sup>c</sup>	70.00 <sup>bc</sup>	115.00 <sup>b</sup>	56.70 <sup>a</sup>	56.00 <sup>bc</sup>	1.00 <sup>f</sup>	1307.37 <sup>g</sup>	29.00 <sup>d</sup>
Teketay	100.33 <sup>bc</sup>	79.33 <sup>ab</sup>	67.67 <sup>bc</sup>	96.00 <sup>ef</sup>	44.56 <sup>d</sup>	50.33 <sup>c</sup>	1.5 <sup>b</sup>	1661.67 <sup>d</sup>	32.00 <sup>b</sup>
Minjar	111.67 <sup>a</sup>	78.67 <sup>ab</sup>	72.67 <sup>ab</sup>	107.00 <sup>d</sup>	48.00 <sup>c</sup>	87.00 <sup>a</sup>	1.4 <sup>c</sup>	2301.33 <sup>a</sup>	33.00 <sup>a</sup>
Akaki	90.00 <sup>c</sup>	65.67 <sup>bc</sup>	71.33 <sup>ab</sup>	115.00 <sup>b</sup>	40.00 <sup>f</sup>	70.00 <sup>abc</sup>	1.2 <sup>e</sup>	2017.13 <sup>c</sup>	3100 <sup>c</sup>
Natoli	108.67 <sup>ab</sup>	84.00 <sup>ab</sup>	76.33 <sup>a</sup>	118.00 <sup>a</sup>	56.00 <sup>b</sup>	51.67 <sup>c</sup>	1.3 <sup>d</sup>	1523.60 <sup>e</sup>	15.00 <sup>g</sup>
Kutaye	69.00 <sup>d</sup>	50.00 <sup>c</sup>	71.67 <sup>ab</sup>	103.33 <sup>d</sup>	41.13 <sup>e</sup>	73.33 <sup>ab</sup>	1.2 <sup>e</sup>	1404.50 <sup>f</sup>	28.00 <sup>c</sup>
Fetenech	110.00 <sup>ab</sup>	87.33 <sup>a</sup>	73.00 <sup>ab</sup>	95.67 <sup>f</sup>	34.33 <sup>h</sup>	76.67 <sup>ab</sup>	1.3 <sup>d</sup>	2141.10 <sup>b</sup>	26.00 <sup>f</sup>
Local check	90.00 <sup>c</sup>	74.33 <sup>ab</sup>	64.67 <sup>c</sup>	96.67 <sup>e</sup>	36.83 <sup>g</sup>	69.00 <sup>abc</sup>	1.6 <sup>a</sup>	907.33 <sup>h</sup>	15.00 <sup>g</sup>
GM	92.87	71.54	70.91	105.83	44.69	66.75	1.18	1658	25.91
CV	6.53	16.48	4.56	0.49	0.5	17.97	14.2	0.26	13.61
R <sup>2</sup>	0.93	0.69	0.66	0.99	0.99	0.64	0.53	0.99	0.87

VAR=Variety, GM=Grand mean, CV=coefficient of variation, SG=Stand count at germination, SH=Stand count at harvest, PH=plant height, DF= days to flowering, DM=days to maturity, PPP= number of pods per plant, SPP= number of seeds per pod, HSW=hundred seed weight, GY=grain yield.

**Table 6.** The rank of 5 Desi type chickpea varieties by Farmers selection at Simada and Libokemkem District in south Gondar zone, 2019 cropping season.

Preference Criteria	Libokemkem							
	Dalota	Teketey	Minjar	Akaki	Natoli	Kutaye	Fetenech	Local check
Branch number	24	20	30	25	24	26	29	11
Disease reaction	22	20	29	25	25	26	27	9
Pods	24	16	30	28	26	27	29	12
Adaptability	23	19	29	26	25	28	27	16
Early maturity	25	26	28	26	28	27	29	20
Total	118	101	146	130	128	134	141	68
Rank	6	7	1	4	5	3	2	8

Preference Criteria	Simada							
	Dalota	Teketey	Minjar	Akaki	Natoli	Kutaye	Fetenech	Local check
Branch number	20	16	29	25	22	24	27	11
Disease reaction	23	20	28	25	25	26	27	9
Pods size	22	14	30	28	24	24	28	12
Adaptability	24	17	28	26	25	26	27	16
Early maturity	26	26	28	24	28	26	29	24
Total	115	93	143	128	124	126	138	72
Rank	6	7	1	3	5	4	2	8

### 3.8. Farmers' Variety Evaluation Criteria

Chickpea variety selection was carried out at flowering and maturity stages by organizing a field day. Farmers' selection criteria were Disease reaction, Branch number, pod size, adaptability and early maturity. Out of the eight different traits, farmers chose traits that they often use when

evaluating chickpea varieties for implementation. Therefore, while farmers consider many traits, there are a few traits that they often use and these need to be identified. Previous studies by working on cowpea [17] and [23] working on faba beans reported. There were 30 participants in Simada districts and Libokemkem during the chickpea variety selection. The 30 participants were contained of 20 Males and 10 Females for participatory variety selection (PVS) evaluation at

Simada and Libokemkem districts. Finally, the selection of chickpea varieties was done by the farmers based on their preference criteria. Farmers' varietal assessment showed that variety Minjar was ranked highest (143) followed by Fetenech, Akaki and Kutaye with total values of 138, 128 and 126 respectively at Simada while Minjar was ranked highest (146), followed by Feteneche (141) and Kutaye (134) at Libokemkem for Disease reaction, Branch number, pod size, adaptability and early maturity (Table 6). For this purpose farmers rank the varieties as very good, good, average, poor and very poor using a 1-5 scale. Where "5" = very good, "4" = good, "3" = average, "2" = bad and "1" = worst. Finally, the farmers should select the varieties to use as planting material as the first, second, third and fourth preferred varieties. Accordingly, chickpea varieties Minjar, Fetenech, Akaki and kutaye were selected by the farmers.

Finally, the participant farmers selected and accepted Minjar and Fetenech as best varieties in Simada and Libokemkem districts in their preferences (Table 6). Farmers and corresponding woreda of the Agriculture development office were experts who request the seed of selected varieties to be promoted or multiplied in the future. Therefore, the participant farmers and districts manager decided to distribute the selected improved chickpea varieties on their farms.

## 4. Conclusion and Recommendations

Participatory varietal selection is the selection by which farmers evaluate released varieties on their farms. The present study at Simada and Libokemkem districts necessitates the presence of significant variations among desi chickpea varieties. The variety Minjar and Fetenech had the highest grain yield in the research selection criteria similarly Minjar and Fetenech were selected by the farmers' selection criteria. In this trial varieties selected by farmers based on their selection criteria and researcher analysis had the same result. Minjar and Fetenech desi type chickpea varieties are found to be well adapted and promising to the target districts in both the researcher's and farmer's will be demonstrated and popularized to the small-scale holder farmers. Therefore researcher data analysis and farmers' varietal selection criteria consider for proper varietal endorsement.

## Training

A training program was prepared to improve the concentration of farmers on chickpea varieties available technology in which 41 farmers (36 males, 5 females at simada and Libokemkem districts), and 8 extension personnel (7 males, 1 female) also participated. Of the 49 individuals involved in chickpea training, 12% were women. An information package or manual was prepared on improved chickpea technologies in Simada and Libokemkem districts for development agents.

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## References

- [1] Abdulfeta Tariku. 2021. Evaluation And Adaptability Study Of Desi Type Chickpea (*Cicer Arietinum* L.) Varieties At Hirna Districts Of West Harerghea Zone, Eastern Ethiopia. International Journal of Advanced Technology & Science Research. Volume 02.
- [2] Alemu, B., Abera, D., Adugna, A. Terefe, M. 2014. Adaptation Study of Improved Kabuli Chickpea (*Cicer arietinum* L.) Varieties at Kellem Wollega Zone, Haro Sabu, Ethiopia. *Journal of Natural Science and Research*. 4: 21-24.
- [3] Anbessa, Y., Bejiga, G. 2002. Evaluation of Ethiopian chickpea landraces for tolerance to drought. *Genetic Resource Crop Evolution*. 49: 557-564.
- [4] Asfaw, A., Almekinders, C. J. M., Blair, M. W., Struik, P. C. 2012. Participatory approach in common bean (*Phaseolus vulgaris* L.) breeding for drought tolerance for southern Ethiopia. *Plant Breed*. 131: 125-134.
- [5] Balcha, A., Tigabu, R. 2015. Participatory Varietal Selection of Common Bean (*Phaseolus vulgaris* L.) in Wolaita, Ethiopia. *Asian Journal of Crop Science*. 7: 295-300.
- [6] Berhanu, Adugna, 2009. The Effect of Rural Land Certification on Land Tenure Security: A Case Study in Libokemkem Woreda, Amhara Region. A thesis submitted to the Institute of Development Research Department of Rural Livelihood and Development.
- [7] Dadi, L., Regassa, S., Fikre, A., Mitiku, D., Gaur, P. M. 2005. Adoption Studies on Improved Chickpea Varieties in Ethiopia. Ethiopian Agricultural Research Organization, Addis Ababa, Ethiopia.
- [8] Danial, D. Parlevliet, J., Almekinders, C., Thiele, G. 2007. Farmers' participation and breeding for durable disease resistance in the Andean region. *Euphytica*. 153: 385-396.
- [9] Demelash, A., Desalegn, T., Alemayehu, G. 2013. Participatory Varietal Selection of Bread Wheat (*Triticum aestivum* L.) Genotypes at Marwold Kebele, Womberma Woreda, West Gojam, Ethiopia. *Int J Agron Plant Prod*. 4: 3543-3550.
- [10] FAO-Unesco. 1990. Soil Map of the World, Revised Legend. FAO Rome.
- [11] Goa, Y. 2014. Evaluation of Chick Pea (*Cicer arietinum* L.) Varieties for Yield Performance and Adaptability to Southern Ethiopia. *J Biol Agric Healthc*. 4: 34-38.
- [12] Gurmu, F. 2013. Assessment of Farmers' Criteria for Common Bean Variety Selection: The case of Umbullo Watershed in Sidama Zone of the Southern Region of Ethiopia. *Ethiopian E-Journal for Research and Innovation Foresight*. 5: 4-13.

- [13] <https://latitude.to/articles-by-country/et/Ethiopia/305357/Libokemkem>, March 9/2022.
- [14] Hulse, J. H., 1991. Nature, composition, and utilization of grain legumes, In: Uses of tropical Legumes: Proceedings of a Consultants' Meeting, 27-30 March 1989, ICRISAT Center, Patancheru, India p: 11-27.
- [15] ILRI, CIAT, CCAFS, 2014. MarkSim® DSSAT Weather File Generator. ILRI. <http://gisweb.ciat.cgiar.org/MarkSimGCM/>.
- [16] Jenber, Abaynew Jemal, Birarayalew, Misganaw, Tadesse, Tilahun, 2020. Effect of seeding rate and inter-row spacing on yield and yield components of upland rice (*Oryza sativa* L.) at Libo Kemkem district, Northwestern Ethiopia. *Int. Res. J. Appl. Sci.* 2 (1), 12–21.
- [17] Kamara, A. Y., Ellis, J., Ekeleme, F., Omoigui, L., Amaza, P. 2010. A participatory evaluation of improved cowpea cultivars in the Guinea and Sudan savanna zones of northeast Nigeria. *Arch Agron Soil Sci.* 56: 355-370.
- [18] Marye, Belete, 2011. Local Peoples' Perception on Climate Change, its Impact, and Adaptation Measures in Simada Wereda of South Gondar. MA Thesis. College of social sciences, Addis Ababa University.
- [19] Meseret, Belachew, 2012. Assessment of Drinking Water Quality and Determinants of Household Potable Water Consumption in Simada District, Ethiopia. MSc. Thesis. Faculty of the Graduate School of Cornell University.
- [20] Tadesse, D., Medhin, Z. G., Ayalew, A. 2014. Participatory in Farm Evaluation of Improved Maize Varieties in Chilga District of North Western Ethiopia. *Int J Agric Forest.* 4: 402-407.
- [21] Varshney, R. K., Song, C., Saxena, R. K., Azam, S., Yu, S., Sharpe, A. G., Cannon, S. Baek, J. Rosen, B. D. Tar' and B. 2013. The draft genome sequence of chickpea (*Cicer arietinum*) provides a resource for trait improvement. *Nature Biotechnology.* 31: 240–248.
- [22] Yadaw, R. B., Khatiwada, S. P., Chandhary, B., Adhikari, N. P., Baniya, B. 2006. Participatory varietal selection of rice varieties for rainfed conditions. Rice Fact Sheet, International Rice Research Institute (IRRI).
- [23] Yasin, G., Kambata, E. 2017. Participatory on Farm Evaluations and Selection of Improved Faba Bean (*Vicia faba* L.) Varieties in Four Districts of South Ethiopia. *Adv Crop Sci Tech.* 5: 293.