Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.7, No.24, 2017

Participatory Variety Selection for Enhanced Promotion of Improved Sesame varieties: A case for konta District in Southern Ethiopia

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Abstract
Participatory varietal selection was conducted in Southern part of Ethiopia to evaluate the performance of sesame varieties and to identify farmers' preference and selection criteria in the study site. Six sesame genotypes along with local check from respective area were evaluated in randomized complete block design with three replications in 2016/17 main cropping season. Farmers' evaluation was made at two different stages of the crop, namely at flowering and at maturity using both direct-matrix and pair-wise ranking methods of selection system. Farmers' set; stand strength , number of capsule per plant, plant height, disease resistance, shattering resistance, earliness, seed color and Grain yield as selection criteria to evaluate and identify their preferred varieties. The results of analysis of variance indicated the existence of highly significant differences among varieties for grain yield at 5% probability level. The highest mean grain yield was obtained from the genotypes Setiti-1 (783.35 Kg ha-1), Abasena (756.25kgha-1) and Humera (713 Kg ha -1). Likewise, Setiti-1, Abasena and Humera were identified as farmers preferred varieties from both pair-wise and direct matrix ranking evaluations. Thus, the varieties Setiti-1, Abasena and Humera were selected for their performance in the field and from farmers' evaluation perspective. Therefore, based on the results of present study, Setiti-1, Abasena and Humera can be recommended for cultivation under konta areas and similar agro ecologies.
Keywords: Direct-matrix ranking, Pair-wise ranking, PVS, Farmers selection criteria, sesame

Introduction

Sesame (Sesamum indicum L.) is one of the oldest culti-vated plants in the world. Neoug (Niger seed), sesame and linseed covered 2.8%, 2.48% and 1.61% of grain crop area, respectively; and about 1.11%, 1.27% and 0.91% of the grain production, respectively (CSA, 2009). Ethiopia was the 7th major sesame producing country in the world in the year 2004 with area coverage 65,000 hectare, production about 49,000 tons and productivity about 479 kg ha-1 and now, Ethiopia is the 4th with area coverage 384,682.79 hectare, production about 327,740.92 tons and productivity is estimated as 852 kg ha-1 (CSA, 2011/12). Next to coffee, sesame seed is the second largest export earner for Ethiopia and it is an important cash crop as it has an excellent demand in the international market and is consumed by existing domestic large and small-scale oil mills (CSA, 2011/12). The Ethiopian government has indicated that the oil seeds such as sesame, niger and safflower seeds as high-priority export crops and ranks the second biggest export earner.

In Southern Ethiopia, sesame is cultivated in some parts of the country occupies about 6,365.7 hectares of land annually with estimated production of 31,650 quintals (CSA, 2014/2015). The National (6.87qt/ha) and regional (4.97 qt/ha) average yield of sesame has remained low (CSA, 2014/2015).

Despite the fact sesame has superior economical potential in local consumptions and export demand, the average productivity is low as compared to other oilseeds, due to the complex constraints such as; the limited cultivation of improved varieties was due to insufficient variety information, poor agronomic practices, biotic and abiotic factors. Therefore, improved varieties as well as agronomic practice of sesame production will help the farmers to utilize full package that would increase sesame production in South region. Even though, some efforts have been made to demonstrate and popularize crop varieties through demonstration in South Ethiopia, the farmers' selection criteria for sesame varieties were not adequately assessed and well documented especially in the southern region of Ethiopia. The farmers have little experience with demonstration of improved varieties.

Therefore, this experiment was conducted to improve farmers' production and productivity of sesame through participatory selection, in selected district of Southern regional state.Keeping this in view, field experiments were conducted with objectives to evaluate the performance of sesame varieties and to identify farmers' preference and selection criteria in the study site

Materials and Methods

Grandmother trial:

In the present investigation six sesame varieties including local check were evaluated in 2016/2017 at konta districts in Ethiopia (Table 1). Both grandmother and mother trials were laid at farmers' field/FTC of Konta, konta koysha kebele ($06^0$43', 030''N, 036034'350''E) lies at 969.7 meters above sea level. In this district, three farmers were identified to lay out the mother trials and FTC farm were used for grandmother trials. The trials were designed

by the researcher but laid and all cultural operations including planting, weeding and harvesting was managed by the selected farmers.

Table 1. List of sesame varieties tested.

No	Name of variety
1	Setiti-1
2	Humera
3	Mehado-80
4	Local
5	Tate
6	Abasena

The experiments were laid out in randomized block design with 3 replications. Each variety was grown with a plot size of 9.6 m2 represented by 6 rows of 4 meter length with inter- and intra-row spacing of 40 cm and 10 cm, respectively. Recommended fertilizer rate and cultural practices were done. Parameters such as grain yield and farmers preferences data were collected for the sesame varieties.

Farmers' Participatory Varietal Selection (PVS): Participatory varietal selections were conducted using participatory tools (direct matrix and pair-wise rankings). Farmers' selection was done based primarily on their sesame growing experience and willingness to participate in the research. Farmers were invited to the FTC and model farmer field to evaluate the sesame varieties at flowering and at maturity stages before harvest, assisted by researchers and technical assistants from Areka Research Centre and Extension staffs from the Konta district Agriculture and Natural Resource development offices. A total of 23 stakeholders (farmers; extension staff) of both sexes (male=19, female=4) participated in the study. Out of the 23 participants at districts/field 4 were women (17.3%). At the beginning of the evaluation farmers gathered to discuss what they thought were the important criteria for selecting a given variety at a particular development stage.

A direct matrix table was prepared for the evaluated genotypes listed in the row and traits preferred by farmers listed in the column. Farmers discussed and all these criteria were ranked in the order from 1 to 5 (5 = very good, 4 = good, 3 = average, 2 = poor and 1 = very poor) according to their importance by each farmer for selecting a new variety characteristic with highest rank is considered to be the most important while the one with smaller rank is perceived to be less important in choosing a new variety. Likewise, during direct matrix ranking, farmers have given rating of importance (a relative weight) of a selection criterion ranked from 1 to 3 (3= very important, 2= important and 1= less important) and rating of performance of a variety for each trait of interest was given based on their level of importance on the basis of common agreement of evaluators. The score of each variety was multiplied by the relative weight of a given character to get the final result and then added to the results of other characters to determine the total score of a given variety. These criteria were ranked and top ones were used. Farmers were also asked to give an overall assessment of tested varieties and select two to three varieties that they would like to grown in their sesame field. In addition to farmers' evaluation, an agronomical evaluation was conducted and grain yield data were collected and subjected for analysis of variance using SAS software, version 9.2.

RESULTS AND DISCUSSION

The analysis of variance (Table 2) showed highly significant differences ($P \leq 0.01$) among sesame varieties for grain yield at Konta district. Researchers' evaluated the varieties based on grain yield and ANOVA result indicated that there was significant difference among the sesame varieties. As it is indicated in Table 2 Setiti-1 has the highest grain yield 783.5 kg ha-1, but local check (542.75 kg/ha) was a variety with comparatively low grain yield. In other words, the analysis result for the trial showed that there was significant difference among the varieties for grain yield at Konta in 2016/2017(Table 2).

Table. 2. Analysis of variance for grain yield (kg) of sesame grandmother trails at konta

Varieties	Grain yield (kg/ha)	Researchers Rank	Farmers rank
Setiti-1	783.50a	1	1
Humera	713.00ab	3	2
Mehado-80	708.00ab	4	6
Local	542.75c	6	5
Tate	695.25b	5	4
Abasena	756.25ab	2	3
G.mean	699.791		
LSD(0.05)	86.372		
CV	8.18929		

Farmers evaluation result: The farmers who participated and evaluated in the trial were representative to the area. The evaluators were most interested in some of the parameters like stand strength (lodging resistance),

number of capsule per plant, plant height, disease resistance, shattering resistance, early maturity, seed color and grain yield. At flowering and maturity stages, the farmers evaluated grandmother and mother trials at Konta, generally farmers responded positively to the sesame varieties they have evaluated. In the grandmother trial farmers' assessment indicated that there was a matching result with researchers analysis result (Table 2). In other words, the results also showed that farmers are eager to participate in selecting improved varieties and in present experiment their selection is match with that of researchers. Farmers' pairwise and direct matrix ranking evaluation indicate that variety setiti, Humera,,Abasena, Local, Tate and Mehado-80 were selected by farmers as 1st ,2nd ,3rd ,4th rank, 5th and 6th during field evaluation (Table 4 & 5).

Picture 1: Field view and farmers' evaluation of sesame varieties at konta district during 2016/17

Table 3: Pairwise ranking of farmers' selection criteria of sesame varieties in konta district

No	SLC	SS	NC/PT	PH	DR	CL	SR	EM	SC	GY	Total	Rank
1	SS	*	NC/PT	SS	DR	SS	SR	EM	SS	GY	3	6th
2	NC/PT		*	NC/PT	NC/PT	NC/PT	NC/PT	EM	SC	GY	5	4th
3	PH			*	DR	CL	SR	EM	SC	GY	0	8th
4	DR				*	DR	DR	EM	SC	GY	3	6th
5	CL					*	SR	EM	SC	GY	1	7th
6	SR						*	SR	SC	GY	4	5th
7	EM							*	EM	GY	7	2nd
8	SC								*	GY	6	3rd
9	GY									*	9	1st

Where, SLC=selection criteria, SS = Stand strength, NC /PT= Number of capsule per plant, PH= Plant height CL= Capsule length DR= Diseases resistance SR= Shattering resistance EM = Early Maturity SC= Seed color and GY= Grain yield

Accordingly, the preferred sesame variety should have high grain yield, earliness, white seed color, number of capsule per plant and better resistance to blight diseases. Besides grain yield and earliness, farmers most

preferred white seed color of sesame varieties which are expected to give high market prices. Pair-wise matrix ranking was used to identify the prioritization order of the farmers' selection criteria (Table 3). In this study, farmers gave the highest weight to grain yield followed by earliness and seed color. This has been reported for several crops such as maize (Tadesse *et al*., 2014), common bean (Balicha and Tigabu, 2015), faba bean (Mulualem *et al*., 2012) and sorghum (Muui *et al*., 2013).Likewise, disease resistance, shattering resistance and stand strength were also selected by farmers' as moderate significance. Similarly, the importance of seed color for wheat (Workineh *et al*., 2014), maize (Tadesse *et al*., 2014), common bean (Balicha and Tigabu, 2015), finger millet (Fentie Molla, 2010) and sorghum (Muui *et al*., 2013) have also been reported in previous studies as being farmers important selection criteria.

Table 4: Direct matrix ranking evaluation of sesame varieties by of group of farmers (n=23 (male=19; Female=4 and their assessment in konta district, ranked in order of importance

Selection Criteria set by farmers	**Sesame varieties**										
	SS	NC/PT	PH	DR	CL	SR	EM	SC	GY	Total score	Rank
Relative weight	3	3	2	2	1	1	3	3	3	-	-
Setiti-1	**15**(3)	**9**(3)	**2**(2)	**10**(5)	**5**(5)	**4**(4)	**15**(5)	**15**(5)	**15**(5)	90	1
Humera	**9**(3)	**15**(5)	**10**(5)	**10**(5)	**5**(5)	**4**(4)	**12**(4)	**9**(3)	**12**(4)	86	2
Tate	**6**(2)	**6**(2)	**8**(4)	**4**(2)	**4**(4)	**4**(4)	**6**(2)	**6**(2)	**15**(5)	59	4
Mehado-80	**3**(1)	**6**(2)	**8**(4)	**4**(2)	**4**(4)	**4**(4)	**6**(2)	**9**(3)	**12**(4)	56	5
Abasena	**9**(3)	**15**(5)	**10**(5)	**10**(5)	**5**(5)	**4**(4)	**12**(4)	**9**(3)	**12**(4)	86	2
Local	**6**(2)	**6**(2)	**8**(4)	**4**(2)	**4**(4)	**3**(3)	**12**(4)	**12**(4)	**12**(4)	67	3

NB: "5" means very good and "1 means very poor; numbers in parenthesis indicated the performance rating value of each variety given from 1-5 (5= very good, 4= good,, 3= average, 2= poor and 1=very poor) and numbers written in the bold indicate total score of a variety as per each selection criteria, which was obtained by multiplying the relative weight of each selection criteria with that of the performance rating number in the parenthesis. Where, SS = stand strength, NC /PT= Number of capsule per plant, PH= plant height CL= Capsule length DR= Diseases resistance SR= Shattering resistance EM = Early Maturity SC= Seed colour and GY= Grain yield

Table 5: Farmers pair-wise ranking of evaluated sesame varieties during 2016/2017 cropping season at konta district

Varieties	Setiti-1	Humera	Tate	Mehado-80	Abasena	Local	Score	Rank
Setiti-1	*						5	1
Humera	Setiti-1	*					4	2
Tate	Setiti-1	Humera	*				2	4
Mehado-80	Setiti-1	Humera	Tate	*			0	6
Abasena	Setiti-1	Humera	Abasena	Abasena	*		3	3
Local	Setiti-1	Humera	Tate	Local	Abasena	*	1	5

Based on the direct matrix rankings, the total score (the product of relative weight of each criterion by the relative importance) of the evaluation by farmers ranged from 56 to 90. The highest score was given to Setiti-1 (90) followed by Abasena and Humera both scored 86 and ranked second together ; whereas the least score given to Mehado-80 (56) due to its poor stem strength and susceptibility to blight diseases. Moreover, pair-wise ranking evaluation provides opportunities to farmers to see in detail the merits and demerits of each variety by comparing and contrasting pair varieties at a time. According to pair-wise ranking the variety setiti-1 preferred five times and ranked first followed by Humera and Abasena preferred four and three times and ranked second and third ,respectively. Therefore, based on the results of field experiment and farmers' evaluation the varieties Setiti-1,Humera and Abasena were the most preferred ones.

Conclusion

The most preferred varieties identified by the focus group discussion through PVS were Setiti-1, Abasena, and Humera. The analysis of variance showed highly significant differences ($P \leq 0.01$) among sesame varieties for grain yield at Konta district. The result of present study indicated that varieties Setiti-1, Humera and Abasena are the three best varieties for the test agro ecology. In this trial the rank given by researchers match with farmers rank. That means most of the studied varieties selected by farmers' based on their own selection criteria and researcher analysis had the same result. Thus, these varieties are found to be well adapted and promising to the test district in both the researcher's and farmers will be demonstrated and popularized to the small-scale holder farmers.

Recommendations

For results from this preliminary study to transform in to improved food and income security, we need to carry

out:

- Promotion of three sesame varieties in sesame trial areas with full package(seed rate,fertilier rate and weeding frequency)
- Development of seed multiplication and dissemination protocol to make seeds of three varieties sustainability accessible to farmers, investors and seed growers
- Promotion of good agricultural practices in sesame production

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