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Participatory evaluation and demonstration of Ethiopian mustard genotypes at Wolmera district Finifine special zone of Oromia regional state, Ethiopia

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Abstract

Pre-extension demonstration of Ethiopian mustard varieties with their production package was conducted in west shewa zone of Oromia region at Wolmera districts for two consecutive years (2016/17 and 2017/18). The study was carried out to demonstrate the performance of Ethiopian mustard varieties under farmers' field conditions to select best preferred varieties by farmers and to exchange experiences and get feedbacks from farmers and other stakeholders in the study area. The trial was executed on 12 host farmers' fields using six promising varieties and two standard check varieties. Grain yield, farmers' perception data and feedback were collected from the demonstration plots. Simple descriptive statistics was used to analyze the collected data. The statistical data analysis result indicates that the standard check Yellow Dodolla gave relatively better yield than the tested entries. The two years mean grain yield across location showed that variety Yellow Dodola gave 36.34 qt/ha that is relatively higher than the tested entries 153Aw.X PGRC/E 208507/2/1/3/65/2 which gave 33.35 qt/ha, while the lowest poor yield 6.72 qt/ha was recorded by variety Dogder. When we compare oil content and oil yield mean of the tested entries with the standard check, Gen.5 (153Aw.Xpgrc/E 208507/2/1/3/65/2) gave the highest oil yield of 60.5 kg/ha while the checks gave 36.1 kg/ha respectively. The oil content result also showed that Gen 2 (153 Aw. X PGRC/E208507/2/1/3/1/2) gave the highest 45.35% while the standard check yellow Dodolla gave 36.5% respectively.

Keywords: pre-extension Demonstration, Ethiopian Mustard, Genotype

Introduction

Ethiopia is among the top five leading oilseed producing countries of the world. Oilseeds are the second largest export commodities that earn hard currency for the country next to coffee. Oilseeds are important components of the Ethiopian agriculture next to cereals and pulses. More than 3 million smallholders are involved in the oilseed production. They contribute 6% of the

total cultivated land (879,657 ha.) and 3% of the total production (8,550,738 quintals) at the national level (CSA, 2017/18).

Oilseed research in Ethiopia was started in 1960's on noug, safflower, linseed, and caster at Debre Zeit and Alemaya (Asnake, 2011). Varieties on oilseeds have been getting into the oilseed farming system since half a century ago. The research had recognized noug, linseed, rapeseed, sesame, groundnut, caster, cotton, and sunflower as economically important oilseed crops. The productivity of oilseeds was identified very low at the national level.

Ethiopian mustard (*Brassica carinata* A. Braun), locally known as "gomenzer" is among the oldest oil crops widely cultivated in Ethiopia but grown on limited scale in other parts of Africa as a leafy vegetable (Simmonds, 1979). Cultivation of Ethiopian mustard as leaf vegetable is limited to small-scale production but it is slowly gaining popularity in rural as well as urban areas where commercial production is taking place. The crop is best grown in the mid to high altitude (2000 to 2600 m) areas on more fertile, well-drained soil often close to homesteads that are rich with organic matters (Hiruy et al., 1983; Adefris Teklewold and Nigusie Alemyyehu, 1996; Nigussie Alemayehu, 2001).

Farmers often harvest its top parts by cutting off the upper tender parts (growing tips including 2-3 leaves) at 30-50 cm height to sell in local markets or for home consumption as green vegetables. The leaves are largely consumed during summer season, when shortages of most crops encounter usually after the planting season (July-September). In practice, so many rural dwellers depend on such vegetable foods especially during food scarcity seasons to rescue their lives. In the past, because of such traditional consumption patterns, it is often regarded as poor people's food

Mustard seeds are used to produce oil that can be used for both edible and industrial purposes. Seed cake remaining after extraction of oil can be used as fertilizer or animal feed. It is also used as a green fodder crop, green manure and as a cover crop (Alemayehu, 2001).

The available agricultural technology does not serve the very purpose until it reaches and adopted by its ultimate users the farmers. Technology transfer refers to the spread of new ideas from originating sources to ultimate users (Prasad *et. al.,* 1987). Conducting of Demonstrations on farmer's field help to identify the constraints and potential of the rapeseed–mustard in specific area as well as it helps in improving the economic and social status of the farmers. The aim of

the demonstration is to convey the technical message to farmers that if they use recommended package and practices then the yield of this crop can be easily doubled than their present level. Several biotic, abiotic and socio-economic constraints inhibit exploitation of the yield potential and these needs to be addressed. Wolmera district has the potential to produce Ethiopian mustard cultivation but the productivity level is very low. The reasons for low productivity are poor knowledge about newly released crop production and protection technologies and their management practices in the farmers' fields. Keeping the above point in view, the demonstration on mustard using improved production technologies was conducted with the objective of showing the productive potentials of the new production technologies under actual farm situation.

Objectives

- To demonstrate good performance varieties of Ethiopian Mustard to farmers, extension agent, experts and other stockholder in the study area
- To equip the end users with the knowledge of using full/complete recommended packages of Ethiopian Mustard technologies through training
- To exchange experience among farmers and other stakeholders and to get feed backs for the betterments of future project activities.

Materials and Methods

Description of study area:

The study was conducted in Welmera district of Addis Ababa Zuria Special zone of Oromia, Regional State in Ethiopia. Welmera district is one of the eight administrative units of the Addis Ababa Zuria Special zone of Oromia Regional State. Geographically, the district is located between 8°50'-9°15'N latitude and 38°25'-38°45'E longitude and has area coverage of 66,247 ha (WORLA, 2016). Most of its areas are high lands (Dega) and mid highlands (Weyna Dega) with an altitude ranging from 2060 to 3380 m above sea level. The Major soil type in the district is reddish-brown clayey similar to some other highland areas of Ethiopia (Asefa, 2012). The district is sub-divided in to 23 rural kebele (Kebele is the lowest administrative unit under Ethiopian condition) administrations and one town, excluding the capital town of the district. The area is characterized by mixed crop-livestock farming systems like other central highlands of Ethiopia where both crop and livestock production play a significant role in the lives of the farming community. Oilseed is the third important crop next to cereals and pulses grown by the farmers in the area.

Site and farmer selection:

The target district Wolmera was selected purposively for the implementation of the experiments because of its potential in oilseed production. Among the 23 rural kebeles found in the district one potential Ethiopian mustard growing kebele's *Robegebeya* was purposively selected. Twelve Volunteer women farmers who are willing to participate in the demonstration were randomly selected with the consultation of district Bureau of agriculture and kebele development agents (DAs).

Planted materials:

This demonstration comprises of six Ethiopian Mustard varieties and two standard checks tested for two consecutive years. The trial was laid on 12 farmers' field with a plot size of 20 m^2 and a seed rate of 15 kg/ha. Fertilizer at a rate of DAP 50 kg/ha and UREA 30.4 kg/ha was applied at the time of planting. The research centers provided all the necessary inputs to implement the demonstration activities. On the other hand farmers avail land and manage all farm activities according to research recommendations

Training:

Theoretical as well as practical training on Ethiopian mustard production and management practices was provided to farmers, district level agricultural experts and development agents. Variety evaluation and field visits were made at different plant growth stage to assess the performance of the varieties.

Preference evaluation:

Preference evaluations based on important plant parameter (leafiness, plant stand, taste, Ac. for cu. Pur., cooking time, color after cooking and chewability,) mainly set by farmers as "a farmer selection criterion" was used as a key to select best Ethiopian mustard varieties among the tested entries. Since the importance of one criterion was different from another, a weight was assigned for each parameter using matrix ranking methods. Direct matrix ranking method was used to prioritize the different varieties with respect to a single evaluation criteria and weighted matrix ranking method was used to prioritize varieties with respect to overall criteria. According to its importance, the weight given for each plant parameters was; leafiness = 1, plant stand =2, taste =3, acceptable for culinary purpose (AC. for cu. Pur.) = 4, cooking time =5, color =6 and chewability =7. Cooking time scale also given as: 15-19 minute good (3), 20-24 minute medium

(2) and 25-30 minute poor (1). The rating scale was given as 1to 3 i.e. 3= good, 2= medium and 1= poor.

Data collection and analysis

Both qualitative and quantitative data was collected using appropriate data collection methods such as field observation and measurement, agronomic data and grain yield data, and farmers' perception data. The collected data was analyzed using SAS software package.

Result and discussion

The post-harvest selection criteria and agronomic performance data was shown in the table below. Across the tested sites, in the year 2016/17 the highest mean grain yield 35.88 qt/ha followed by 32..09 was obtained from variety Yellow dedolla and genotype 5 (153Aw.X PGRC/E 208507/2/1/3/65/2) while the lowest seed yield 6.72 qt/ha was obtained from variety Dodeger (Table 1). The yield result of 2017/18 season also showed that the first and the second mean yield 36.8 qt/ha and 34.6 qt/ha was obtained by the same variety yellow dedolla and genotype 5 while the lowest poor yield 7.7 qt/ha was recorded by genotype 7 respectively (Table 1). The two years mean grain yield data result showed that the highest seed yield 36.34 qt/ha and 33.35 qt/ha was recorded by variety yellow dodolla and genotype 5 153Aw.Xpgrc/E 208507/2/1/3/65/2) while the lowest seed yield was obtained from variety Dogder respectively. The treatment mean yield across the tested sites for the two years was 22.45 qt/ha (Table 1). The result for the seven pair comparisons shows that all the tested entries gave yields lower than that of the control, hence, because of the mean difference is smaller than the LSD value at 5% level of significance; the mean yields of the seven entries were not significantly different.

When we compare the oil content of the tested genotype, the highest oil content 45.35% was recorded by genotype 2(153 Aw. X PGRC/E 208507/2/1/3/1/2 and the lowest 36.5 % oil content was recorded from standard cheek (yellow dedolla). The result of oil content analysis showed that all the tested entries were significantly higher than that of the check Yellow Dodolla. The oil yield analysis result also showed that the highest oil yield 60.5 kg/ha was recorded by genotype 153Aw.Xpgrc/E 208507/2/1/3/65/2 and the lowest 6.6 kg/ha was obtained from genotype 7 (Table 1). Genotype 2 and 5 showed a significance oil yield difference as compared to the check while the rest were not significant.

Table 1. Mean agronomic performance of Ethiopian Mustard varieties evaluated under on farm conditions at Robgebeya, Ethiopia during 2016/17 and 2017/18 season.

Variety/Genotype	Agronomic trait								
	Gyld qt/ha			Oil content %			Oil yield		
	2016/17	2017/18	**Mean**	2016/17	2017/18	**Mean**	2016/17	2017/18	**Mean**
Gen 1	15.88	17.6	**16.74**	41.2	39.1	**40.15**	32.5	30.2	**31.35**
Gen 2	19.21	21.2	**20.21**	46.4	44.3	**45.35**	43.5	41.3	**42.55**
Gen 3	21.38	23.4	**22.39**	38.0	36.0	**37.0**	9.8	7.9	**8.85**
Gen 4	20.49	22.9	**21.7**	43.5	41.3	**42.4**	13.7	11.9	**12.8**
Gen 5	33.09	34.6	**33.35**	42.6	40.1	**41.35**	61.9	59.1	**60.5**
Gen 6	21.23	23.3	**22.27**	43.2	41.6	**42.4**	37.1	35.7	**36.4**
Dogder	5.74	7.7	**6.72**	43.0	41.0	**42.0**	7.7	5.5	**6.6**
Yellow Dodolla	35.88	36.8	**36.34**	27.3	35.4	**36.5**	37.1	35.1	**36.1**
Mean	21.46	23.44	**22.45**	41.9	39.85	**40.88**	30.4	28.34	**29.37**
LSD 5%	11.073	9.03		0.2318	0.53		1.5312	3.23	
CV %	21.87	23.9		3.054	5.5		22.54	25.5	

Preference evaluation by farmers:

Results of evaluations of the varieties based on the pre-and post-harvest selection criteria set by farmers are given in fig 1 and table 2. Among the five criteria set for pre-harvest prioritization, leafiness and plant stand was a prime importance followed by the value of taste. Among the demonstrated genotypes the pre-harvest selection criteria result showed that the highest total scored 57.31 was recorded by genotype 5 and the lost total score 31.63 was obtained from genotype 8. The order of ranking in farmers; preference was genotype 5 become first, genotype 2 become second and variety yellow dedolla was third. The result of post- harvest evaluation data showed that genotype six and Yellow dodolla was better performed in grain weight, grain size and grain color as compared to the other tested entries (Table 2).

Leaf as a home consumption and source of income

Ethiopian mustard has dual utility i.e. as vegetable and seed source for oil or other traditional purposes and thus time of harvesting vary with type of plant part used. If the plant is used as source of vegetable, the first leaf harvest will be done when the plants reached 30 cm tall (early harvesting) and the second will be harvested at 50 cm tall (late harvesting). Farmers in the study area used this crop as vegetables and seed source. The average amount of income obtained by sealing the first defoliation leaves from 800 m2 area of land was 400 Ethiopian Birr which is

equal to 5,000 birr per hectare. Based on research recommendation farmers can defoliate/ harvest two times and the income obtained from sealing will be doubled. After defoliation the farmers also harvest oilseeds used as a raw material for oil.

Figure1. Green leaf harvesting for home consumption and sealing and farmers' variety performance evaluation

Conclusions

Ethiopian mustard is among the ancient crops grown in Ethiopia for centuries both as an oilseed and vegetable crops. It serves as the main dish and source of income for small-scale farmers especially at the time of food and income shortage. In the study area, the host farmers growing Ethiopian mustard near their homestead and defoliate the vegetative part twice per growing season for the leafy vegetables and the remaining plant was harvested for oilseed when it was mature. Two varieties showing better performance with respect to leafiness, taste, oil content and oil yield was recommended to be popularized in wider areas for the coming season.

Figure 1. Summary of farmers' preference evaluation of Ethiopian Mustard varieties for different plant parameters evaluated by farmers and researchers at Robe gebeya, 2016/17 and 2017/18 season. No of evaluators = 26 (18 women farmers and 8 researchers)

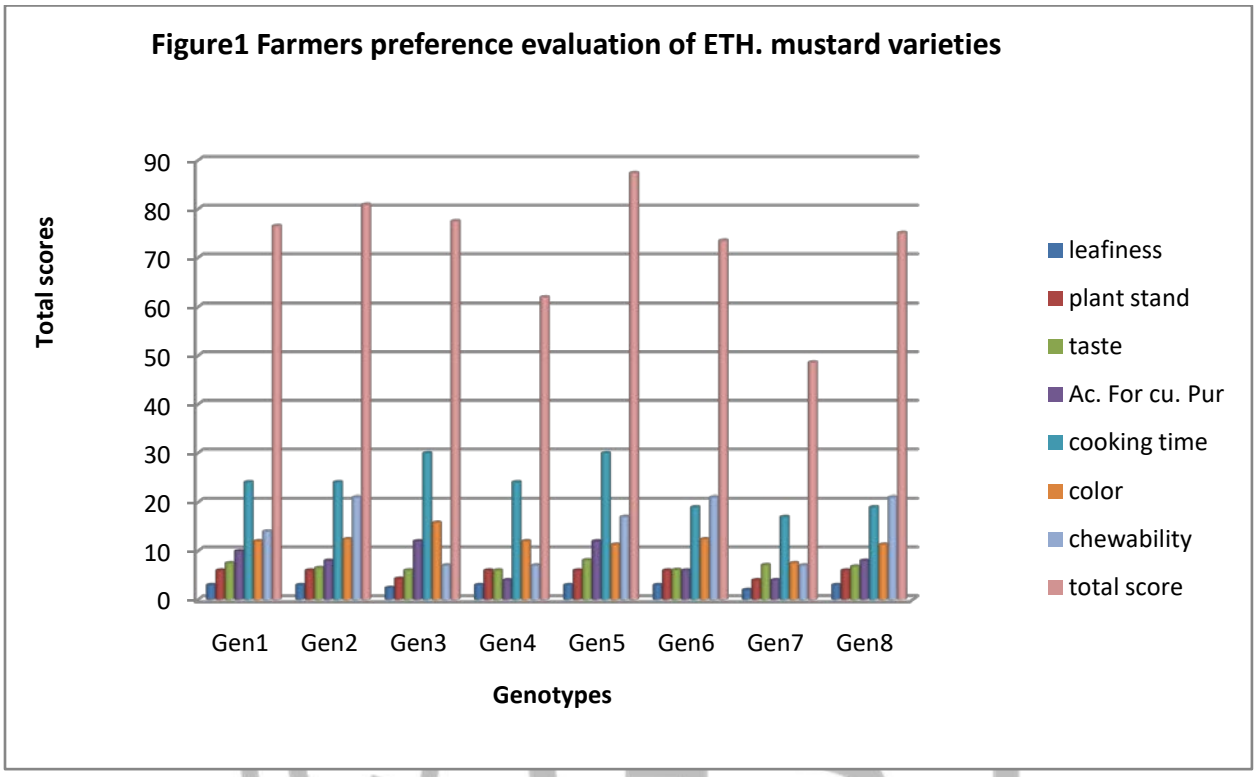

Table 2. Summary of post-harvest evaluation of Ethiopian Mustard varieties evaluated under on farm and laboratory conditions, 2016/17 and 2017/18

Evaluation Criteria	Variety							
	Gen 1	Gen 2	Gen 3	Gen 4	Gen 5	Gen 6	Gen7	Gen 8
Grain Color	Brown	yellow	yellow	Yellow	brown	yellow	black	Yellow
Grain Filling (Day)	77	80	81	80	79	80	79	79
Grain Size	Medium	Medium	Large	Medium	Large	Large	Large	Large
1000 seed wt.	3.64	3.15	2.38	2.82	3.33	4.28	1.24	4.1

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