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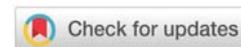
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Research Article

Cluster-based improved Malt barley technology demonstration in selected districts of Arsi and West Arsi zones of Oromia Regional State, Ethiopia

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Abstract

Large Scale Demonstration (LSD) of Malt barley were conducted in Oromia regional state of two Malt barley producing Zones of Arsi. From the two zones (Arsi and west Arsi) 4 districts and three of them namely Lemu-bilbilo, Arsi-Robe and Hetosa from Arsi zone, and one district namely Kofale from West Arsi zone included in the program. A total of 5 malt barley clusters which contains 104 hectares of land were formed in collaboration with the districts level experts and "kebeles" level Development Agents (DAs).

The Zones were selected due to their potential for Malt barley production. One popular variety called IBON 174/03 was demonstrated along with its full-recommended packages in the study areas. Training were given for a total of 164 participants (135 farmers, 12 DA and 17 experts) at different stage on production practice of Malt barley technologies. To raise farmer's awareness on the performance of the Malt barley technologies, a total of 5 field days were organized, by these field days, a total of 308 participants were attended the field events (261 farmeres, 15 development agents and 23 Experts 9 Higher Officials and Others were attened the events). The variety (IBON 174/03) demonstrated at study districts was acceptable during field visit and field day by farmers due to its disease tolerant, well adaptation and its productivity after harvesting (at all study areas the variety has showed a yield advantage over the Ethiopian national average yield of barley (21 quintals per hectare CSA;2020).

Background and justification

Barley (*Hordeum vulgare L.*) is among cereal crops produced in the world [1,2]. There are three subgroups of barley grown; six-row (*H. vulgare*), two-row (*Hordeum distichon*) and the rarely cultivated intermediate (*Hordeum irregulare*). Both two-row and six-row barleys are used for malting, but the best malt quality for beer is produced from two-row varieties [3].

Barley is believed to have been cultivated in Ethiopia before 3,000BC [4,5]. In Ethiopia, it can grow in wide range of agro ecology with an altitude 1800-3400m above sea level

but it grows best at altitudes ranging from 2300-3000 m.a.s.l. [3,6]. Barley which includes both food and malt barley species is cultivated in Ethiopia [7]. In Ethiopia, among the cereals, barley is ranked in the fifth place most important crop next to teff, sorghum and wheat [3,7,8]. Ethiopia is listed in one of the top 10 major barley producing countries in the world [5] and it is the second largest producer of barley in Africa next to Morocco [8].

The majority of barley production is food barley with its share estimated to be 90% compared with malt barley [2], with this Oromia, Amhara, Tigray, and Southern Nations,

Nationalities and People's Region (SNPPR) are the main areas of production in Ethiopia [9]. In general in Ethiopia, barley grain is used for the preparation of different traditional foodstuffs, such as injera, kolo, and local drinks, such as tela, borde and beer [1,7,10,11]. Malt is the second most important use of barley that is used mostly in beer [3,6].

The major Market shares of barley in Africa are concentrated in three countries- Morocco, Ethiopia and Algeria-accounting for 87% of the total barley production in the continent [8]. In Ethiopia, the market potential and use of malt barley as a raw material in brewery factory has increased from year to year [3,6].

In the context of Ethiopia; in general, the demand and supply side of malt barley is not balanced; due to this the brewery and malt factory are forced to import from abroad, in order to satisfy the ever-increasing demand for raw materials and this has a direct and negative impact on hard currency of the country, so in order to minimize the shortage of improved malt barley technologies this activity was initiated with the following objectives.

General objective

The aim of this study was to contribute for agro-industry by promoting newly released Malt barley technologies through LSD Approach.

Specific objectives are:

1. To access and utilization of improved Malt barley technologies
2. To acquaint with the LSD approach among concerned body and to understand the benefits of LSD approach
3. To create awareness on the importance of Malt barley technologies among stakeholders,
4. To document best practices, experiences, and lessons learned from the large-scale demonstration of Malt barley varieties.

Materials and methods

Description of the study areas

The activity was implemented in 4 potential Malt barley producing districts of Oromia regional state in 2019/20 cropping season. In this activity a total of 2 zones were addressed by the LSD of Malt barley technologies.

Arsi zone: Arsi Zone is located in the central part of the Oromiya National Regional State. The zone astronomically lies between 6° 45" N to 8° 58,, N and 38° 32 E to 40° 50" E. It has 25 administrative districts included [12]. The zone is highly potential for both food & malt barley.

West arsi zone: Is one of the zones of Oromiya Regional State located in central part of Ethiopia, where mixed farming is commonly practiced. The altitude ranges from 500 metres

above sea level (masl) to 3200masl. Average annual temperature in the zone ranges between 15 and 20 °C.

The Mean annual rainfall varies between 800 mm and 1400mm [13]. In general the zone is highly potential for both food and malt barley Kofale district in particular.

Demonstration process

Site and farmers selection: From the two zones (Arsi and west Arsi) 4 districts and three of them namely Lemu-bilbilo, Arsi-Robe and Hetosa from Arsi zone, and one district namely Kofale from West Arsi zone Were selected for the implementation of the activity based on their potential for malt barley production. A total of 5 malt barley clusters which contains 104 hectares of land were formed in collaboration with the districts level experts and "kebeles" level Development Agents (DAs). Then training malt barley production was prepared and delivered the target on farmers. Then improved seed of recently released variety of malt barley called IBON 174/03 was given for the target farmers and planted in LSD program. The areas covered on 104 hectares with malt barley variety. A row planting method was applied with a spacing of 20 cm between rows and a seed rate of 125 kg ha⁻¹ were used. Fertilizer were applied at a rate of 100 kg ha⁻¹ N and 120 kg ha⁻¹ NPS, respectively. All agronomic practices like ploughing, weeding, rouging and other management operations were applied as per the research recommendation.

Input utilization

A popular Malt barley variety IBON 174/03 was demonstrated along with its full-recommended packages. Ploughing, weeding, and other agronomic management practices were applied by farmers according to the recommendations.

Method of data collection

Data on Yield was collected and comparison with Ethiopian national barley average yield was made between the study areas.

Data analysis method

The collected data (quantitative data) were analyzed by using average grain yield and package comparison among study areas were made.

Result and Discussion

Locations and farmers selection

The activity was implemented in 4 potential of malt barley producing districts of Oromia regional state in 2019/20 cropping season.

Four districts were addressed in the program from oromia region. Among these three districts namely: Lemu-bilbilo, Arsi robe and Hetosa were from Arsi zone. And one district namely Kofale was from west Arsi zone (4 below).

In general a total of 4 malt barley producing districts from Oromia region and 2 zones were selected (West Arsi and Arsi



zones) were selected and the the activity was implemented in LSD program (4 below).

A sum of 5 clusters were formed in collaboration with districts levele experts .Four districts were selected and three of them from Arsi zone (Lemu-bilbilo, Hetosa , Arsi-Robe) ,one district included from west Arsi zone (Kofale). Included in the LSD program from Amhara Regional state.

Four (4) clusters were from Arsi zone ,one cluster from west Arsi zone were formed and a total land of 104 hectare of land were covered with improved malt barley technologies of 1 malt barley variety called “IBON 174/03” was demonstrated in LSD program (Table 1).

In general in the large scale demonstration of malt barley technologies a total of twor zones and 4 districts (woredas) were involved in the program from Oromia regional state (Table 2).

Number of clusters and clusters size in hectares covered with IBON 174/03

A total of 5 clusters 4 clusters from Arsi zone ,one cluster cluster from West Arsi zone of oromia regional state were formed in collaboration with districts level agricultural experts .Generally the clusters size covered 104 hectares of land.

Direct and indirect beneficiaries of farmers

In general, 140 farmers (125 male and 15 Female) were got improved variety (IBON 174/03) of malt barley according to the land allocated for the demonstration program, so that they were directly benefited in the activity.

Regarding trainings on different topics at different time and implementing areas a total of 135 farmers (126 Male and 9 Female) were benefited directly from the training provided on different topics which were arranged by Kulumsa Agricultural Research Center (KARC) and 261 farmers (240 male and 21 female) were also participated/benefited in the field days and experience shring events indirectly (Table 3).

Varieties and agronomic practices promoted

One recently released varity of malt barley called IBON 174/03 was demonstrated in LSD program.

A row planting method was applied with a spacing of 20 cm between rows and a seed rate of 125 kg ha⁻¹ were used. Fertilizer were applied at a rate of 100 kg ha⁻¹ N and 120 kg ha⁻¹ NPS, respectively. All agronomic practices like ploughing, weeding, rouging and other management operations were applied as per the research recommendation.

Malt barley

Malt barley: As indicated in Table 4: In this activity a total of 2 zones (Arsi and west Arsi) were addressed by the LSD of malt barley technologies.

From the two zones (Arsi and west Arsi) 4 districts and three of them namely Lemu-bilbilo, Arsi-Robe and Hetosa

Table 1: Indicate number of participants on Trainings.

s.no	Participants	Gender	
		M	F
1	Farmers	126	9
2	Development Agents (DAs)	9	3
3	Experts	12	5
Total		147	17

Table 2: Shows minimum,Maximum and average yield of malt barley (IBON 174/03) variety per locations.

S/No.	variety	Zones	district	No.cluster	Hectares	Min.	Max	Ava.
1	IBON 174/03	West Arsi	Kofale	1	72	14	72	40.2
2	IBON 174/03	Arsi	Lemu-bilbilo	1	10	21.3	56	35.2
3	IBON 174/03	Arsi	Hetosa	2	14	18.5	50	36.8
4	IBON 174/03	Arsi	Arsi robe	1	8	18	42	27.5
Total	1	2	4	5	104			

Table 3: Number of participants for the Field days /experience sharing events.

s.no	Participants	Gender	
		M	F
1	Farmers	240	21
2	Development Agents (DAs)	12	3
3	Experts	18	5
4	Higher Officials and Others	7	2
Total		277	31

Table 4: Indicate name of region ,zones and Districts, number of Clusters and area Covered by LSD on Malt barley technologies.

Region	Zones	Name of District	No.clusters	Direct beneficiaries		hectars
				M	F	
Oromia	Arsi and west Arsi	Kofale, Lemubilbilo, Hetosa and Arsi-Robe	5	125	15	104
Total	2	4	5	125	15	104

from Arsi zone, and one district namely Kofale from West Arsi zone included in the program from Oromia regional state.

A total of 5 malt barley clusters which contains 104 hectares of land were formed in collaboration with the districts level experts and “kebeles” level Development Agents (DAs) (Table 4).

Malt barley variety popularized

Regarding the variety promoted in LSD. One of recently released variety called IBON 174/03 was demonstrated in Oromia regional state in 2019/20 cropping season. From oromia region two zones namely Arsi and west arsi zones were selected due to major growing areas of malt barley (Table 4).

The variety IBON 174/03 was demonstrated in LSD on five (5) clusters which covered 104 hectares of land Arsi and West Arsi zones of Lemu-bilbilo, Arsi-Robe and Hetosa from Arsi zone districts and Kofale District from West Arsi zone which was coordinated and facilitated by Kulumsa Agricultural Research center (ARC) (Table 4).

In general, a total of two zones and 4 districts, Kofale district from west Arsi zone of Oromia region, Lemu-bilbilo, Hetosa and Arsi-Robe from Arsi zone of Oromia region were addressed in LSD in 2019/20 cropping season.

Trainings delivered on malt barley technologies for the beneficiary farmers as well as other stakeholders

As indicated in Table 1: Training were given for different stakeholders at different stage on agronomice practice of malt barley, chemical applications and safety mechanisms and rouging which is an important activity to produce quality seed because rouging can avoid off type, diseased and other than the sawn variety within the a given clusters. The Authors belived that awerness on the above mentioned topics were enhance the implementation of LSD.

As indicated in Table 1 a total of 135 farmers (126 male and 9 female) were attended on different topics of training at different time. Concerning developing agents (DAs) an awerness creations were made on the malt barley related issues by this a total of 12 DAs (9 Male and 3 female) were attended. Different experts also gain different training on malt barley techinologies in this regards a total of 17 experts (12 male and 5 female experts at district level were attended training on malt barley techinologies related (Table 1).

Field days

Different levels of field days were organized at different time as shown in Table 3. To raise farmer's awareness on the performance of the malt barley techinologies and large scale demonstration.

From the 5 clustered established a total of five (5) field days were organized. To raise farmer's awareness on the performance of the malt barley techinologies, by these field days, a total of 308 participants were attend the field events. Among these 261 participants were farmers (240 Male and 21 Female), 23 of participants were experts (18 male and 5 Female), 9 participants were higer officials and others special guests (7 Male and 2 Female) were attended the field days and belived that awareness were created among participants of the field days including zonal experts, SMS, DAs and among participant farmers (Table 3).

Malt barley productivity and comparisons of actual yield of IBON 174/03 variety at study areas

Malt barley: As indicated in Table 2: In this activity a total of two zones were addressed by the LSD of malt barley technologies. From the two zones 4 districts namely Lemu-bilbilo Arsi robe and Hetosa from Arsi zone, Kofale district from west Arsi zone of Oromia Regional state was selected for this activity. A total of 5 malt barley clusters which contains 104 hectares of land were formed in collaboration with the districts and "kebeles" level experts and Development Agents (DAs).

Malt barley variety popularized

Regarding the Variety demonstrated and promoted in large scale demonstration. One Malt barley Variety namely (IBON174/03) was demonstrated in Oromia region of Ethiopia.

As indicated in Table 2 an actual grain yield of the variety IBON 174/03 was collected from 72 hectares of land from Kofale district of West Arsi zone of Oromia regional state and a minimum of 14 quintals per hectare, a maximum grain yields of 72 quintals per hectare and an average grain yields 40.2 quintals per hectare per cluster were scored.

An actual grain yield of the variety IBON 174/03 was collected from 10 hectares of land from Lemu-bilbilo district of Arsi zone of Oromia regional state and a minimum of 21.3 quintals per hectare , a maximum grain yields of 56 quintals per hectare and an average grain yields 35.2 quintals per hectare per cluster were scored (Table 2).

As indicated in Table 2 an actual grain yield of the variety IBON 174/03 was collected from two clusters which covered 14 hectares of land from two kebeles of Hetosa district of Arsi zone of Oromia regional state and a minimum of 18.5 quintals per hectare, a maximum grain yields of 50 quintals per hectare and average grain yields 36.8 quintals per hectare per clusters were scored.

An actual grain yield of the variety IBON 174/03 was collected from one cluster which covered 8 hectares of land from one kebele of Arsi robe district of Arsi zone of Oromia regional state and a minimum of grain yield of 12 quintals per hectare , a maximum grain yields of 21 quintals per hectare and an average grain yields 17.4 quintals per hectare per cluster was scored this cluster was scored the least yield when compared with the othe districts clusters due to heavy rain fall during grain filling stage (Table 2).

Conclusion and Recommendation

The actual yields of variety of Malt barley IBON 174/03 were collected and analised per clusters and in all clusters there were a promising average yield were recorded (at all study areas except Arsi robe district clusters recorded low yield due to heavy rain fall during grain filling stage the malt barley variety (IBON 174/03) showed higer yield than the Ethiopian national average of barley yield 21 quintals per hectare [14].

Conclusion

During the implementation year (2019/20) of the the activity based on the data collected and from recerchers observation points of view concluded that the following points were addressed.

1. Access and utilization of improved Malt barley technologies were enhanced
2. The LSD approach were well aquainted and understood among stakeholders
3. Awareness on the importance of Malt barley technologies were created among stakeholders.

Recommendations

In general cluster based approach with new verity and input utilization demonstration was successful in terms of yield.



Therefore, based on this result the researchers recommend farmers and other development practitioner to focus more on LSD. Again the authors recommend the farmers to produce in cluster farming approach for scale up activity with best performed Malt barley varieties has to be done in areas where Malt barley is not scaled up especially in areas where Malt barley is potential like study areas.

Malt barley is a potential crop in the highlands of Ethiopia in general. The crop is primarily used for agro-industry and generating income for farmers. currently, the demand for malt barley is at increasing rate, due to expansion of malt processing industry. So there is high potential demand for malt barley and still demand and supply is not at equilibrium position. To satisfy their demand those industry (beverage) owners import the grain malt by hard currency as a result Ethiopia incur additional hard currency. Eventhough, Ethiopia has a potential for malt barley, but not satisfy the local demand. Among the limiting factor improved variety(ies) is/are one and a key for low productivity. Therefore, policy maker and development practioner should use LSD approach to push the crop to produce in wider areas. This can minimize the import of malt barley grain and finally resulted with saving hard currency allocated for importing the grain.

Therefore, to minimize or solve this problem availing improved technologies related with Malt barley and motivating farmrs to produce in large scale should be a best way and concerned body should use LSD approach as good extension mpdality.

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