

Popularization of Sanate Bread Wheat Variety in the Highlands of Guji Zone, Southern Oromia, Ethiopia

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Abstract— In Ethiopia wheat is the national strategic crop to solve food insecurity. Highland districts of Guji zone were potential producers of bread wheat varieties. The production of bread wheat on large area is limited by occurrence of rust and lack of improved bread wheat varieties. But the demand and supply of wheat is imbalance in the area. Farmers were demanding improved and rust tolerant bread wheat varieties. Sanate variety was tested on small area on few experimental farmers. The variety was recommended for the wheat production in the areas. Therefore, it is necessary to disseminate Sanate variety in highlands areas of Guji zone. The objectives of the study were to popularize Sanate variety, to evaluate yield and profitability of Sanate production, capacitate farmers on bread wheat production and linkage among key stakeholders. Four districts were selected based on wheat production potential. Farmers were selected based their interest to grow Sanate variety and ownership of land. 57.72 quintals of improved Sanate variety was distributed for four districts, 12 kebeles and 156 farmers were participated during 2018/2019 and 2019/2020 production seasons. 39 ha of land were covered by Sanate variety. The seed was sown 20 cm between rows and drilling of 148 kg/ha seed rate in the rows. 121kg/ha of NPS fertilizer was applied at planting time. Hand weeding and 2-4-D was used to control weed. Yield data, costs of production, income from Sanate production and farmers' feedback were collected and analysed by descriptive statistics, qualitative and cost benefit analysis. Training, exchange visit and field day were used for the popularization of Sanate. 539 participants were capacitated on Sanate production. 32.23 qt/ha was obtained from pre scaling up of Sanate. The cost benefit analysis shows that Sanate variety was profitable with 27,966.5 ETB/ha. Even though, Sanate gave high yield and profit at the study areas the variety was not highly demanded on the market due to its dark color. However, it was used for household consumption. The variety was also affected by rust at some farmers field. Therefore, the production of Sanate should be done with the support of fungicide in the highlands of Guji zone.

Keywords— Wheat, Guji, Highland, Popularization, Sanate.

I. INTRODUCTION

Agriculture contributes 34.1% to the GDP, employs some 79% of the population, accounts for 79% of foreign earnings, and is the major sources of raw material and capital for investment and market (MOA, 2019). Wheat is one of the major cereals grown for use as food and industrial raw materials in Ethiopia. Bread wheat in Ethiopia is used in different forms such as bread, porridge, soup and roasted grain. In addition to the grain, the straw

of bread wheat is used for animal feed, thatching roofs and bed decking (Bezabih, 2020; CSA, 2018). Wheat is also a strategic commodity which generates farm income and improves food security status (Amentae *et al.*, 2017).

In the World among 125 wheat-producing countries, Ethiopian wheat area coverage and productivity are ranked 25th (1.7 million hectares) and 63th (28,126 kg/ha), respectively. Its productivity is by far lower compared to wheat-producing countries such as Ireland (101,746

kg/ha), New Zealand (98,633 kg/ha) and Netherlands (90,936 kg/ha) (FAOSTAT, 2017) Empirical studies on assessment of wheat yield indicate that other African countries such as Egypt, South Africa and Kenya obtained 67, 35 and 30 quintals per hectare, respectively more than Ethiopia (28qt/ha) (Adugnaw and Dagninet, 2020; Goshu et al., 2019; Tadesse et al., 2018).

In Ethiopia, to improve the productivity of bread wheat in the country, 89 bread wheat genotypes were released until 2017 (MOANR, 2019). However, the productivity of bread wheat is affected by factors such as genotypes, low use of agricultural inputs, environments, wheat rusts, management practices and their interactions (Gemechu et al., 2019; Misganaw, 2017).

Despite releasing different improved wheat varieties Ethiopia is still importing about 1.6 million tons of wheat which estimated to 25% in deficit to fulfill domestic wheat demand by foreign currency (USDA, 2018). Furthermore, the Ministry of Agriculture and Natural Resource plans to increase wheat productivity from 2.7 metric ton/ha in 2019 to 4 metric ton/ha by 2023 and reduce wheat import from 1.7 million metric ton in 2019 to zero by 2023 (Getachew, 2020). Demand of wheat for household consumption is achieved by popularizing the released varieties in their agro-ecologies recommendation. This can be achieved by multiplying improved wheat on farmers' land.

Highland districts of Guji zone were potential producers of bread wheat varieties. Nine year ago, different varieties of bread wheat varieties namely Kakaba, Meraro, Digalu, Alidoro, Huluka, Sofumar, Shorima, Danda'a and the others were demonstrated and pre-scaled up to many farmers in the highlands of the zone. Currently these improved bread wheat varieties were out of production due to rust (both stem and leaf), and environmental hazards (frost, snow). At Guji highlands wheat is highly exposed to rust damage (Tolessa et al., 2013). The occurrence of rust and lack of improved bread wheat varieties made farmers reluctant to grow wheat on large scale. Being the national strategic crop to solve food insecurity the land covered by wheat become smaller and smaller in the study areas. But the demand and supply of wheat for rural and urban household consumption is imbalance. To solve this problem participatory variety selection of bread wheat was conducted during 2017 production season. The result revealed that Sanate variety was tolerant and higher yield and recommended for further promotion in the highland districts. Promotion of improved bread wheat varieties can fulfill the demand of wheat for rural and urban dwellers in Guji Zone. This is why popularization of Sanate variety was important and disseminated to highland districts of Guji Zone.

Objectives of the activity

1. To popularize Sanate variety in the highland areas
2. To evaluate the yield and profitability of Sanate production
3. To capacitate farmers knowledge and skills on production of bread wheat
4. To enhance linkage among key stakeholders

II. MATERIALS AND METHODS

2.1. Description of study areas

Bore, Ana Sora, Dama and Uruga were the most highland districts of Guji zone. Bore and Ana Sora was situated at a distance of 385 KM and 410 KM from Addis Ababa to the South respectively. Dama and Uruga districts are found alongside to the Southern direction of Addis Ababa. The districts have similar agro ecology where diverse crops such as bread wheat, food barley, horticultural crops (mostly potato, enset, garlic and head cabbage) and highland pulse crops (faba bean and field pea) were largely produced in each district. These districts are also known for rearing of livestock. Rural women sold of milk to near town to enhance their livelihood. White honey is produced each district from natural vegetation found in their district (Basha et al., 2017; Basha and Dembi, 2017).

2.2. Sites and farmers selection

With collaboration of District Agriculture and Natural Resource two kebeles (sites) were selected from each district. The site for popularity of Sanate was selected based on wheat producing potential and accessible for monitoring purpose. Farmers were selected based their interest to grow Sanate variety and ownership of land. 12 kebeles and 156 (30 women) farmers were participated during 2018/2019 and 2019/2020 production seasons. Based on farmer management practices, purchase and apply fertilizer 0.25 to 1 ha was used for this activity. Thus, 39 ha of land were covered by Sanate variety during popularization.

2.3. Agricultural inputs used

Bore Agricultural Research Center had freely distributed 57.72 qt of improved Sanate variety for four districts. Three liters of Rex-duo fungicide was given freely for farmers where field day event was conducted. Herbicide (2-4-D) and fertilizer (NPS) was purchased and applied by farmers based on their land size.

2.4. Agronomic practices

Land was prepared by farmers from May to August month. Plough was done by oxen. Sanate was sown from the early of June to late August. The seed was sown 20cm between

rows and drilling of 148 kg/ha seed rate of Sanate in the rows. 121kg/ha of NPS fertilizer was applied at planting time. Hand weeding and 2-4-D was used to control weed. 3 Liters of Rex-duo fungicide was given freely for farmers where field day event was conducted. Other farmers intended to purchase and apply fungicide to minimize the effect rust on Sanate variety. The application of fungicide was done before occurrence of the symptom of rust. Harvesting and threshing was done manually by farmers with technical support of DAs and researchers.

2.5. Stakeholders Linkage

Promotion of all agricultural technologies cannot be provided by a single organization. It needs multi stakeholders who had common goal for improvement of agricultural production. Sanate variety did not popularized alone unless other recommended packages were delivered with it. Thus, Mea Boko Union provides fertilizers, herbicides and fungicides for farmers ensuring linkage among key stakeholders. However, the cost of herbicide

and fungicide is a key problem for farmers. Covering many districts and kebeles increased the popularity of Sanate and increased stakeholders’ linkage. Bore Agricultural Research Center provide seed (Sanate variety freely) as starting stakeholder. Training, field day and monitoring was also conducted by the research center. District Agricultural and Natural Resource Offices of respective district select their kebeles and farmers with collaboration of Bore Agricultural Extension Research Team and kebele Development Agents. Farmers prepare their land, apply chemicals, weed, harvest, and thresh Sanate production. Farmers were intended to sale their yield during sowing time (when there is high demand of seed for further popularization) to neighboring farmers (to increase spin over effect). Generally, material (agricultural inputs such as seed, fertilizers and chemicals) and technical (information) linkages were the main important linkage enhanced in popularization of agricultural research varieties in the community (Figure 1).

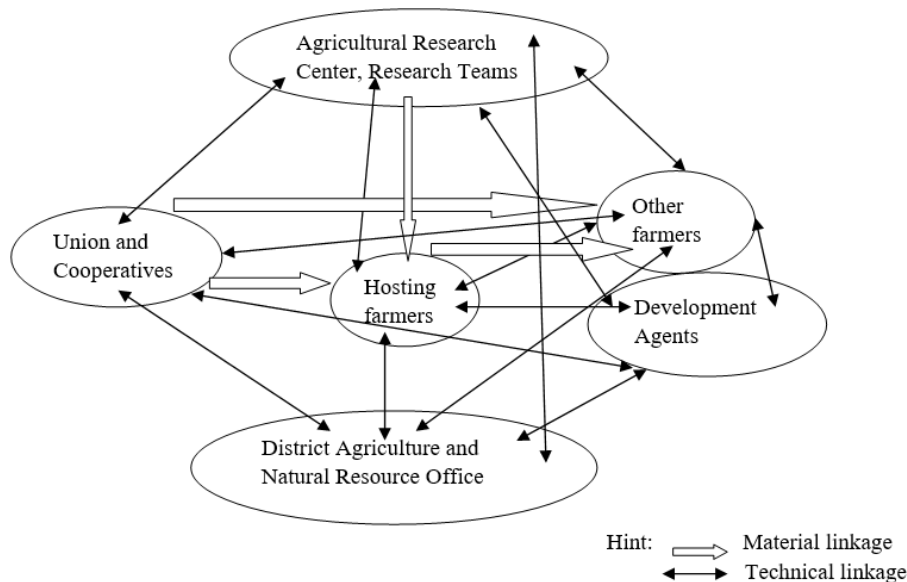


Fig. 1: Stakeholders linkage on agricultural research variety popularization

2.6. Methods of data collection and analysis

Personal observation, measurements and interview were used to collect yield data, costs of production, income generated and farmers’ feedback. Descriptive statistics and qualitative analysis of farmers’ assessment/feedback was used to analyze the data. Cost benefit analysis was used to estimate economic returns of Sanate variety.

III. RESULTS AND DISCUSSIONS

3.1. Capacity building on Sanate Production

Agricultural production is not only labour consuming but also needs knowledge and skills to plant, weed, harvest,

thresh, store and utilize it. The main intention of agricultural extension is to enhance the knowledge and skills of farmers on recommended agricultural technologies (Basha et al., 2021a; Basha et al., 2021b). For Sanate popularization, capacity building methods like training, exchange visit and field day were used in order to enhance the knowledge and skills of farmers, Development Agents, Subject Matter Specialists and other stake holders on Sanate production packages. Cereal and Agricultural Extension Research Teams and Agriculture and Natural Resource Offices actively participated by sharing their experience and knowledge during training, exchange visit and field day organized. Unions and cooperatives were

participated during training and field days. Totally, 539 (412 male and 127 female) were participated on Sanate

popularization (Table 1).

Table 1. Capacity building methods and number of participants on popularization of Sanate

Capacity building methods	Participants	Number of participant		
		Male	Female	Total
A. Training	Farmers	100	40	140
	DAs	20	4	24
	SMSs	16	2	18
B. Exchange Visit	Farmers	10	2	12
	DAs	4	1	5
	SMSs	3	1	4
	Others	3	1	4
C. Field day	Farmers	150	33	183
	DAs	14	2	16
	SMSs	12	2	14
	Others	80	39	119
Grand total		412	127	539

DAs = development Agents, SMSs = subject matter specialists

3.2. Yield performance of Sanate Popularization

Average yield of popularization up of Sanate was 32.24 qt/ha. Mean yield obtained during both production year was greater than national average yield of wheat which is 27.64 qt/ha (CSA, 2019). Higher yield (34.60 qt/ha) was obtained from Bore district followed by Dama district

(33.31 qt/ha). The lowest yield (29.46 qt/ha) was obtained at Uruga district. The lower yield of at this district was due to late planting of Sanate and occurrence of leave and stem rusts at some hosting farmers. This result indicated that Sanate should be planted early June to mid July month in order to escape from rust.

Table 2: Combined yield performance of Sanate variety (qt/ha)

Name of variety popularized	Districts	Number of farmers	Mean	Minimum	Maximum	Standard dev.
Sanate	Ana Sora	42	34.60	20	40	4.94
	Bore	42	30.37	28	44	3.35
	Dama	44	33.31	24	40	4.29
	Uruga	26	29.46	16	44	7.03
	Total	156	32.24	16	44	5.17

3.3. Cost benefit analysis of Sanate Variety

GLEE (2014) stated that Benefit-Cost Analysis is a tool that is well suited for evaluating the profitability of scaling up options at the user level, or any level. Both fixed (cost of land) and variable costs (land preparation, fertilizer, sowing, weeding, harvesting, threshing, etc.) were calculated to consider the profitability of Sanate variety at study areas. On Average 1Kg of Sanate was sold at 12.43 ETB during harvesting time. Total Revenue was calculated

by multiplying farm gate price by yield obtained ($TR = Y * P$), Growth Marginal rate were calculated by subtracting Total Variable Costs from Total Revenue ($GM = TR - TVC$) and the final profitability was calculating by subtracting Total Fixed Cost from Growth Marginal rate ($Profit = GM - TFC$). The cost benefit analysis showed that Sanate variety was profitable at the study area, which gave average profit of 27,966.5 ETB/ha.

Table 3: Net return obtained from popularization of Sanate variety

Benefit Cost Analysis	N	Mean	Std. Deviation
Yield of Sanate in qt/ha	156	32.2372	5.17670
Farm gate price of Sanate 1kg in ETB	156	12.4327	2.16950
Total Fixed Cost in ETB/ha	156	3461.5385	1220.17775
Total Variable Cost in ETB/ha	156	8806.4872	2138.83978
Total Cost in ETB/ha	156	12268.0256	3287.84820
Gross margin of Sanate in ETB/ha	156	31429.4167	8044.81796
Profitability of Sanate in ETB/ha	156	27966.5897	7340.99921

3.4. Farmers' perception

For sustainable agricultural development collecting and analyzing users perception is necessary. Thus, farmers were interviewed on perception of Sanate popularization in their areas. Sanate variety was relatively tolerant to rust and adapted to the environment according to the farmers feedbacks. During the second year production Sanate variety was affected by leave rust at some place after milking stage. So the production of Sanate was affected based on the occurrence of rust sowing time and season. Farmers who planted their Sanate at early time were not affected by rusts. The recommended fungicides were not fully applied by farmers due to high expensive and not available on time. Being affected by leave rust the hosting farmers' eager to produce Sanate variety due to more yield and it generates incomes farmers. Even though, Sanate gave high seed yield and profit at the study areas the variety was not highly demanded on the market due to its dark color. However, it was used for household consumption and was important for household food security. Straw of Sanate variety used for house construction at rural and urban areas. In addition, it was used as livestock feed during dry season. Income obtained from Sanate helped hosting farmers to purchase other agricultural inputs for subsequent season and encouraged farmers purchasing power and investment in their agriculture practices.

IV. CONCLUSIONS AND RECOMMENDATIONS

Wheat is strategic crop to solve household food security in Ethiopia in general and Guji potential districts in particular. This household food security is maintained when large production is obtained as a result popularization of improved bread wheat at potential areas. Many wheat varieties were released by national and regional research institutes. Despite varieties released Ethiopian farmers were not achieved sufficient meal for

their household. This is due to the released varieties were left on shelf and not intensively popularized to potential areas. In order to fulfill the demand for bread wheat it was necessary to promote the released varieties to be disseminated in the producing areas. Sanate variety was used for popularization purpose in four districts of Guji highlands. Though the color of Sanate is dark and not highly demanded at market the crop gave high yield per unit area and generates return for farmers. Harvested yield and income obtained from Sanate production improved household food security and increased purchasing power of agricultural inputs. But the production of wheat in the highland districts of Guji zone is affected by the occurrence of rust (leave and stem). In addition, production of Sanate was affected by time of sowing where early planting was important to escape from occurrence of rust. Fungicide was previously recommended for control of rust on wheat production in highlands of Guji zone. However, according to farmers' suggestion, affordability and accessibility of such fungicide is another problem for farmers to produce wheat in their area. Unions and agricultural cooperative should also provide fungicides for farmers on time. Early planting was advised to minimize the effect of rust on Sanate yield. Generally, the production of Sanate should be done with the support of fungicide in the highlands of Guji zone.

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