

Popularization of Improved Bread Wheat Varieties in the Southern Highlands of Tigray, Ethiopia

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Abstract
Popularization of improved wheat varieties was proposed based on the objectives of enhancing the adoption behavior and participation of farmers to the newly introduced bread wheat varieties with their full package implementation. Two improved bread wheat varieties, Mekelle-3 and Mekelle-4, were popularized in three districts of the Southern Zone of Tigray Region particularly in E/Alaje, E/Mekhoni and Ofla districts. Mekelle-4 has about ETB 1302 net benefit (MRR=4.83) over the standard check in Ayba kebele, E/Alaje district while this variety had about ETB 1761 net benefit (MRR=5.64) over the standard check in Ofla district, Hashenge kebele. On the other hand, mekelle-3 had about ETB1789 net benefit (MRR=2.71) over the standard check in E/Mekhoni district of Mekhan kebelle which indicates that the variety had better profitability than the standard check. Farmers' perception on the newly introduced varieties also revealed that these varieties were better and preferred by the farmers as shown from their varietal evaluation result. Therefore, the improved bread wheat varieties are economically viable and profitable than the previously introduced varieties (standard checks) in all the three districts.
Keywords: popularization, mekelle-3, Mekelle-4, standard check and net benefit

1. Introduction

Ethiopia is the largest wheat producer in sub-Saharan Africa. Wheat is an important food crop and it is one of the major cereal crops in Ethiopia. Ethiopia endowed with a wealth of genetic diversity, particularly for tetraploid-wheats. Nevertheless, the productivity of wheat has remained very low mainly because, improved production technologies have not been adopted by the farming community (Adugna *et.al*, 1991). It is grown in the highlands at altitudes ranging from 1500 to 3000 masl. However, the most suitable agro ecological zones for wheat production fall between 1900 and 2700 masl. Major wheat production areas are located in the Arsi, Bale, Shewa, Illubabor Western Harerghe, Sidamo, Tigray, Northern Gonder, and Gojam regions (Bekele *et. al*, 2000). Currently, wheat is one of the major cereals of choice in Ethiopia, dominating food habits and dietary practices, and is known to be a major source of energy and protein for the highland population of the country. Moreover, wheat has been selected as one of the target crops in the strategic goal of attaining national food self-sufficiency. In several countries in the world, too, it provides more human nourishment than any other food source (Hoveland, 1980; Stoskopf, 1985; Orth and Shellenberger, 1988; Ayoub *et al*., 1994).

In the past, variety development and recommendation was made based on on-station trial with testing and selecting of promising genotypes under high external input and optimum crop management practices with low participation of farmers. In most of the cases, varieties developed under such conditions were poor and failed to prove their superiority under on-farm conditions and farmers' management practices. This could be due to differences in management levels practiced by researchers and farmers and due to the lack of farmers' participation and interaction in the variety evaluation and selection processes. To fill the gap of low adoption of technologies by farmers and increase farmers' participation in technology evaluation and recommendation, a participatory research approach through client-oriented research should be employed widely (Getachew *et al*, 2002).

Wheat contributes to the major share of daily consumption demand of rural households. In addition, it is used as cash source for a household. Even though there is a tremendous and continuous effort made by agricultural development workers and researchers to address farmers accessible with improved technologies, farmers grow both the improved and local varieties. Moreover, Alamata Agricultural Resaerch Center in its mandate areas and especially in the study area a number of research activities were carried out related with wheat varieties during 2010-2013 production years. The result showed that some improved varieties shows promising yield increment, disease and pest resistant than the local cultivar in research station. However, dissemination, social acceptance and adoption of these improved bread wheat varieties at grass root level by the community is a critical issue to be assessed and evaluated. Hence, this proposal is initiated to address the social and biological factors related to improved bread wheat verities in ground.

2. Objectives

2.1 general objectives

✓ To enhance the livelihoods of the farming community, by increasing productivity of a unit area through

popularization of the improved varieties of wheat

2.2 specific objectives

- ✓ To popularize good performance varieties to farmers, extension agents and experts and other stakeholders in the study areas
- ✓ To enhance the adoption behavior of farmers with newly released improved bread wheat varieties and full package implementation to change their livelihood through long term dissemination and technology adaptation.
- ✓ To enhance the participation of farmers in the technology and boost the supply of improved bread wheat varieties to local and regional fast foods agro-processors.
- ✓ To evaluate farmers' perception on the technology

3 Research Methodology

The study was conducted in Alaje, Ofla and E/mekhoni districts. One representative kebele was selected for each district where the areas have similar agro-ecology which matches the varieties. The popularization activities were conducted on a single plot observation bases in 130 farmers. The participating farmers with adjacent farm plot were selected in collaboration with OoARD of the respective PAs. Three candidate bread wheat varieties Mekelle-3, Mekelle-4 and pica-flore were offered to farmers and a total of 130 farmers were participated and 32.5 hectares of land was cover. Agreement had made with farmers to return the seed they received at the end of harvesting and seed collection to the Alamata research center.

Data collected

- Demographic characteristics of the household and Socio-economic profile of the household
- Plot history and Exposure to extension services
- Production level improved Vs local technologies
- Farmers' perception on technology attributes

Data analysis

Data will be analyzed using simple descriptive statistics

4. Result and discussion

The average yield for mekelle-4 in Ayba was 50.34 Qt/ha whiles it was about 52.32 Qt/ha in Hashenge. There is no reasonable yield difference for mekelle-4 in Ayba and Hashenge. On ther other hand, mekelle-3 yielded about 52.625 Qt/ha in Enda-Mekhoni, Mekhan kebele. The maximum and minimum yields for both varieties in all locations were also given in the table below. Mekelle-4 yielded a maximum of 55.20 Qt/ha and a minimum of 45.48 Qt/ha in Alaje while it yielded a maximum of 62.79 Qt/ha and a minimum of 41.85 Qt/ha in Hashenge kebele. The maximum and minimum yields for mekelle-3 in mekhan kebele were also 65.25 and 40 Qt/ha respectively which shows that there was a high yield difference within the same location.

Table 1.Yield of mekelle-3 and mekelle-4 compared to their standard check

Variety	Location	Yield (Qt/ha)		
		max	Min	Average
Mekelle-3	E/Mekhoni, Mekhan	65.25	40.00	52.625
Standard check		61.04	37.62	49.33
Mekelle-4	E/Alaje, Ayba	55.20	45.48	50.34
Standard check		55.61	41.25	48.43
Mekelle-4	Ofla, Hashenge	62.79	41.85	52.32
Standard check		60.20	38.46	49.83

Table 2. Partial budget analysis of mekelle-3 and mekelle-4

variable costs	Alaje (Ayba)		Ofla (Hashenge)		E/Mekhoni (Mekhan)	
	Mekelle-4	S. check	Mekelle-4	S. Check	Mekelle-3	S. check
Cost of seed (Birr/Qt)	800	780	800	770	800	775
Cost of planting (Birr/ha)	840	280	720	240	720	240
Cost of weeding (Birr/ha)	1600	1920	1540	1750	1920	1540
Cost of harvesting (Birr/ha)	960	880	800	720	880	720
Total variable cost (TVC)	4200	3860	3860	3480	4320	3275
Yield obtained (Qt/ha)	50.34	48.43	52.32	49.83	52.625	49.33
Selling price (Birr/Qt)	860	860	860	860	860	860
Total benefits (Birr)	43292	41650	44995	42854	45258	42424
Net benefit (Birr)	39092	37790	41135	39374	40938	39149
Change in TR	1642.6		2141		2834	
Change in TVC	340		380		1045	
MRR (Ratio)	4.83		5.64		2.71	
MRR (%)	483		564		271	

Both mekelle-3 and mekelle-4 had shown better economic benefits as the marginal rate of return for these varieties was greater than 2 in all locations. Mekelle-4 had about 483 % benefits over the standard check in Ayba kebele and 564% in Hashnge. This means that mekelle-4 returns about 4.83 and 5.64 birrs for a unit cost expend in it production in Ayba and Hashenge kebeles respectively. As shown in the table, the total variable cost and total benefits for both varieties were higher than the standard checks used in each kebele which means that the cultivation of new improved wheat varieties with the combination of improved agricultural practices and packages increases the total costs incurred in a production function and the total benefits gained from the new cultivars. The marginal rate of return for mekelle-3 was also high (2.71) in mekhan kebele with ETB 2.71 gain for every ETB 1 cost incurred relative to the standard check.

Ato shimuye Abadi: Ayba, Popularization of M-4 in E/Alaje district, Ayba

Farmers' perception

Pre-harvest and post-harvest perception data were collected to analyze farmers' opinion about the varieties. Agronomic, breeding and social perception aspects were collected and analyzed as well. Some of the crop attributes used in the analysis were number of tillers, head size, disease and rust resistance, seed size, frost resistance, early maturity, water loading, lodging, yield, plant height, marketability, food quality, straw palpability and threshing ability. Farmers in both locations (Ayba and Hashenge) have positively perceived in its plant height and spike length for mekelle-4 as it has the highest plant height and spike length compared to the previously introduced bread wheat varieties in the areas. On the other hand, farmers in E/Alaje perceived Mekelle-4 as poor disease and rust resistance variety which was highly affected by septorea blotch at the maturity stage which resulted in reduced yield. About 90% of the respondents in Ayba replied that the variety had poor disease and rust resistance capacity and the rest 10% ranked it to the medium resistance variety. This shows that most of the farmers have negatively perceived to this variety towards it rust resistance capacity. Moreover, farmers in both kebeles were also perceived mekelle-4 as late maturity variety. About half (49.7%) of the respondents perceived that it is late matured variety and the rest 30 and 23% of the respondents perceived as medium and early matured variety respectively.

Mekelle-3 was also shown its own strength and drawbacks at the farmers' field. Farmers just liked it in its yield, seed size, frost resistance and other agronomic attributes. However, they perceived it negatively in its marketability. The variety has unwanted seed color (red) which resulted in poor marketability and less demand in the market by consumers.

Table 3. Farmers' perception and varietal evaluation

Crop attributes and their degree of acceptance by farmers	Farmers perception	Location					
		E/Alaje, Ayba		E/Mekhoni, Mekhan		Ofla, Hashenge	
		Variety		Variety		Variety	
		Mekelle-4	Local	Mekelle-3	local	Mekelle-4	Local
		Column N%	Column N%	Column N%	Column N%	Column N%	Column N%
No. of tillers	Poor	0%	4.31%	0%	0%	0%	9%
	Medium	14.3%	47.21%	24.3%	35.02%	25.3%	35.02%
	Good	85.7%	48.48%	75.7%	64.98%	74.7%	25.98%
Head size	Poor	0%	11.65%	0%	31.65%	0%	30.65%
	Medium	6.5%	65.32%	6.5%	45.32%	80%	55.33%
	Good	93.4%	23.03%	93.4%	23.03%	20%	14.02%
Disease & rust Resistance	Poor	90%	12.33%	0%	12.33%	0%	12.33%
	Medium	10%	63.24%	63%	63.24%	77%	53.24%
	Good	0%	24.43%	37%	24.43%	33%	44.43%
Seed size	Poor	0%	0%	0%	0%	0%	0%
	Medium	25.4%	54%	32.4%	56%	58.4%	69%
	Good	74.6%	46%	67.6%	44%	41.6%	31%
Frost resistance	Poor	0%	8.53%	0%	27.53%	0%	27.53%
	Medium	5.2%	49.32%	5.2%	33.32%	61%	43.32%
	Good	94.8%	42.15%	94.8%	49.15%	39%	39.15%
Early maturity	Poor	49.7%	0%	30.7%	0%	30.7%	35%
	Medium	30%	36%	49.1%	63%	44%	42%
	Good	20.3%	64%	20.3%	37%	25.3%	23%
Water lodging	Poor	0%	0%	0%	10%	0%	10%
	Medium	4.3%	68%	4.3%	58%	58%	68%
	Good	95.7%	32%	95.7%	32%	42%	22%
Lodging	Poor	0%	15.18%	0%	15.18%	0%	25.8%
	Medium	12.25%	73.44%	21.25%	53.44%	21.25%	65.44%
	Good	87.75%	11.38%	78.75%	31.38%	78.75%	29.38%
Plant height	Poor	0%	0%	0%	0%	0%	0%
	Medium	2%	84.39%	82%	84.39%	72%	64.39%
	Good	98%	15.61%	18%	15.61%	28%	35.61%
Marketability	Poor	0%	8.33%	70%	8.33%	0%	18.33%
	Medium	23%	23.47%	20%	68.47%	74%	58.47%
	Good	77%	68.20	10%	23.20	36%	23.20
Food quality	Poor	0%	0%	0%	0%	0%	0%
	Medium	32%	73.23%	30%	37.23%	42.4%	67.24%
	Good	66%	26.77%	62.6%	62.77%	35.6%	32.76%
Straw palpability	Poor	2%	0%	7.4%	0%	22%	0%
	Medium	35%	68.59%	43%	65.59%	58.25%	71.5%
	Good	65%	31.41%	57%	34.41%	20.75%	28.5%
Threshing	Poor	12.33%	0%	12.33%	0%	10.33%	0%
	Medium	33.67%	46.21%	33.67%	82.21%	53.67%	78.24%
	Good	54%	53.79%	54%	17.79%	36%	22.76%
Yield	Poor	0%	10.55%	0%	20.55%	0%	15.4%
	Medium	63.24%	45.36%	69.24%	47.36%	53.12%	44.6%
	Good	36.76%	44.09%	30.76%	32.09%	46.88%	40%

Source: Farmers varietal evaluation result

5. Conclusion and recommendation

5.1. Conclusion

Both mekelle-3 and mekelle-4 has better economic importance to boost the income and food supply of the smallholder farmers in the areas. This helps to farmers to ensure the food security program and reduce poverty and malnutrition at the household level.

The cultivation of new improved wheat varieties in combination with the recommended input packages increases the total and net benefits of smallholder farmers which significantly can rise the income of the households in the study areas.

5.2. Recommendation

- All stakeholders and concerning bodies should strongly work in market linkage among bread wheat producers and agro-processors in order to strengthen wheat production and marketing in a sustainable manner in the areas.
- Cooperatives and seed unions in the respective districts and kebeles should maintain sustainable seed system in order to strength the linkage among producers and agro-processors.
- Mekelle-4 is highly susceptible to syptorea blotch in Ayba kebele. So, further modifications are needed by breeders making it highly resistance reaction.
- Farmers have been claimed at the color of mekelle-3 as it is not in the desired color for marketing which has lower demand and market price in the market. So, market oriented varieties just like mekelle-4 and others has to be introduced and disseminated to farmers which will enhance the production and marketing of the crop in a continuous trend.

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