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Science for Better Livelihoods in Dry Areas

YIELD GAPS, VARIETAL ADOPTION, AND SEED COMMERCIAL BEHAVIOR

Barley Seed System Landscape in the Highlands of Ethiopia[1]

INTRODUCTION

Barley (food and malt) is among the most important crops for food and nutritional security of smallholders' farmers in the mixed crop-livestock farming systems in the highlands of Ethiopia. Barley is normally grown twice a year during the small (belg) and main (meher) rainy seasons[2]. According to CSA (2014) estimates, it is cultivated on about 1.02 million ha, with a total grain production of 1.8 million tonnes and an average productivity of 1.71 tonnes ha^{-1}, engaging about 4.5 million smallholders during the main season.

Despite the availability of improved crop varieties and associated crop management practices, availability and access to these technologies are limited, resulting in low productivity. The yield gaps between research-managed and national yield levels are still very high across crops and agro-ecologies. Likewise, the performance of the formal seed sector also varies considerably by crop type and agro-ecology. The formal seed sector serves the mid-altitude agro-ecologies better where maize and wheat are predominantly produced (Spielman et al., 2010). This paper reports on the performance of the barley seed system in the highlands of Ethiopia. It specifically presents the current yield gaps, the adoption of improved varieties, the commercial behaviour in seed, and the demand and supply relations for certified seed.

The study was based on a nationally representative sample of 549 barley growers selected from 19 districts in 13 zones of the four major regions of the country (Amhara; Oromia; South Nations, Nationalities and Peoples; and Tigray) during the 2014 cropping season.

KEY FINDINGS

Yield gaps

Yield gaps based on comparisons of productivity levels achieved at national level, at farmers' field under farmers' practice and under recommended practices, and on-station at research stations may serve as indicators of the availability and access to technologies, knowledge and information, thereby reflecting on the performance of a seed system, other input delivery systems, and extension services (van Ittersuma et al., 2013; Spielman et al., 2010).

The result indicates that there is a clear yield gap due to variety and application of recommended crop management practices for both food and malt barley. The national average yield (1.5 tonnes ha^{-1}) is 29% and 61% lower than the yield achieved at farmers' fields with improved variety and recommended practices and at research stations, respectively. These trends indicate the potential of narrowing the yield gap through improved access to varieties and quality seed along with associated extension services on recommended agronomic practices (Table 1).

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[2] According to CSA, belg season are crops that are planted and harvested during the months of March (Megabit) to August (Nehase) and meher season are crops produced during September (Meskerem) to February (Yekatit).

Table 1: Yield gaps of barley in the highlands of Ethiopia

Category	Yield range (tons/ha)		Technologies and practices
	Food barley	Malt barley	
Research field	2.4 – 5.2 (~3.8)	2.3 – 4.3 (~3.3)	• Improved variety • Recommended practices, and • Researcher managed
Farmers' field with recommended practice	2.1 – 3.3 (~2.7)	1.9 – 3.8 (~2.8)	• Improved variety • Recommended practices, and • Farmer managed
National average*	1.17 – 1.9 (~1.5)	1.2 – 1.9 (~1.5)	• National production system

Source: *CSA (2004–2014); MoA, 2012; *Considers both food and malt barley from national CSA data*

Varietal adoption

The adoption rates for barley were assessed independently for food and malt barley by season. All malt barley growers used improved varieties and only cultivated during the main (meher) season. The adoption rates of improved food barley varieties were estimated considering both seasons. Among food barley growers, 67.2% (4.9% are women) are non-adopters of improved varieties; of which 62.58% planted barley only during the main season and the remaining 4.63% planted during both seasons (Table 2). Among the adopters, 23.3% of barley farmers (2.6% are women) fully adopted improved varieties and almost all of them (22.94%) grow barley only during the main season. The remaining barley growers (9.5%) were partial adopters (<1% are women) and grow both local and improved food barley varieties.

In terms of land allocation, the data shows a statistically significant difference ($p < 1\%$) where full adopters on average allocated 0.66 ha, partial adopters 0.81 ha, and non-adopters 0.48 ha of land for food barley. In terms of the number of plots allocated for food barley per household, the data shows again a statistically significant difference (P<1%), where full adopters on average allocated 1.23 plots, partial adopters 2.26 plots, and non-adopters 1.39 plots of land for food barley.

The proportion of land covered with improved food barley varieties is estimated at 40.6%, considering both full and partial adopters. Of the total 36 released food barley varieties, farmers were able to report the use of only seven varieties, namely HB–42 with 1.3% (released in 1984), Shege with 1.7% (1995), Meserach with 5.1% coverage (1998), Dimtu with less than 1% (2001), Estayish with less than 1% (2004), HB-1307 with 2.1% (2006), and Gobe with less than 1% (2012) of food barley growing farmers. Similarly, among the 16 released malt barley varieties, farmers identified the use of four varieties, namely Beka with 1.5% (released in 1976), Holker with 33.3% (1979), Kiflu B with 12.8% (2006), and Sabini with 15.8% (2011). The remaining 36.4% of farmers were unable to identify the improved malt barley variety that they grow. Most of the improved food and malt barley varieties used are very old with a weighted average age of 16.8 and 23.7 years, respectively, showing low varietal replacement rates in farmers' fields.

Table 2: Estimated adoption of improved varieties of food barley

Measurement	Adoption status	Adoption estimates (%)
Farmers	Full adopters	23.3
	Partial adopters	9.5
	Non-adopters	67.2
Plots	Adopters	28
	Non-adopters	72
Area	Adopters	40.6
	Non-adopters	59.4

Source: *Survey, 2014*

Commercial behaviours in seed use

Farmers may use seed from different sources due to various reasons (Bishaw, 2004). Understanding the commercial behavior of smallholder farmers in terms of their purchasing practices or their use of saved seed helps in gauging the seed market and target promotions in order to create demand and to ensure supply (Alemu and Bishaw, 2015; Bishaw et al., 2011). The assessment revealed that 23.3% of farmers are full adopters of improved varieties of food barley, among which 8.3% purchased certified seed, 3.5% purchased seed from local sources, and 11.8% used their own saved seed. Among the non-adopters (76.7%), 9.2% used purchased seed from local sources and 62.6% used own saved seed. For malt barley, 38.5% of farmers purchased certified seed, 17.5% used locally purchased seed, and the remaining 44.1% used own saved seed. These results indicate that even most adopters of improved varieties still depend on the use of saved seed or locally purchased seeds for barley, showing the predominance of the informal sector.

Certified seed demand and supply

The main actors in the certified seed supply of barley are public seed enterprises. Moreover, given the limited commercial interest in these crops, their engagement is limited in terms of volume of seed and varietal coverage. The data for the 2014 production season indicates that there is a considerable gap in seed supply compared to the revealed demand.

In 2014, the revealed certified seed demand of barley was 4,540 tons, but only 9% of the revealed demand was actually supplied (424 tons), which was estimated to cover less than 1% of the total barley area (1.02 million ha). The disaggregated data further shows that more attention is given to malt barley in certified seed production. The total revealed demand for food barley was 2,595 tons but only 4% was actually supplied, whereas for malt barley the revealed demand was 1,944 tons and 17% was supplied.

In addition, the data shows a considerable mismatch between varietal choice and certified seed supply in the 2014 cropping season. For malt barley, demand for certified seed was revealed for eight varieties but the formal seed sector was only able to produce and supply certified seed for four varieties. Similarly, certified seed was supplied for three food barley varieties of the four varieties for which demand was revealed.

These trends reveal the huge gap between demand and supply and the varietal mismatch implies that very few farmers were served through the formal sector despite there being considerable demand for quality seed of these crops. Moreover, seed of old commercial varieties are supplied by the formal sector.

CONCLUSIONS AND RECOMMENDATIONS

The current state of barley production in terms of yield gaps, varietal adoption levels, and the commercial behaviors of smallholders in seed use demonstrate the following key challenges and future areas of attention:

- Barley is grown as a food security crop in the highlands of the country where there is limited crop diversity. Moreover, the barley farming landscape is characterized by low average yields where old commercial varieties dominate the formal sector for both food and malt barley, showing a low rate of varietal replacement. Therefore, the promotion of newly released improved barley varieties to create awareness and to enhance varietal choices and adoption are critical for increased productivity;
- There is a huge gap between demand and supply of certified seed and mismatch in varietal choices of both food and malt barley. Moreover, the size of the revealed demand for certified seed for both food and malt barley is found to be very small and is not commensurate with the total land allocated for these crops. In order to ensure realistic demand and supply of certified seed from the formal sector, better demand assessment measures must be put in place, taking into account shifts in farmers' demand in response to emerging production and marketing challenges. This should be coupled with creating demand for the use of certified seed and creating awareness of newly released varieties;
- The commercial behavior of farmers indicates the dominance of farmers' use of own saved seed or locally purchased seed even among adopters of improved varieties. Given the considerable use of saved seed of improved varieties, it will be important to promote decentralized and business-oriented seed production schemes by mobilizing the communities or farmer groups that can contribute to improve the use of better quality seed;

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