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Direct Seed Marketing Program in Ethiopia in 2013

An Operational Evaluation to Guide Seed-sector Reform

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ABSTRACT

In 2013 the Bureaus of Agriculture in the regional states of Amhara, Oromia, and Southern Nations, Nationalities, and Peoples of Ethiopia supported a program of direct marketing of certified seed by seed producers to farmers across 31 *woredas* (districts). This program stands in contrast to the dominant procedure for supplying such seed in which farmers register with local agricultural offices or extension agents to purchase seed for the coming cropping season and then receive seed either directly from these local offices or through local cooperatives. Under the direct seed marketing program, seed enterprises, both public (parastatal seed enterprises) and private, were authorized to sell seed, primarily hybrid maize seed, directly to farmers in the selected *woredas*.

To generate evidence to guide future action by government on whether it should allow greater direct interaction between seed producers and Ethiopian smallholder farmers, the Ethiopian Agricultural Transformation Agency requested that the International Food Policy Research Institute evaluate how the program operated. Many government officials in Ethiopia are hesitant to cede responsibility to traders for providing seed to farmers without a high level of oversight on the part of government. Does the evidence gathered justify this suspicion on the part of government officials?

The evaluation shows that competition between entrepreneurial seed producers to capture a substantial portion of the market of farmer-customers for their seed to enable their firms to remain in business will propel wider and more effective distribution of new and improved hybrid maize to more and more farmers. This increased engagement by private seed producers in the provision of improved seed to Ethiopia's smallholder farmers is a useful and necessary element in the transformation of Ethiopia's agricultural sector and will contribute to improved welfare for many farming households across the country. While Ethiopian seed producers will have to significantly increase the scope and quality of their marketing efforts to develop profitable and reliable direct commercial seed supply relationships with farmers, we find that the suspicion on the part of government of competitive market forces in the formal seed subsector in Ethiopia is not justified.

Keywords: seed sector, Ethiopia, private sector, hybrid maize seed

ABBREVIATIONS AND ACRONYMS

ASE	Amhara Seed Enterprise
ATA	Agricultural Transformation Agency
BoA	Bureau of Agriculture
DA	development agent
DSM	direct seed marketing
EIAR	Ethiopian Institute of Agricultural Research
ESE	Ethiopian Seed Enterprise
IFPRI	International Food Policy Research Institute
ISSD	Integrated Seed Sector Development
MoA	Ministry of Agriculture
OSE	Oromia Seed Enterprise
REAP	Research for Ethiopia's Agricultural Policy
SG2000	Sasakawa-Global 2000
SNNP	Southern Nations, Nationalities, and Peoples
SSE	South Seed Enterprise
WoA	<i>woreda</i> office of agriculture

1. INTRODUCTION

In 2013, the Bureaus of Agriculture (BoAs) in the regional states of Amhara, Oromia, and Southern Nations, Nationalities, and Peoples (SNNP) of Ethiopia authorized and supported a program of direct marketing of certified seed by seed producers to farmers across 31 *woredas* (districts). This program stands in contrast to the dominant procedure for supplying certified seed in which farmers register with local agricultural offices or extension agents to purchase seed for the coming cropping season and then receive seed either directly from these local agricultural extension offices or through local cooperatives. Under the direct seed marketing (DSM) program, seed enterprises, both public (parastatal seed enterprises) and private (both private seed companies and cooperative unions), were authorized to sell hybrid maize seed directly to farmers in the selected *woredas* through several channels, including private traders serving as agents for the producers, local primary cooperatives, and the government extension agents at the *kebele* (subdistrict) or the *woreda* levels. As this DSM program is being considered as a possible model for scaling up to broadly improve smallholder access to certified seed, the Ethiopian Agricultural Transformation Agency (ATA) requested that the International Food Policy Research Institute (IFPRI) undertake an operational evaluation of the program. This document is a detailed report of IFPRI's findings on the program in the main *meher* cropping season of 2013 and the potential for scaling up the program in coming years.

The structure of this paper is as follows. The next section examines the policy context, conceptual rationale, and motivation for consideration of a program for direct marketing of hybrid maize seed in Ethiopia. The discussion in section 3 describes the current status of the hybrid maize seed production and distribution system in Ethiopia. The fourth section describes the 2013 DSM program and the approach taken in conducting the operational evaluation of its activities and performance reported on here. The fifth section provides the results of the evaluation of the DSM program in 2013. The last section highlights policy and operational questions related to expanding the formal seed subsector and strengthening the entire Ethiopian seed sector for which the DSM evaluation provides insights and guidance.

2. CONTEXT, RATIONALE, AND MOTIVATION

Policy Context

The increased use by farmers of well-adapted, high-quality seed and other planting materials has been a central element in most national efforts to improve food security, reduce rural poverty, and transform agriculture into a more productive and profitable sector of a country's economy. The cultivation of genetically superior material embodied in seed can result in higher, more stable crop yields; lower losses to pests, disease, or adverse weather conditions; or higher value from crop production in the form of outputs with improved consumption characteristics. Ensuring reliable access to improved cultivars requires the establishment of robust seed systems that are able to develop the improved varieties that farmers require, multiply high-quality seed of these varieties, and distribute the seed to farmers in sufficient quantities at a time and price that meets the precise needs of farmers.

The government of Ethiopia is engaged in an effort to transform the agricultural sector to support the overall economic transformation of the country. Led by the federal Ministry of Agriculture (MoA) and regional BoAs, with the support of the Ethiopian ATA, this effort explicitly identifies and seeks to address systemic bottlenecks, both in the agricultural sector and more broadly, that constrain productivity, farmer incomes, and agricultural-sector growth. A center of attention for these efforts is the strengthening of Ethiopia's seed system, the formal elements of which are at only an early stage of growth relative to other national seed systems in Africa (Mabaya, Omanga, and DeVries 2013).

The five-year strategy of the MoA and ATA for the transformation of the Ethiopian seed system describes three seed subsectors (MoA and ATA 2013):

1. An informal subsector in which farmers engage in their own seed selection and local exchange
2. A nascent intermediate subsector centered on community-based seed production with some regulatory oversight
3. A formal subsector in which commercial and parastatal firms, working with crop breeders, multiply and distribute improved varieties to farmers

The DSM program that was implemented in 2013 explicitly addresses this formal subsector. The long-term vision for this particular sector is "a dynamic, efficient, and well-regulated" sector that will provide "farmers with sufficient, affordable, timely, and high-quality certified seeds" for all key crops (MoA and ATA 2013).

An obvious starting point in pursuit of this vision is the hybrid maize seed market in Ethiopia. Hybrids are characterized by their unique ability to exhibit heterosis or hybrid vigor, an increase in yield, uniformity, or hardiness that results from genetic contributions derived from the crossing of distinct parental lines. The commercial value of hybridization lies in the fact that yield gains conferred by heterosis decline dramatically after the first generation of seed is cultivated. This compels farmers to purchase new seed each season and thus provides seed breeders and producers with a means of recouping their investments in research and development. This is in contrast to self-pollinating crops, such as teff and wheat, or vegetatively propagated crops, such as *enset* or potato, for which harvested grain or plant parts can be stored and used as planting material in the following year without significant loss of vigor.

Because farmers must purchase new hybrid maize seed each year to realize the genetic potential conferred by heterosis, hybrid maize seed provides a potentially profitable business model for commercial seed producers. This has been demonstrated across many industrialized and developing countries (Morris, Singh, and Pal 1998; Morris 1998) and is potentially applicable to Ethiopia where there is strong evidence of growing demand and strong willingness to pay for high-quality hybrid maize seed among smallholder farmers in the country's high-potential maize production areas (Alemu 2010; Alemu and Tripp 2010; Spielman et al. 2010). As such, expanding the role that seed producers play in the marketing of hybrid maize seed to maize producers is a reasonable early step toward this vision for the formal subsector of Ethiopia's seed system.

Why Direct Seed Marketing?

In designing the IFPRI evaluation of the DSM program, it is useful to have a theory of change in mind—that is, a succinct understanding of how direct marketing of improved seed by seed producers to farmers is expected to strengthen the country’s seed system, increase agricultural productivity, and contribute to a wider agricultural transformation in Ethiopia (Box 2.1).¹

Box 2.1 A theory of change for the direct seed marketing program in Ethiopia

Permitting seed producers to directly compete for customers (individual farmers, cooperatives, or other farmer groups) will result in sufficient quantities of improved, certified seed of desired qualities being provided to farmers at prices that allow them to profitably produce their crop at higher levels of productivity. Competition between seed producers for market share can occur along several dimensions, including varietal characteristics, price, seed quality guarantees, quality and quantity of information on seed performance and use, the spatial density of seed selling points, timeliness of provision of seed, and payment modalities. If successful, direct seed marketing will offer a complementary channel to the primary means used to distribute improved seed in Ethiopia, which involves government agencies’ assessing farmer seed demand, obtaining the seed required, and then supplying that seed to farmers through agricultural cooperatives and Bureaus of Agriculture.

Source: Authors, 2013

Conceptually, the DSM program is rooted in the notion that fostering seed sales in a well-regulated and competitive market will improve both the availability and the quality of seed for smallholder farmers. Competition forces firms to strike a balance between supplying a product that farmers are willing to pay for and generating revenues that allow the firm to cover the full costs of production, invest in future products and services, and reward its owners and shareholders. For most seed companies active in the hybrid maize market, this balance will be found by careful cost management at the production stage, marketing significantly large volumes of seed to farmers, and continuously exploring opportunities for higher-quality products that meet the needs of a long-term customer base. The government’s role in this market is to uphold the practice of fair competition through regulatory mechanisms and invest in upstream research and development to encourage continuous innovation in the sector. An effort to foster competition along these lines is one of the quickest ways to build a sustainable seed system for hybrid maize seed. A central question that our evaluation of the DSM program seeks to inform is how government might best engage with seed producers to develop a more competitive hybrid maize market along multiple dimensions.

However, competition in the hybrid maize seed market is somewhat of a new approach for seed producers in Ethiopia. To date, the dominant approach to seed distribution has been managed by government’s agricultural sector infrastructure, that is, development agents (DAs) and cooperatives at the *kebele* level, offices of agriculture at the *woreda* level, and regional BoAs. The actual production of seed has been similarly managed by parastatal seed producers at the regional and federal levels, with private firms typically contracted as outgrowers for these parastatals or operating as private seed producers that directly supply seed to the regional BoAs on contract. We will examine this production and distribution system in detail later.

Beyond competition, there are at least two other justifications that can be advanced for permitting and encouraging Ethiopian seed producers to directly market their seed to farmers. First, DSM eliminates or transfers some of the costs and risks currently imposed on this official system for seed supply. These

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¹ This statement about the theory of change for the DSM does not emerge from consensus between the MoA, BoAs, and the ATA, nor has it been endorsed by these institutions. It is presented here primarily to justify the design of the operational evaluation and to foster further discussion on desired outcomes from DSM and the broader goals to which it is expected to contribute.

include the costs associated with annual seed demand assessments, seed procurement operations by DAs and *woreda* offices of agriculture (WoA), and carryover stock management. These also include the risks associated with unexpected changes in weather, prices, and farmers' preferences for specific hybrids.

In a more commercial system of hybrid maize seed distribution, such costs and risks would primarily fall on private-sector seed producers, thereby inducing seed producers to invest in more accurate market intelligence, market growth strategies, careful cost management, and other strategies required for a firm to remain commercially viable. A more commercially oriented system could also free up public resources currently allocated to covering the costs of the seed system to more efficient uses. These include regulatory functions for seed quality oversight and market surveillance; research, development, and production of less commercially viable open-pollinated varieties of maize or improved varieties of other crops; rural infrastructure development; or other development priorities of the government of Ethiopia.

Second, directing marketing of hybrid maize seed to farmers should result in an expansion in the seed market, in terms of both coverage (numbers of farmers and area) and products (number of unique, well-adapted hybrids) that can further drive productivity growth. Direct marketing should encourage seed producers to invest not only in greater production of high-quality seed but also in the acquisition of new germplasm, breeding of better hybrids, and more targeted marketing strategies for their products. These investments should, when supported by a more conducive regulatory and policy environment, lead to gains both in production and in yields of maize in Ethiopia.

However, for direct marketing of hybrid maize seed to succeed in a sustainable manner in Ethiopia, there are at least three complementary components that must be in place. The first requirement is a relatively strong and stable output market for maize. The benefits resulting from the use of improved seed are primarily realized through the sale in agricultural output markets of the additional maize production obtained through the use of the seed. Those output markets need to be reliable if farmers are to continually purchase hybrid maize seed season after season and thereby keep the seed producers in business. Fortunately, as a result of the significant investments made by the government of Ethiopia over the past 10 years in transportation and communication, combined with population growth, growth in household incomes, and urbanization, cereal markets in Ethiopia today are more efficient and reliable than they have ever been (Minten, Stifel, and Tamru 2012). This bodes well for the development of a strong commercial seed supply subsector in the country, particularly for maize.

The second required component is regulation to ensure that markets remain competitive and contribute to aggregate social welfare. The benefits of a sensible and effective regulatory system are primarily realized through the sale of seed that meets basic quality standards and does not put farmers at risk with undesirable attributes such as weak genetic potential, low value in use, poor seed purity, or low germination rates. This means that regulatory agencies must play an important role in the release of new hybrids (for example, through performance testing or other means) and in the marketing of hybrid maize seed (for example, through certification or market surveillance to prevent the sale of adulterated, mislabeled, or counterfeit seed). The Ethiopian government must stay involved in the formal seed sector to ensure that the objective quality of the seed sold meets the purported quality of the product as advertised by the seed producer. Considerable effort has been put into revising Ethiopia's regulatory system for seed during the past five years. With the right strategic outlook and fine-tuning of the regulations to better and more efficiently meet the needs of hybrid maize producers and farmers, these regulatory reforms will facilitate the growth of a more commercial seed sector.

The third necessary complementary component is the broad provision of better-quality and more-timely information to farmers who use or might use hybrid maize seed. Currently, farmers have limited information to guide their choices of maize hybrid (for example, recommended planting time, duration, or yield potential), on site-specific recommendations for inputs (for example, fertilizer quantities and combinations), and on best management practices (for example, planting densities, weed control, and disease surveillance). This is partly due to the narrow selection of maize hybrids available to farmers at present and the long-standing use of blanket, rather than area-specific, crop management recommendations. But in a more commercially competitive seed market, it is expected that farmers will

have a wider menu of hybrids from which to choose the seed they plant. This means that farmers will need accurate and timely information that enables them to make informed choices that will lead to productivity gains and profitable maize cultivation. The supply of this information is the joint responsibility of private seed producers and public extension services. Both must invest in innovative means to inform farmers about the attributes of specific hybrids, the recommended management practices, and the means by which such hybrids can be integrated into farming systems to ensure sustainable use of soil nutrients, water, and other scarce natural resources.

Finally, it is useful to think of DSM in terms of Ethiopia's overall agricultural development challenge and the role that hybrid maize plays in meeting that challenge. Ethiopia's agricultural sector—and thus its national food security—is principally driven by five cereal crops: teff, wheat, barley, sorghum, and maize.² Although official figures for maize seed supply suggest that coordination efforts to boost production by parastatals in 2011/2012 and 2012/2013 were able to supply an average of 84 percent of official demand across the two years, longer-term trends suggest more significant shortfalls (63 percent for the five-year period from 2008/2009 to 2012/2013) (Figure 2.1). More important, these figures obscure the issue of whether the demand assessment system accurately estimates the market size for hybrid maize seed, whether farmers actually have a choice in maize hybrids appropriate to the agro-ecology in which they farm, and what the costs are that result from long-term supply shortfalls and, conversely, the storage and proper management by government and seed producers of the often large quantities of seed that go unsold in one season and are carried over to the next year for sale to farmers.

Figure 2.1 Maize seed supplied to Ethiopian farmers relative to official demand estimates, 2002/2003 to 2012/2013, percentage of demand and seed supply deficit, mt

Source: Adapted from Spielman and Mekonnen (2013).

Note: mt = metric tons.

² We recognize that Ethiopia's food security is also directly related to the productivity of *enset*, roots and tubers, mixed crop-livestock, and high-value export crop farming systems. These also contribute to development in the agricultural sector and in the wider economy. However, the importance of cereal productivity growth—including maize—is a central and dominant feature of Ethiopia's agricultural development strategy. See Diao et al. (2012) for economywide estimates of the importance of cereals in the agricultural sector of Ethiopia's economy.

More to the point of the gap between seed supply and demand, figures from the 2011 *meher* cropping season show that cereals were planted on about 9.6 million hectares, producing about 18.8 million metric tons (mt) of grain (CSA 2013). Of this, maize accounted for 21.4 percent of the planted area and 32.2 percent of the production—second to teff in area planted but first in terms of total production, given the higher yields obtained from maize. Assuming a maize seeding rate of 25 kilograms of seed per hectare (kg/ha) over the 2.05 million ha planted with maize, the maize seed requirement for Ethiopia for the main *meher* cropping season is 51,250 mt. Current estimated hybrid maize seed production levels represent just 35 percent of this requirement. Much greater investment is needed in seed production to bring hybrid maize seed supply more in line with farmer demand, and it is unlikely that public resources alone can bridge this gap in seed supply.

3. CURRENT HYBRID MAIZE SEED PRODUCTION AND DISTRIBUTION IN ETHIOPIA

A Brief History

Hybrid maize seed was introduced into Ethiopia during the Derg regime that ruled Ethiopia from 1974 to 1991. An important component of the agricultural policy of this regime was the creation of large, mechanized state farms. Initially, hybrid maize seed for these farms was obtained from Kenya. However, within a few years the government established the parastatal Ethiopian Seed Enterprise (ESE) to produce improved seed for the state farms and eliminate seed imports. In 1990, Pioneer Hi-Bred International, Inc., the US seed producer, was contracted to work with ESE in developing its seed production. Both ESE and Pioneer continued to operate even after the downfall of the Derg. Today ESE remains the largest producer of hybrid maize seed in Ethiopia, while Pioneer is the largest private hybrid maize seed producer, supplying seed both to the official seed supply system and directly to farmers in selected areas.

In the early 1990s, efforts were made to enhance smallholder adoption of hybrid maize seed as part of a high external inputs technology package. Sasakawa-Global 2000 (SG2000), an international nongovernmental organization, began working in Ethiopia in 1993 on a program of field demonstrations of the use of improved cultivars, inorganic fertilizer, and best management techniques for major cereal crops in Ethiopia, including hybrid maize. The SG2000 program was considered very successful. Maize yields for participating farmers using the improved practices averaged 4.73 mt/ha, against maize yields using traditional practices of 1.57 mt/ha (Spielman et al. 2010). In consequence, the program was scaled up by government in 1995 under the National Agricultural Extension Intervention program, expanding to more than 600,000 demonstration plots nationally by 1997 (Howard et al. 2003). Through these combined efforts, a large proportion of farmers in Ethiopia's high-potential maize areas observed the productivity benefits of the use of hybrid maize seed and inorganic fertilizer in the 1990s.

Recent Growth

The number of seed producers in Ethiopia has increased since the SG2000 and National Agricultural Extension Intervention programs. Pioneer Hi-Bred ended its relationship with ESE in 1995 but remained in Ethiopia and established itself as an independent hybrid maize seed producer, Pioneer Hi-Bred Seeds Ethiopia PLC. The regional governments of Amhara, Oromia, and SNNP established their own parastatal seed production units—Amhara Seed Enterprise (ASE), Oromia Seed Enterprise (OSE), and South Seed Enterprise (SSE), respectively—in 2009 and 2010 to provide seed for farmers in their regions, including hybrid maize. At the same time, a growing number of private seed producers and agricultural cooperatives emerged to supply hybrid maize seed primarily to the regional BoAs for distribution through their supply channels to farmers.

Overall, there are now more than 30 private, agricultural cooperative and parastatal seed producers in Ethiopia. They vary considerably in scale and capitalization, with ESE being the largest. Several, including SSE and Pioneer Hi-Bred, do not have their own seed multiplication farms but rely solely on contracted out-grower farmers to produce commercial quantities of seed. Only a minority of producers have any irrigated land on which to produce seed outside of the main rainy season. The smaller producers rely primarily on manual seed processing, with little or no mechanization. Most producers focus exclusively on hybrid maize seed, although some also produce teff, wheat, haricot bean, sunflower, and vegetable seed. There is an industry body for the formal seed producers in Ethiopia, the Ethiopian Seed Growers and Processors Association, which primarily serves to represent the interests of seed producers in discussions with government about reforms to the seed sector.

Production and distribution of hybrid maize seed is currently managed through the government's extensive infrastructure for agricultural development (Figure 3.1). The process begins with DAs at the *kebele* level or agricultural officers at the *woreda* level identifying and registering local farmers who plan to cultivate hybrid maize and purchase hybrid maize seed in the next growing season. Information about the quantity of seed required by these farmers is aggregated and conveyed through official channels to the BoAs. The regional agencies in turn contract with seed producers to produce the quantities required.³ Seed producers respond accordingly, and certified seed is supplied to farmers back through the system, ultimately reaching farmers through the DAs, through local agricultural offices, or via local agricultural cooperatives⁴ (Spielman and Mekonnen 2013). Participants in this system said that it took four to six months from the start of the demand assessment exercise until seed was delivered to farmers.

The flowchart illustrates the seed supply system in Ethiopia, showing the flow from the Federal Ministry of Agriculture to Farmers. The system involves several key entities and their interactions:

- Federal Ministry of Agriculture** (top center) provides regulatory oversight (double line) to the **Regional Bureaus of Agriculture** (top left), **Ethiopian Seed Enterprise** (middle right), and **Private seed producers** (middle left).
- Regional Bureaus of Agriculture** (top left) provide regulatory oversight (double line) to **Regional seed enterprises (ASE, OSE, SSE)** (bottom left) and **Private seed producers** (middle left).
- Ethiopian Seed Enterprise** (middle right) provides seed supply (solid line) to **Private seed producers** (middle left) and **Cooperative unions** (bottom right).
- Private seed producers** (middle left) provide seed supply (solid line) to **Cooperative unions** (bottom right).
- Cooperative unions** (bottom right) provide seed supply (solid line) to **Primary cooperatives** (bottom right).
- Primary cooperatives** (bottom right) provide seed supply (solid line) to **Farmers** (bottom right).
- Woreda office of agriculture** (bottom left) provides seed demand assessment (dotted line) to the **Regional Bureaus of Agriculture** (top left) and seed supply (solid line) to **Development Agents at kebele level** (bottom center).
- Development Agents at kebele level** (bottom center) provide seed supply (solid line) to **Farmers** (bottom right) and seed demand assessment (dotted line) to the **Woreda office of agriculture** (bottom left).
- Farmers** (bottom right) provide seed demand assessment (dotted line) to the **Woreda office of agriculture** (bottom left).
- Agricultural research system (EIAR, universities)** (top right) provides seed supply (solid line) to the **Ethiopian Seed Enterprise** (middle right) and seed demand assessment (dotted line) to the **Regional Bureaus of Agriculture** (top left).

Legend:

- ..... Seed demand assessment
- Seed supply
- - - - Supply of basic seed for multiplication
- ==== Regulatory oversight

Note: EIAR = Ethiopian Institute of Agricultural Research; ASE = Amhara Seed Enterprise; OSE = Oromia Seed Enterprise; SSE = South Seed Enterprise.

On the seed producer side, forecasting demand for the seed that they can supply is difficult. The results of the seed demand assessment exercise of the government come out only after the producer has finished producing seed intended for sale in the coming season. As most seed is produced under rainfed conditions, the seed is produced in the main cropping season the year before farmers will plant it. Consequently, the seed demand assessment exercise is of limited value to seed producers in guiding their decisions about how much hybrid maize seed and of which type to produce. Rather, such decisions by seed producers are based on patterns of farmer seed demand two years earlier.

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Problems relating to timeliness of seed delivery and the quantity and quality of seed provided are well-documented shortcomings of this system, resulting in high costs for producers, government offices, and cooperatives if they must store significant quantities of seed from one planting season to the next and for disillusioned farmers who are unable to obtain seed for the maize hybrids that they want. These problems have prompted MoA and ATA to explore innovative mechanisms for improving seed distribution, particularly the DSM program evaluated here.

Regardless of how the seed is distributed, there is no explicit subsidy or credit involved. Farmers are expected to pay for the full value of the seed that they obtain on receipt, if not before. Where there are implicit subsidies in seed supply and distribution is in the low prices that parastatal seed producers set for the public hybrid maize hybrids and in the narrow margins that seed producers, *woreda* and *kebele* agricultural officials, and local agricultural cooperatives receive for transporting and otherwise managing the flow of seed to farmers.

The producers whose seed is distributed through the government agricultural agencies and cooperatives engage in very little marketing. The government essentially creates their market for them. There is little if any competition between the seed producers to gain market share, except possibly on access to information on pending government contracts for the supply of seed. As will be discussed below, the rudimentary to nonexistent efforts at marketing by seed producers that were seen in the evaluation of the DSM program in 2013 reflects this legacy of seed producers' not having to win customer-farmers to use their seed through employing good marketing efforts. Until the DSM program, government provided them with their customers.

Hybrid Maize Choice

In spite of the relatively large number of hybrid maize seed producers in Ethiopia, the number of hybrids made available to farmers is limited. In our study, only five hybrids were reported grown by farmers on more than 3 percent of all maize plots on which information was obtained—three public hybrids produced by many producers, BH-540, BH-543, and BH-660, and two proprietary hybrids produced by Pioneer Hi-Bred, PHB-3253 (*Javi*) and PHB-30G19 (*Shone*). All of these are white, semiflint hybrids.

The public hybrids were developed by maize breeders at research centers under the Ethiopian Institute of Agricultural Research (EIAR). BH-660 is a long-duration hybrid suitable for higher elevations, while BH-540 and BH-543 are medium-duration, medium-altitude hybrids. BH-543 has greater disease tolerance than BH-540. Farmers are particularly familiar with BH-660 and BH-540, as they have been available for almost 20 years: BH-660 was released in 1993 and BH-540 in 1995. Having been released in 2005, BH-543 is the newest of these three public hybrids (EIAR 2009). However, while the older hybrids are found in all high-potential maize areas of the Amhara, Oromia, and SNNP, BH-543 is commonly grown only in SNNP.

Most seed producers focus on the production of these public maize hybrids. The hybrids are well known by farmers and the extension services, and producers are assured a reasonably secure market through seed supply contracts for the hybrids entered into with the regional BoAs. Seed producers rely on EIAR to supply the necessary inputs to production, namely, basic seed of the hybrids' parental lines. Basic seed is provided at cost to such producers but has frequently been in short supply in past years. In an effort to address this issue, ESE was recently given responsibility for supplemental production of basic seed then sold to other producers (Sahlu and Beshir 2011).

There are no exclusive production or licensing agreements related to the use of the public hybrids or their parental lines: those who wish to produce them are free to do so. However, before the planting season, the parastatal seed producers—ESE and the seed enterprises of Amhara, Oromia, and SNNP—in consultation with the MoA and regional BoAs, jointly establish the prices at which they will be selling the different public hybrid maize seed types that they produce. However, all producers of these hybrids, whether parastatal or private producers, generally respect these set prices. As discussed later, farmers are price sensitive when making a decision about which producer they should purchase seed from for a specific hybrid. In consequence, seed prices for the same public hybrid type in any locale will converge.

For the 2013 *meher* season, BH-660 was sold at ETB 1,500 per quintal (100 kg), BH-543 at ETB 1,660, and BH-540 at ETB 2,175.⁵ The parastatal seed producers reported that they set their seed prices for these hybrids primarily based on the cost of production of each hybrid type for the seed firms. The only adjustments to these prices that the parastatal seed producers agree to are some slight increases to reflect transport costs to locations distant from where the seed was produced. However, even in such cases producers are unwilling to raise prices if one or more of their competitors selling the same public hybrid seed in the same market do not do so. With regard to the competition that the DSM program seeks to foster, at present, there is little scope for producers of these public hybrids to compete on the basis of the price at which they sell seed of the public hybrids to consumer-farmers.

In spite of the small number of public hybrids commonly planted by farmers, EIAR maize breeders regularly produce new hybrids. For example, in June 2013 EIAR announced the release of BH-546 and BH-547, hybrids that are targeted to the same agro-ecologies as BH-540 and BH-543 but that yield significantly more than either of the older hybrids (International Maize and Wheat Improvement Center 2013). However, there are numerous bottlenecks in the flow of new hybrids from the research system to farmers' fields (Alemu 2010). For example, in the course of interviews conducted as part of this DSM evaluation, several DAs mentioned that demonstrations conducted in 2012 of BH-661, a new long-duration hybrid, had generated interest among farmers who attended field days at those demonstrations. However, virtually no seed for BH-661 was supplied in 2013, at least in the DSM program areas. We were informed that this was due to a lack of seed for the parental lines of the hybrid. Many public maize hybrids remain on the shelf rather than being made available to Ethiopian farmers. In consequence, as shown in Table 3.1, the average age of improved maize varieties and hybrids under cultivation in Ethiopia is between 13 and 16 years, suggesting that few farmers are cultivating new and improved releases from either the public research system or the private sector.⁶

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⁵ In mid-2013, US\$1.00 = ETB 18.50. *ETB* is the symbol for Ethiopian Birr.

⁶ The average age of improved varieties and hybrids of maize is calculated from data collected as part of the EIAR/IFPRI Baseline Survey that was conducted for ATA in 2012. The figures given are based on averages weighted by the number of farmers cultivating a specific variety or hybrid and by the area under cultivation with a specific variety or hybrid, respectively. A total of 504 maize farmers (32.4 percent of all farmers in the sample who reported growing maize) responded with information on about the specific variety or hybrid they were cultivating in *meher* 2012; however, only 332 of these responses had sufficient associated information for the calculation of these averages.

Table 3.1 Average age of hybrid and improved varieties of maize in use in Ethiopia, weighted by area under cultivation and proportion of farming households using seed

Variety or hybrid	Year of release	Age of variety in 2013 (years)	Proportion of households cultivating variety or hybrid (%)	Proportion of area under cultivation with variety or hybrid (%)
Public hybrids				
BH-140	1988	25	6.29	11.63
BH-660	1993	20	40.82	40.60
BH-540	1995	18	18.89	20.49
BH-541	2002	11	1.43	1.71
BH-543	2005	8	1.83	1.76
Proprietary hybrids (Pioneer)				
PHB-30G19 (<i>Shone</i>)	2006	7	2.49	0.65
PHB-30D79 (<i>Agar</i>)	2008	5	1.69	0.65
PHB-2859W (<i>Shalla</i>)	2012	1	0.20	0.52
Public varieties (composites or open-pollinated varieties)				
Katumani	1974	39	0.20	0.05
Other/unknown	various	na	26.20	18.11
Weighted average age of all improved varieties or hybrids in use, years (weights indicated by column)			13.77	15.74
<i>n</i>			332	332

Source: Authors analysis of data from 2012 EIAR-IFPRI Baseline Survey.

Note: na = not applicable.

Although the public hybrids are the most common hybrids grown in the high-potential maize areas of Ethiopia, there are two suppliers of proprietary hybrids, Pioneer and Alemayehu Makonnen Farm. In particular, the successful experience of Pioneer in supplying proprietary hybrids to smallholders at prices that are significantly higher than those of the public hybrids is an important indicator of the solid prospects for a more commercially oriented market for hybrid maize seed in Ethiopia. The median price per quintal in 2013 for PHB-3253 (*Javi*) was ETB 4,000 and for PHB-30G19 (*Shone*), ETB 3,800. Moreover, Pioneer is able to sell almost all of its seed every season and has much less carryover stock than other producers.

Pioneer's experience offers strong evidence that farmers, particularly those in high-productivity maize areas, are willing to pay higher prices for high-quality hybrid maize seed. This evidence undercuts the strength of arguments for maintaining fixed prices for public hybrid maize seed that are pegged to the costs of production. Indeed, other seed producers acknowledge Pioneer as an industry leader in terms of not just product quality but also business practices. In the course of interviews conducted as part of this DSM evaluation, many seed producers observed that Pioneer does a good job of building relationships with local farmers, establishing demonstration plots, conducting useful field days at their demonstrations, and following up with the farmers who purchased its seed.

Pioneer also actively introduces new hybrids while pulling hybrids from the market when it has new, improved hybrids to replace those older hybrids.⁷ For example, PHB-30D79 (*Agar*) is unlikely to be available in 2014, whereas a new variety, PHB-3812 (*Limu*), will be promoted in its place. Pioneer's PHB-3253 (*Javi*) has found an important market niche as a green maize variety produced in the shorter *belg* cropping season in SNNP. Its other hybrids compete directly with the medium-duration hybrids BH-540 and BH-543, particularly its very successful PHB-30G19 (*Shone*).⁸

A more recent entrant to the market, Alemayehu Makonnen Farm, offers additional insights into the prospects for a more commercially oriented market for hybrid maize seed. This firm has an agreement with SeedCo, a Zimbabwean seed producer, to multiply and sell SC-627 (*Aberaya*), a medium-duration hybrid. The hybrid has been popularized during the past two to three years principally in the Alaba Special Zone in SNNP and neighboring *woredas*. Alemayehu Makonnen Farm has recently invested in extensive irrigated seed production facilities with the hope of expanding production of additional proprietary maize hybrids alongside improved cultivars for other crops.

ESE has also experimented with the production of its own maize hybrids, engaging in multilocal testing of several (Sahlu and Beshir 2011). However, popularization efforts for the ESE proprietary hybrids has not been extensive, so they are not commonly found in farmer's fields.

Initial Piloting of the DSM Program

The regional BoAs in the Amhara region in 2011 and in the Oromia and SNNP regions in 2012, with technical and some financial support of the Integrated Seed Sector Development (ISSD) program in Ethiopia,⁹ implemented pilot programs of DSM by seed producers to farmers in a few *woredas* in each region—five *woredas* in total. In these pilot programs, seed enterprises, both public (ESE and the regional seed enterprises) and private (both private seed companies and cooperative unions), directly marketed and sold seed to farmers in the selected *woredas*. Figure 3.2 is a diagram of the design of the DSM program that can be contrasted to the design of the existing predominant hybrid maize seed supply system shown in Figure 3.1.

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⁷ Pioneer has based its business in Ethiopia on the use of hybrids developed at its research centers in Zimbabwe, Kenya, and South Africa. Pioneer gives the breeder seed for any prospective hybrids to EIAR research centers for testing and evaluation against the standard Ethiopian maize hybrids. Those hybrids that do well are submitted to the requisite variety approval process of government before being released to farmers.

⁸ Currently, Pioneer does not have a long-duration, higher-altitude variety to compete with BH-660.

⁹ The ISSD program in Ethiopia is a multi-stakeholder-driven initiative that seeks to further develop and strengthen the seed system of Ethiopia, across all of the three subsectors—informal, intermediate/community, and formal. The objective is that high-quality seed for varieties that farmers desire will be available and affordable to farmers throughout Ethiopia. Hybrid maize seed is only one component of its efforts. The program has been operating in Ethiopia since 2009. ISSD is an initiative to strengthen national seed systems in eight countries in Africa that is managed by Wageningen University in the Netherlands, with financial support from the Dutch government.

ISSD-Ethiopia has established regional seed groups made up of stakeholders in the seed sector in Tigray, Amhara, Oromia, and SNNP to identify challenges to seed provision, prioritize those challenges, and design and guide the implementation of interventions to solve them. The initial DSM pilot efforts in Amhara, Oromia, and SNNP were an intervention promoted by the ISSD regional seed groups, as was the scaling up of the DSM program in 2013 that is evaluated in this paper.

Figure 3.2 Schematic diagram of direct marketing program for hybrid maize seed in Ethiopia

Source: Authors, adapted from Spielman and Mekonnen (2013).

Note: ASE = Amhara Seed Enterprise; OSE = Oromia Seed Enterprise; SSE = South Seed Enterprise.

The focus of the DSM program was on marketing of hybrid maize seed, with some wheat seed also offered in some areas. The three regions used different institutions and modalities to implement the DSM pilot programs. As will be discussed, these different modalities were carried over into the 2013 DSM program.

In designing the DSM pilot program, it was anticipated that DSM would result in timely provision of good seed to farmers in such a manner that the seed producers would be accountable to farmers for the quality of their seed. It also would motivate producers to promote their seed and to compete with other producers on the basis of seed quality and information provided to farmers to increase their market share and build more sustainable seed businesses.

On a qualitative basis, the pilot programs in 2011 and 2012 were successes. The ISSD-Ethiopia program conducted an evaluation of the 2011 and 2012 experiences in the three regions, which confirmed the satisfaction of most participants in the programs—farmers, seed producers and sellers, and government officials in agriculture. Participating farmers reported that generally they were able to obtain good-quality seed at competitive prices in the quantities and at the times that they desired. Farmers in *woredas* neighboring *woredas* where the pilot programs were implemented expressed strong interest in having DSM extended to their *woredas*. Indeed, most stakeholders in the seed sector agreed—whether based on their observations of these pilot programs or based on their own experiences and lessons from elsewhere—that DSM had shown itself to be a promising approach by which to improve the access of farmers to improved seed.

4. DIRECT SEED MARKETING PROGRAM IMPLEMENTATION IN 2013 AND ITS EVALUATION

The DSM program in 2013 was a scaling up of the earlier pilot efforts in 2011 in Amhara and in 2012 in the Oromia and SNNP regions. These earlier DSM programs were generally seen to have been quite successful. Thereafter, ISSD-Ethiopia, through its regional core groups made up of stakeholders in the seed sector, advocated with the regional BoAs and with the federal MoA for a scaling up of the DSM program for 2013. These promotional efforts were successful, with the minister of agriculture in February 2013 endorsing a significant scaling up of the DSM pilot program.

Design of the 2013 DSM Program

Thereafter, the regional BoAs, ISSD-Ethiopia, the Seed Program of ATA, and MoA quickly engaged in planning the 2013 DSM program. The regional BoAs, supported by the regional core seed groups that the ISSD-Ethiopia program facilitated, led the design of the program in their regions. The role of the federal MoA and ATA were primarily for oversight in ensuring that the DSM program in each region was aligned with and would contribute to national efforts at strengthening Ethiopia's seed system. A result of program leadership's being located at the regional level was that the heterogeneity seen in how the program was implemented in the pilot phase was maintained for the 2013 DSM program. Essentially, three approaches resulted for enabling farmers to purchase hybrid maize seed directly from seed producers. These approaches are described in more detail below.

BoA for the Tigray region was involved in the initial discussions for implementation of the 2013 DSM program but ultimately did not participate (Box 4.1).

Box 4.1 Tigray region and the direct seed marketing program

Although the Bureau of Agriculture for the Tigray region was involved in the initial discussion about planning for the 2013 direct seed marketing program, the program was not implemented in the region. This reflects the low use of improved seed of any sort in Tigray. For example, Tigray does not have a parastatal seed production enterprise. In consequence, the formal seed subsector in Ethiopia does not have much of a presence in the region. Moreover, maize plays a secondary role in most of the cropping systems in Tigray, sorghum being the dominant cereal. Although the Ethiopian Seed Enterprise reported distributing improved open-pollinated varieties maize seed in Tigray in 2013, most seed is acquired by farmers in Tigray through the informal subsector. However, progress has been made in developing community-based seed multiplication businesses in the region.

Source: Authors, field notes from DSM evaluation (2013).

The *woredas* chosen in each of the three regions for DSM implementation in 2013 are all located in the high-potential maize production zones of the regions (Figure 4.1).

- All of the Amhara DSM *woredas* are located in the West Gojjam or Awi zones to the south and west of Lake Tana and Bahir Dar. Two of the *woredas* that implemented the DSM are urban *woredas*—Bahir Dar and Dangila. However, both of these have rural *kebeles* in which agricultural cooperatives are active.
- In Oromia, two areas on opposite sides of the region were chosen for the DSM—three *woredas* in the East Wollega zone, about 200 km west of Addis Ababa, and two *woredas* in the West Arsi zone in the Rift Valley about 150 km south of Addis Ababa. The 2012 DSM pilot program in Oromia had been in one *woreda* in each of the two zones. Both areas are high-potential maize areas, particularly East Wollega.

- In SNNP, 19 *woredas* were selected—several south and southeast of Hawassa on the floor of the Rift Valley in the Sidama area, with the majority located in the highlands to the west of the Rift Valley in the Gurage, Hadiya, and Wolaita Sodo areas along the road north from Wolaita Sodo to Hosaena and Butajira. Notably, in many of the DSM *woredas* in SNNP, maize is primarily a *belg* crop that is grown for sale as green cobs. Consequently, sale of seed in SNNP started almost immediately after the DSM program for 2013 started. In the other regions, maize is almost exclusively a *meher* crop that is harvested as grain.

Figure 4.1 Location of *woredas* in which the 2013 DSM program was implemented

Source: Drafted by authors.

Note: DSM = direct seed marketing; SNNP = Southern Nations, Nationalities, and Peoples.

Among the initial preparations for the DSM program in 2013 was obtaining commitments from seed producers to participate in the program. As shown in Table 4.1, 10 seed producers agreed to supply seed for direct sale to farmers. Most local sellers involved in the DSM program in 2013 faced no up-front costs to obtain the stocks of seed from the suppliers. Sellers remitted the funds that they received from buyers to the seed supplier generally two or three times a week. At the end of the selling season, the seed producer collected any unsold seed from the local seller.

Table 4.1 Elements of design of direct seed marketing program for 2013, by region

	Amhara	Oromia	SNNP	All
Modality	Seed producers delivered to warehouses of local agricultural cooperatives, where farmers purchased seed from cooperative employees without any authorization from extension staff required.	Seed producers contracted local traders or cooperatives to sell their seed to local farmers from the trader's sales premises or the cooperatives. No authorization for farmers from extension staff was needed for them to purchase seed.	WoA facilitated provision of storage and sales facilities to seed producers. With authorization of WoA, farmers purchased seed from local sales agents of producers, who generally were WoA employees assigned to sell seed under the DSM program.	—
DSM <i>woredas</i> , 2013	7, including urban <i>woredas</i> of Bahir Dar and Dangila	5	19	31
DSM <i>woredas</i> , 2011 or 2012 pilot program	2	2	1	5
Seed producers	6—ESE, Pioneer, Yimam, Ayehu Zingini, Ethio Agri-CEFT, Merkab Cooperative Union	5—ESE, OSE, Anno Agro-industries, Homa, Pioneer	2—ESE, SSE	10
Local seed sellers, estimated	51 cooperatives	58	30	139
Seed buyers, estimated	109,400	55,200	96,300	261,000
Seed sales through DSM program, estimated, metric tons	1,300	1,600	1,500	4,400
Sales period	Start of <i>meher</i> season (May/June)	Start of <i>meher</i> season (May/June)	Belg (February/March) and start of <i>meher</i> seasons	na
Principal hybrid maize seed supplied under DSM program	BH-540, BH-660, PHB-3253 (<i>Javi</i>)	BH-540, BH-543, BH-660, PHB-30G19 (<i>Shone</i>)	BH-540, BH-660	na

Source: Authors, documents from July 2013 DSM national experience sharing workshop and Amhara DSM program consultation meeting.

Note: SNNP = Southern Nations, Nationalities, and Peoples. WoA = Woreda office of agriculture; ESE = Ethiopian Seed Enterprise; OSE = Oromia Seed Enterprise; SSE = South Seed Enterprise; na = not applicable. The estimates for total number of seed buyers and metric tons of seed sold are calculated from the results of the seed seller survey, expanding the results to account for all seed sellers. More accurate estimates based on administrative records likely are available.

However, the results of the farmer survey for the evaluation show that other seed producers also provided seed in some of the DSM *woredas*. This primarily was due to agricultural cooperatives or WoAs having arranged for seed supplies to be provided to farmers under the arrangements that were used in the past, parallel with the DSM program. Notably, although it was not one of the DSM seed providers for SNNP, Pioneer supplied significant amounts of seed to agricultural cooperatives in several DSM *woredas* there. More than a third of the seed planted by farmers surveyed in the DSM *woredas* in SNNP was supplied by Pioneer.

Across the three regions, the local sellers of seed under the DSM program were expected to maintain registers of all individuals who purchased seed, recording their names, in which *kebele* they farmed, and details about the type of seed and seed quality certificate number for every packet of seed the farmer purchased. In most areas, but not all, where the DSM program was implemented in Amhara and Oromia, sellers were instructed that they could not sell to farmers who farmed outside of *kebeles* neighboring the place of sale. In SNNP, where only *woreda* selling points operated, sales were not restricted only to farmers from that *woreda*, although actual practice varied across *woredas*. Sellers in all regions were also expected to determine whether the seed buyer was a maize farmer. Reasons given for restricting sales to local farmers were to allow a better assessment to be made of local real seed demand and to avoid access to the seed for illegal traders to resell.

However, in Amhara and Oromia, DAs and WoA officials were not involved in the seed sales. Farmers could come off of the street and into a selling point and purchase seed as long as they could say that they were local maize farmers. In SNNP, however, farmers had to obtain a certification note from WoA before being permitted to purchase seed. Alternatively, the DA would take responsibility for purchasing seed from the local seller for a group of farmers in the *kebele* in which the DA worked in a manner not so different from how hybrid maize seed is supplied to farmers outside of the DSM *woredas*.

As one of the motivations for the DSM was to foster greater accountability by seed producers for the quality of their product, all of the seed sold was packed in 12.5 kg packets that were labeled with details about the seed producer and to which a seed quality certificate was attached. Resolution of any seed quality issues took place at the point of sale. In most DSM *woredas*, farmers were allowed to examine the seed that they were purchasing for evidence of insect or moisture damage or shriveled, small seed. If substandard seed was found, the packet would be substituted with good seed.

The differing modalities used earlier for implementing the pilot programs in each of the three regions were generally maintained in the design of the 2013 program in each. Here detail is provided for each region.

Amhara

The implementation of DSM in Amhara in 2013 involved the supply of seed from six seed producers—ESE; Pioneer Hi-Bred; three smaller private seed producers, Yimam, Ayehu Zingini, and Ethio-Agri CEFT; and an agricultural cooperative, the Merkab Cooperative Union. ASE and Avallo International, a private producer, both of which provided seed for the 2011 DSM pilot in Amhara, decided not to participate in the DSM program in 2013.

The producers delivered stocks of seed to local agricultural cooperatives in the *woredas* in which the program was implemented. The amount of seed each delivered had been agreed on previously in discussions with the office of agriculture for the *woreda*. Not all suppliers operated in all DSM *woredas* but chose the *woredas* that they would supply based on seed type and stocks each had available and logistical considerations. However, Amhara BoA ensured that a minimum of three seed producers supplied each DSM *woreda* so that seed sales could be done on a competitive basis. Following past patterns of hybrid seed use, BH-660 was supplied to those areas with slightly more rainfall and higher elevations, while BH-540 was stocked in the slightly drier *woredas* in the north of the cluster of DSM *woredas* in Amhara. Pioneer Hi-Bred supplied its PHB-3253 (*Javi*) hybrid to *woredas* where BH-540 also was grown.

Private traders or agents of the seed producers were not involved in the sale of the seed. Rather, between 9 and 13 cooperatives in each selected rural *woreda* agreed with the Amhara BoA and the local WoA officials to stock seed for direct sale to local farmers, both cooperative members and others, receiving a commission from the seed supplier for every packet of seed sold. Employees of the cooperative were responsible for selling the seed and remitting the cash received to the seed producer.

Except for Pioneer, all of the suppliers to a DSM *woreda* in Amhara would provide the same hybrid type to cooperatives in that *woreda*. In consequence, in most locations farmers did not have much of a choice in the hybrid that they would buy—the only choice was between the producer of the seed.

Moreover, as these are public hybrids, all seed was sold at the same price. Figure 4.2 is a photo taken in a warehouse of a cooperative in Dangila *woreda*. The packets of seed at right are BH-660 from Ethio-Agri CEFT, those in the back of the photo behind the pole are BH-660 from Ayehu Zingini, and in an adjoining smaller storeroom are stocks of BH-660 from ESE. (The larger bags at left in the photo are Di-Ammonium Phosphate (DAP) inorganic fertilizer supplied by WoA.) Only in those DSM *woredas* of Amhara where Pioneer also delivered seed was there a choice in hybrid type and in seed price.

Figure 4.2 Photograph of stocks of BH-660 hybrid maize seed in a warehouse of an agricultural cooperative in Dangila *woreda*, Amhara region, for 2013 direct seed marketing, May 2013

Source: Authors.

Oromia

In form, the DSM program in Oromia was the closest of those in the three regions to a free-market approach to distribution of seed, with individual seed producers arranging with local traders or cooperatives to market their seed exclusively at a particular selling point. Five seed producers were officially involved in the 2013 DSM in Oromia—ESE, OSE, Pioneer, and two private seed producers, Homa and Anno, that have their seed multiplication farms in East Wollega. All of these suppliers had participated in the 2012 DSM pilot. Early in the implementation of the DSM program in 2013, the seed suppliers and the office of agriculture in each DSM *woreda* would come to an agreement about the amount of seed each would supply and to which seed-selling location within the *woreda* that the office of agriculture stipulated. For example, in the case of Gobu Seyo *woreda* in East Wollega, the five suppliers agreed to establish 15 selling points at six sites in the *woreda*.¹⁰

Most of the seed producers participating in the Oromia DSM program contracted local traders to locally market their seed. These traders were selected based on their experience, local prominence, and whether they had sufficient storage space for the seed. Some of the sellers in Oromia were farmers who also engaged in trade. Generally, a trader would sell seed for only one producer. However, one seller in Sibu Sire *woreda* reported that he had a contract with both Homa and Pioneer to sell their seed. But he was required to establish two separate premises from which to sell the seed, one for each producer. Local

¹⁰ While ESE, OSE, Pioneer, Homa, and Anno were the five seed producers that agreed at the start of the 2013 DSM program to provide seed for the program, other seed producers later were permitted to sell hybrid maize seed directly to farmers in the Oromia region, particularly in the West Arsi zone. Documentation from the Oromia bureau of agriculture, documentation from our qualitative fieldwork, and the results from our farmer survey show that seed was sold in the DSM program *woredas* by several other seed producers, including Nonno, Alemayehu Makonnen Farm, Mekaia, Ethio Vegfru, Hawas Agribusiness, and Huta Wayou Cooperative Union. These sales were specifically noted by our informants to be in the context of the DSM program rather than arrangements made with cooperatives by local WoAs.

cooperatives with which seed producers had established working relationships in the past were also contracted by some producers to sell their seed. This was particularly common in West Arsi. All of the seed sellers, whether individuals or cooperatives, received a commission from the supplier for each packet sold.

The two clusters of *woredas* for the Oromia DSM proved problematic for those suppliers that had production farms only in East Wollega or in that area of the region. The costs of transporting the seed produced there approximately 500 km to West Arsi put these producers at a disadvantage relative to other producers, notably ESE, which has production facilities or seed depots much closer to West Arsi. Those producers facing this challenge stated that they simply absorbed the transport cost, as they felt that if they incorporated those costs into the selling price of their seed, they would make no sales.

SNNP

The modality of DSM implementation in SNNP in both 2012 and 2013 involved WoA in the program *woredas* to a significantly larger extent than in the other two regions. In consequence, some of what potentially might have been innovative in using DSM to distribute seed to farmers was lost in SNNP. Certainly the possibility of DAs' and WoA officials' enjoying a smaller workload under the DSM system of seed distribution than with the system involving their extensive involvement in seed demand assessment, procurement, and distribution was not realized there.

Only two seed producers participated in the 2013 DSM program in SNNP—ESE and SSE. While other producers also operated in the region, their sales were made outside of the DSM framework. It was noted earlier, for example, that considerable seed was sold by Pioneer in 2013 in the same *woredas* in which the DSM program operated. While Pioneer has developed a few local agrodealers in SNNP to sell its seed, it also sells a large amount of seed through WoAs and DAs, as do other non-DSM suppliers.

DSM was implemented in 19 *woredas*. Of these, 9 received some financial support from ISSD-Ethiopia in addition to the SNNP BoA. The support from ISSD-Ethiopia in these *woredas* included conducting DSM awareness-creation activities, providing some financial incentives for the DSM salespersons of the two seed enterprises, and paying the salaries of security guards for the seed stocks. In the other 10 DSM *woredas* in SNNP, the SNNP BoA was solely responsible for the program. For reasons that are unclear, ESE provided seed to farmers in only the 9 *woredas* in which ISSD-Ethiopia provided some assistance. In the other 10 *woredas*, only SSE provided seed to farmers under the DSM program. ESE did not sell seed in these *woredas*.

In all but one *woreda*, there was only a single sales point for each of the seed producers. These selling points were located on or near the compounds of WoA in each *woreda*. If there was an empty room with sufficient space for seed storage on the WoA compound that could be made available to one of the seed suppliers during the period when seed sales were made, the room was used for this purpose. It was not uncommon for the two seed producers to be operating from adjoining rooms in the same building in the WoA compound. If there were no rooms available at the WoA premises, storerooms nearby were acquired for use as sales points and seed storage for the seed producer. Most commonly, WoA rented these facilities for the seed producers, although ISSD-Ethiopia also assisted in this regard in four *woredas*.

The individuals responsible for selling the seed from these sales points in all but one case were employees of WoA who were temporarily assigned to manage seed sales for ESE and SSE under the DSM program. (The one exception was an employee of ESE.) These individuals did not receive commissions from the seed producer on the sales that they made but continued to receive their government salary.

The manner in which farmers obtained seed under DSM in SNNP resulted in most farmers' not interacting with the sales agents. DAs still served as intermediaries between the seed sellers and *kebele* farmers. We were informed that commonly DAs would come to the seed sellers with a list of farmers from their *kebeles* who wished to obtain hybrid seed and the quantities desired. If WoA had provided an authorization coupon to the DA, the DA would provide the cash obtained from the farmers to the local

sales agent, and the sale would be made.¹¹ The DA would then work with the farmers to transport the seed to their farms. As such, DAs are intermediaries in the seed sale, resulting in a “mediated seed marketing” process in SNNP rather than DSM.

Even less than in Amhara and Oromia, the two DSM suppliers in SNNP did not compete for farmers’ business. The only semblance of competition was in those *woredas* where both ESE and SSE provided seed when a DA, in most cases, or a farmer decided that the quality of seed provided by one supplier was lower than that of the other supplier, so the better-quality seed was purchased. Also, timeliness of delivery would gain one supplier more sales than the other seed supplier if the second supplier showed up in the *woreda* with stock later than the first. There was no marketing to speak of by either SSE or ESE in SNNP, with no competition on the basis of price, information about seed use provided to farmers, post-sales support, convenience of the sales point to the farmer’s field, or choice of seed varieties. However, in this regard, SNNP was not very different from Amhara and Oromia in implementing DSM, at least in *woredas* where Pioneer did not also offer seed for sale.

Overall, in SNNP there were not many differences between how hybrid maize seed was supplied to farmers within and outside of the DSM program through DAs and WoAs. Farmers were able to come directly to the DSM seed sellers to acquire seed, but only after having received an authorization note from WoA. In this way, farmers who had not made arrangements with their local DAs earlier in the year to obtain seed were able to use the DSM program to acquire seed at the time of planting. However, in other aspects, the two approaches to the distribution of hybrid maize seed in SNNP were not significantly different.

Design of the Operational Evaluation

A few days after the minister of agriculture had authorized an expansion of the DSM program in 2013, ATA requested that IFPRI, under its Research for Ethiopia’s Agriculture Policy (REAP) project that provides analytical support to ATA, lead an evaluation of the 2013 DSM program.¹² It was recognized that, despite the strong endorsement that the 2011 and 2012 DSM pilot programs had received from stakeholders, the absence of objective and carefully collected evidence on the performance of those pilot programs limited the ability of policymakers to understand and make informed decisions about expanding the DSM program. The aim of the IFPRI-led evaluation was to generate objective evidence on the performance of the DSM program that could be brought into policy-level discussions about whether DSM should be permitted nationally. If it was determined that the program should continue in future years, the evaluation would also provide insights to guide changes in its design so that it could be implemented more effectively and on a larger scale.

The evaluation that IFPRI researchers agreed to design and lead is an operational or formative evaluation. That is, the evaluation is designed in a manner that is meant to promote learning about how well the direct marketing of improved seeds to smallholder farmers in Ethiopia in 2013 worked and how this approach could be made more effective. Operational evaluations of this nature are commonly used where program interventions are nascent, tentative, or still under development (Horton 2011).

This is not an evaluation of the DSM program’s impact or cost-effectiveness. The heterogeneous implementation plans across regions, differing timelines, and the exploratory nature of the DSM program limited our ability to design a rigorous evaluation in the strictest sense. As such, this evaluation does not construct a fully credible counterfactual to understand how farmers who did not purchase hybrid maize seed through the DSM program might have fared relative to farmers who purchased through the program.

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¹¹ One reason reported for the WoA authorization procedure in SNNP was to ensure that complete seed and fertilizer packages were sold to farmers. Apparently, the bureau of agriculture did not want hybrid maize seed sold to farmers who did not have fertilizer to put on that seed.

¹² The REAP project is designed to support the goals of ATA by providing evidence from policy research to assist the government of Ethiopia in achieving its national food security goals. Research under REAP seeks to identify shortfalls in the agricultural sector that constrain productivity and growth, evaluate results of ATA interventions, advise ATA on new policies and solutions to pursue, and prioritize issues in need of intervention. REAP is supported financially by the Bill & Melinda Gates Foundation.

As such, the evaluation is not designed as a randomized controlled trial, nor does it rely on difference-in-difference comparisons, propensity score matching, regression discontinuity designs, or other analytical methods to strictly evaluate impact. Thus, we can only speculate about causality from what are essentially correlations between program interventions and outcomes.

Nonetheless, this evaluation can provide insight into the DSM program's general effectiveness in improving farmers' access to hybrid maize seed. Effectiveness is assessed across several dimensions using intergroup comparisons and qualitative feedback from both participants and nonparticipants in the DSM program. These dimensions are

- price of seed supplied and transaction costs for farmers associated with the purchase of directly marketed seed;
- type, quality, and quantity of seed supplied relative to farmer demand;
- timeliness of delivery;
- information about seed choice and use provided by the seed producers to the farmer; and
- the commercial sustainability of this competitive market-based seed distribution channel.

Data Collection

Data collection for the DSM evaluation involved the following:

- Visits to each of the three regions quite early in the 2013 program to develop a good qualitative understanding of the design and implementation of the program in each
- Surveys of
  - Seed sellers under the DSM program
  - A sample of farmers who use hybrid maize seed both in the DSM woredas and in non-program woredas
  - DAs in the kebeles in which sample farmers resided
  - WoA officials in the woredas in which sample farmers resided
- Open-ended interviews with key stakeholders in the DSM program or in Ethiopia's formal seed subsector more broadly
- A post-planting telephone survey of many of the hybrid maize seed producers in Ethiopia

The initial step of the evaluation was to better understand the design of the DSM program. This information was obtained through consultations in Addis Ababa with the ISSD-Ethiopia country office and the ATA Seed Program. Thereafter, field visits, facilitated by the ISSD regional core seed teams, were made to the three regions by two IFPRI researchers. Discussions were held in the three regional capitals with key participants in the DSM program—BoA officials, seed producers, and ISSD regional core seed team members—followed by field visits to a couple DSM *woredas* in each region. SNNP was visited in the second week of April, Oromia in the fourth week of April, and Amhara in early May. While belg planting had already taken place in SNNP by the time of the visit, the visits to the other two regions occurred a week or two before the maize planting rains arrived but as seed stocks were being delivered to the DSM local seed sellers in each region. Detailed reports about each trip were written and shared with national DSM stakeholders to inform them about how the DSM implementation was progressing.

Having obtained through the field trips a good sense of how the DSM program was designed in the three regions, this information was then used to develop formal questionnaires and a sample selection strategy for the four surveys with seed sellers, farmers, DAs, and WoA officials, respectively.¹³

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¹³ After the questionnaires and the survey sample designs were completed, the primary data collection instruments and field protocol were submitted for human subjects review by IFPRI's independent institutional review board. Approval to proceed with the field research was obtained. All survey respondents were required to give their consent before being interviewed.

- The seed seller survey was administered to 92 individuals who were responsible for selling maize directly to farmers under the DSM program. Almost all seed sellers in SNNP were interviewed, while those in Amhara and Oromia were randomly selected from a list of DSM seed sellers in each of the DSM *woredas*. The sellers were asked about the experience of selling seed under the DSM program and about a range of seed pricing, quality, and marketing issues.
- The farmer survey was administered to 500 farmers who use hybrid maize seed across the three regions—10 farmers who planted hybrid maize seed in each of two *kebeles* in 25 *woredas*. The sample was split between 320 farmers in 16 of the 31 *woredas* in which the DSM program was implemented, and the balance of 180 farmers were located in 9 *woredas* in the same high-potential maize production zones in the three regions in which the DSM program was not implemented. This survey collected information about household characteristics, crop production, maize production, and the farmer's experience in using hybrid maize seed.
- In designing the farmer questionnaire, the questionnaire for the baseline survey of ATA that IFPRI and EIAR administered to 3,000 farmers in 2012 and that was representative of all farmers in Tigray, Amhara, Oromia, and SNNP regions was consulted. This was done to allow the characteristics of the farmers surveyed for the DSM evaluation to be compared to the broader population of farmers in Ethiopia, with specific attention to those who reported growing maize using improved seed, as captured in the 2012 ATA baseline survey. Appendix A of this paper provides a comparison of farmers in the sample for the farmer survey for the DSM operational evaluation to the general population of farmers using hybrid maize seed in Ethiopia using data from the 2012 ATA baseline survey.
- The survey of DAs involved interviewing the DAs primarily responsible for input supply in all of the 50 *kebeles* in which survey farmers were located. The DAs answered questions about the seed demand assessment process, seed supply, and what elements they felt needed to be in place for sustainable and profitable smallholder production of maize using hybrid maize seed.
- The survey with the WoA officials was targeted to the official responsible for input supply in the 25 *woredas* in which the farmer survey was carried out. The questionnaire used was similar to that for the DA survey, although it was less locally focused.

The seed seller survey was carried out by a team of four enumerators between mid-June and early August after hybrid maize seed selling had ended for the *meher* season, starting in SNNP. The other three surveys were done by a larger group of 12 enumerators between the last week in August and the third week in September. The timing for the administration of the farmer questionnaire was so that the maize in the farmer's field would already have tasseled so that some indication of the genetic quality of the hybrid maize seed used could be assessed from the tassel color and the length of the tasseling period for the hybrid maize the farmer produced. The farmer survey was conducted before most sample farmers had harvested their hybrid maize crop, however.

The enumeration of farmers was carried out by four teams, each made up of two enumerators and a supervisor. Each team was responsible for carrying out the farmer and DA enumeration in each selected *kebele*. The questionnaires were pretested by the enumerators in a maize-growing area outside of Addis Ababa prior to their going to the *woredas* selected for the farmer, DA, and WoA surveys.

In addition to the surveys, over the course of the evaluation, open-ended interviews were conducted with higher-level stakeholders in the DSM pilot programs in each region. These stakeholders included the managers of the seed production enterprises, both private and public; regional BoA staff members concerned with farm input supply; and ISSD's regional staff and core group members.

Finally, in October, after the maize seed-selling season for the *meher* 2013 cropping season was over, telephone interviews were conducted with high-level managers of 16 seed producers. Several questions were asked about the amount of hybrid maize seed stocks that the firm had available for the season, the types, and the amount sold. Information was also collected about the assets of the firm, how it multiplied hybrid maize seed, and whether it produced any improved seed for other crops.

Sample Design for Farmer Survey

The population from which the sample of farmers was chosen consists of maize farmers who use hybrid seed in the high-potential maize production areas of Ethiopia where the DSM program was carried out. The farmer survey sample was selected using a stratified, two-stage clustered approach and is representative of the study population. The first stage in choosing the subsample of farmers resident in *woredas* in which the DSM program was implemented consisted of selecting 16 DSM program *woredas*—all 5 rural DSM *woredas* in Amhara, all 5 DSM *woredas* in Oromia, and 6 *woredas* randomly selected from the 19 DSM *woredas* in SNNP.

The first stage in choosing the subsample of farmers who grow maize using hybrid seed, but who do not reside in DSM program *woredas*, involved selecting *woredas* that are adjacent to those where the DSM program was implemented and that had similar agroecological conditions, farming systems, and other attributes. This selection of the control *woredas* for the surveys was done somewhat arbitrarily, ensuring that at least one such *woreda* neighbored each of the clusters of DSM *woredas*—East Wollega and West Arsi in Oromia and the Gurage, Hadiya, and Wolaita Sodo cluster and Sidama cluster in SNNP. Nine such *woredas* in which the DSM was not implemented in 2013 were chosen for a total of 25 *woredas* for the survey overall (Figure 4.3).

Figure 4.3 DSM and control *woredas* chosen for sample selection for DSM program evaluation surveys

Source: Drafted by authors.

Note: DSM = Direct seed marketing. SNNP = Southern Nations, Nationalities, and Peoples.

The second stage in selecting the sample of farmers involved using lists of *kebeles* in each of the 25 *woredas* to randomly select four *kebeles*. Ten farmers who grow maize using hybrid seed were randomly selected in two of these *kebeles*. However, four *kebeles* were selected and placed in order to allow a replacement *kebele* to be used if one or both of the first two chosen *kebeles* proved unsuited for the survey—in particular, if it was found when the enumeration team went to the field that the *kebele* was not located in a high-potential maize production area of the *woreda*.

In the 50 selected *kebeles*, lists of resident farmers who use hybrid maize seed were developed by the supervisors of the small enumeration teams working with the *kebele* DAs and government officials. Ten farmers were then randomly chosen from the list to be interviewed by the survey enumerators.

It was expected that the characteristics of the farmers using hybrid maize seed in both the DSM and the non-DSM *woredas* would be similar since the *woredas* from which the sample farmers were chosen are found in the same agro-ecologies and neighbor one another. Nonetheless, in Appendix B of this paper we present tables to directly compare the characteristics of the sample farmers in the DSM *woredas* to sample farmers in the non-DSM *woredas*. Few differences are seen between these two groups of farmers. We conclude that we can expect that, had the DSM program been implemented in the non-DSM *woredas* used to select the subsample of control farmers for our survey, those farmers would have engaged with the DSM program in a manner similar to that of the farmers surveyed in the DSM *woredas*.

5. RESULTS FROM THE ASSESSMENT OF THE 2013 DIRECT SEED MARKETING PROGRAM

In this section of the paper the principal findings of the operational evaluation of the 2013 DSM program are presented. In the first part of the section we consider broad, systemwide issues that the DSM program was designed to address. Thereafter, we consider regional and actor-specific perspectives on the program by providing more detail about how the program was implemented across the three regions. We end this section with a subsection that examines the level of satisfaction with DSM, expressed by actors in the program, obtained through the surveys of seed sellers, farmers, DAs, and WoA officials.

Main Finding

Overall, the 2013 DSM program was successfully implemented in the three regions. Farmers who planted hybrid maize in the DSM *woredas* expressed quite high levels of satisfaction with the seed they were provided and how it was provided. The program was effective in providing hybrid maize seed to farmers.

Where it can be strongly criticized, however, is in the degree to which competition was fostered between seed producers participating in the program and in the provision of information to farmers about the use of hybrid maize seed and how the production and profits derived from its use might be maximized. Although, as was noted earlier in this paper, there are several dimensions related to hybrid maize seed marketing on which an individual seed producer could choose to differentiate itself from other producers, such efforts were rare. In most DSM *woredas*, different producers placed for sale seed for the same hybrid maize types at the same prices with no advertising and no consumer information provided to the farmer purchasing the seed.

As such, most of the seed producers involved in the 2013 DSM are not full-fledged seed businesses in the sense of organizations that provide goods and services to customers for profit. They are simply producers of seed that, up until now, have simply supplied seed to government agencies. For most, farmers are not their customers. Rather, it is the government agencies that are their customers. Consequently, it has been those government agencies that have performed the important business functions of marketing the seed to the farmers who will plant it, including providing the information that farmers need to make good use of it.

DSM presents a useful opportunity to force Ethiopian seed producers to become marketers of the seed that they produce. MacRobert, in the preface to his guide to seed business management in Africa, observes that for any seed business, “the first and foremost strategy to formulate is the marketing strategy, for without a market, a company cannot be sustained” (2009, xv). The experience of the DSM program in 2013 reveals that most Ethiopian seed producers fail on this score. Although some seed sellers in Oromia, in particular, took some initial small steps to market their seed to win some market share, much more effort by the seed producers and greater incentives for local seed sellers are needed if most Ethiopian seed producers are to succeed as seed businesses within a free market in which seed is directly marketed to farmer-customers. By the same token, the government of Ethiopia must also withdraw itself from the hybrid maize seed market to some degree so that seed producers view farmers, and not government, as their customers. Doing so will force seed producers to focus more on the needs of the farmers while government simply facilitates the seed sales between producers and farmers by providing a conducive environment in which seed producers will market their seed to farmers.

Detailed Findings

Seed Producers Involved in DSM

The DSM program provided seed from a broad range of producers and made it locally available to farmers on commercial terms. Table 5.1, constructed from farmer survey data, shows that ESE was the largest supplier of seed to both DSM and non-DSM *woredas*. However, ESE’s share in the DSM *woredas*

was considerably less than it was in the other *woredas*, particularly in Amhara and SNNP. Pioneer Hi-Bred shows a somewhat larger share of plots planted with its seed in the DSM *woredas* than in the non-DSM *woredas*, suggesting that the DSM program enabled hybrid maize growers better access to Pioneer seed, particularly in Amhara.

Table 5.1 Maize producers supplying to sample farmers, maize plots planted with particular hybrids of particular seed producer, and percentage of plots

Maize producer and hybrid	All		Amhara		Oromia		SNNP	
	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM
Ethiopian Seed Enterprise	28.9	37.3	37.2	53.8	31.6	33.3	19.0	26.5
BH-540	9.7	14.3	20.7	16.9	7.5	21.4	2.2	2.9
BH-543	3.6	1.8	0.8	—	9.0	4.8	0.7	—
BH-660	15.6	20.7	15.7	35.4	15.0	7.1	16.1	23.5
South Seed Enterprise	15.3	11.5	—	—	0.8	3.6	43.1	32.4
BH-540	5.1	7.8	—	—	—	3.6	14.6	20.6
BH-543	—	0.5	—	—	—	—	—	1.5
BH-660	10.2	2.8	—	—	0.8	—	28.5	8.8
Oromia Seed Enterprise	12.5	11.1	—	—	36.1	26.2	0.7	2.9
BH-540	3.3	6.0	—	—	9.8	13.1	—	2.9
BH-543	4.1	2.8	—	—	12.0	7.1	—	—
BH-660	4.3	2.3	—	—	12.0	6.0	0.7	—
Amhara Seed Enterprise ^a	8.7	7.8	27.3	26.2	0.8	—	—	—
BH-540	4.9	1.4	15.7	4.6	0.8	—	—	—
BH-660	3.8	6.0	11.6	20.0	—	—	—	—
Pioneer Hi-Bred	26.6	18.4	28.9	1.5	14.3	21.4	36.5	30.9
PHB-3253 (<i>Javi</i>)	11.0	6.0	28.1	—	0.8	—	5.8	19.1
PHB-30G19 (<i>Shone</i>)	12.0	9.2	0.8	—	7.5	19.0	26.3	5.9
Other producers	7.9	13.8	6.6	18.5	16.6	15.6	0.7	7.3
BH-540	0.3	6.6	0.8	—	0.8	12.0	—	5.9
BH-543	0.8	0.5	—	—	2.3	1.2	—	1.5
BH-660	5.7	6.9	5.8	18.5	9.8	2.4	0.7	—
Plots (<i>n</i>)	391	218	121	65	133	85	137	68

Source: Authors, farmer survey (2013).

Note: DSM = direct seed marketing SNNP = Southern Nations, Nationalities, and Peoples. Dashes indicate no cases. Columns headed “DSM” contain statistics from farmers in survey sample resident in *woredas* where DSM program was carried out in 2013. “Non-DSM” columns are for those farmers who produce hybrid maize but do not live in DSM program *woredas*. Only most common hybrids are listed. Totals for each producer may exceed the sum of the hybrids listed if they also sold less-commonly planted hybrids. Other producers included Anno, Homa, Yimam, Ayehu Zingini, Ethio Agri-CEFT, Merkab Union Cooperative, Alemayehu Makonnen Farm, Meki Batu, Beyene Mekonnen, and some unspecified producers. ^a Amhara Seed Enterprise (ASE) did not participate in the DSM program. Farmers in DSM *woredas* reporting having planted ASE seed likely reflects their having obtained ASE seed through seed distribution channels other than the DSM program.

It can be seen in Table 5.1 that DSM-participating seed suppliers were not the only producers who sold seed to farmers in the DSM *woredas*. ASE, which elected not to participate in the 2013 DSM, provided the seed that was used on more than a quarter of the hybrid maize plots among sample farmers in the DSM *woredas* in Amhara. Some of the producers listed in the “Other producers” category of the table similarly provided seed to farmers in DSM *woredas* without being part of the program. The availability of this seed in these *woredas* likely results from arrangements made before the DSM program

was in place between the BoAs and these seed producers to supply seed for the 2013 *meher* season to local farmers through local cooperatives.

Access to Hybrid Maize Seed

The farmer survey does not provide strong evidence that the DSM program significantly improved access to seed relative to *woredas* where hybrid maize seed was provided through the agricultural extension system and local cooperatives. Table 5.2 shows characteristics of the transactions through which surveyed farmers acquired hybrid maize seed. The source of the seed across DSM *woredas* in the three regions reflects, if not exactly, the modality used in the regions to implement DSM. In Amhara, cooperatives are the principal source of seed, while in Oromia both cooperatives and seed sellers (traders) are important. In SNNP, most seed was reported to have been obtained from the DA or WoA, even if it was sold at the WoA premises or nearby by the two seed producers involved with the DSM program in SNNP: ESE and SSE.

Table 5.2 Obtaining hybrid maize seed

Characteristics of transaction to obtain hybrid maize seed		All		Amhara		Oromia		SNNP	
		DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM
Obtained seed from:									
	Cooperative	53.4	67.2	88.0	100.0	67.0	81.7	13.3	20.0
	Development agent, farmer training center, or <i>woreda</i> office of agriculture	38.4	26.1	12.0	0.0	9.0	5.0	85.0	73.3
	Seed seller	7.8	6.1	0.0	0.0	24.0	8.3	0.8	6.7
Travel time to location where collected seed (minutes):									
	Mean	47.2	38.0	40.0	24.5	47.1	26.8	53.3	62.7
	Median	30.0	30.0	30.0	27.5	35.0	15.0	30.0	42.5
Trips made to obtain seed (average)		1.4	1.6	1.3	1.3	1.4	1.6	1.5	1.8
Farmers who made more than one trip (%)		31.2	37.2	22.0	20.0	24.0	45.0	45.0	46.7
Paid for seed before collection (%)		33.2	34.6	15.5	3.3	9.0	28.8	68.1	71.7
Paid for seed at collection (%)		65.8	65.4	84.5	96.7	88.0	71.2	31.9	28.3
Farmers (<i>n</i>)		320	180	100	60	100	60	120	60

Source: Authors, farmer survey (2013).

Note: DSM = direct seed marketing.

The mean travel time to the location where the seed was obtained is somewhat higher for farmers in the DSM *woredas* than for farmers in the non-DSM *woredas*. However, the median travel times are more similar between the two groups of farmers, suggesting that there is no programmatic reason for the differences.

A smaller proportion of farmers had to make more than one trip to the location where the seed was obtained in the DSM *woredas* than in the non-DSM *woredas*. The principal reason for having to make more than one trip stated by those farmers who did so was that they had to register for the seed prior to being allocated a stock and taking it home for planting. Almost half of non-DSM *woreda* farmers in Oromia and SNNP made more than one trip. However, a similar proportion of farmers in the DSM *woredas* in SNNP also made more than one trip, suggesting that continued high levels of involvement by DAs and WoA officials in the DSM program there results in a more complicated process for farmers obtaining improved seed.

The timing of payment for the seed shows considerable variation. Most farmers in Amhara and Oromia were able to make payment on collection of their seed. However, in SNNP, most farmers had to prepay for their seed.¹⁴ The sharpest difference in the timing of payment between DSM and non-DSM *woredas* is in Oromia, where far fewer farmers in DSM *woredas* had to prepay for their seed than did farmers in non-DSM *woredas*.

Very few farmers were able to arrange to make payment after collection of the seed. Only three sellers in SNNP reported in the DSM seed seller survey that they had allowed any farmers to obtain seed on the promise of repayment shortly thereafter. No sellers in Amhara and Oromia sold on credit. There was no input credit scheme available to farmers in 2013 to assist them with purchasing hybrid maize seed.

Timeliness of Supply, Sales Patterns, Carryover Stocks, and Seed of Other Crops Sold

The results presented in Table 5.3 from the survey of seed sellers for the DSM program show that hybrid maize seed was generally supplied in a timely manner. Only a few sellers in SNNP and Oromia reported that they made their first sales of seed after farmers in their area had already started planting. Moreover, most sellers began selling seed within a week of obtaining their first shipment from the producers. The sales period was shorter in Amhara and Oromia than in SNNP. This reflects the belated production of maize in SNNP, which is characterized by quite localized planting times, extending the period during which seed is sold.

The DSM seed sellers restricted their sales to smallholder farmers. The average number of farmers who purchased seed from a seller was slightly less than 2,000 farmers. However, SNNP, which had a sparser network of sellers under the DSM program, had the largest number of farmers per seller. Only a few sales were reported to customers other than smallholder farmers. In Amhara and Oromia, sellers of seed under the DSM program were supposed to restrict their sales to farmers from the kebele in which the sales point was located or neighboring kebeles. This is the pattern we see in the seed seller data in Table 5.3. In contrast, sellers in SNNP—since there were only one or two sellers in each DSM *woreda* in the regions—served all farmers in a *woreda* as well as a few buyers from other *woredas*.

All certified hybrid maize seed sold to farmers in Ethiopia is packaged into 12.5-kg (one-eighth of a quintal) packets. A recurring point of discussion among input supply analysts is whether such large packets of seed, suitable for planting a half hectare plot of maize, are too large for most smallholder farmers, given their small land endowments and cash constraints. Might smaller packets of 1.0, 2.0, 5.0, or 6.25 kg be more suitable? As shown in Table 5.3, the DSM seed sellers estimated that 70 percent of farmers purchased only a single packet of seed. Of these, they estimated that 20 percent would have preferred a smaller seed packet.

However, in discussion with several seed producers, we were informed that smaller seed packets do not make economic sense to produce. Seed producers would have to charge a higher per-unit cost to package seed in smaller bags. As farmers are extremely price sensitive, producers are certain that a farmer would rather make an arrangement with other local farmers to pool their funds to purchase the larger 12.5-kg packet and divide it among themselves than purchase the exact smaller amount the individual farmer requires at a higher per-unit cost. As the sellers' estimates of demand for smaller packets are difficult to verify and producers have an incentive to keep their production simple, it remains to be seen if there is much of a market for smaller packets of seed. This too is a dimension of the marketing of seed that a competitive seed producer could investigate in an effort to build a larger share of the market of farmers using hybrid seed. However, most seed producers are of the opinion that there is little to be gained from doing so as yet.

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¹⁴ It was reported in SNNP that in some *woredas* farmers were asked to make payment directly into the bank account of the seed producer or directly to WoA. When collecting their seed, they presented receipts for these payments to the seed seller as evidence of payment's having been made. These two transactions—payment and seed collection—may well have occurred on the same day—the data are unclear about this point.

Table 5.3 Hybrid maize seed selling in 2013

Characteristics of seed sales	Overall	Amhara	Oromia	SNNP
Reported first seed sales made after maize planting had started locally (% sellers)	5.4	0.0	9.1	8.0
Days between receipt of first seed and first sale (average)	5.0	6.7	5.2	2.2
Maize seed-selling season length (average days)	43	37	39	55
Total hybrid maize seed sales per seller (quintals)				
Average	326.7	255.7	272.4	495.1
Median	201	180	100	333
Individual farmers to whom seed was sold				
Average	1,994	2,146	952	3,210
Median	1,200	1,767	500	1,750
Estimated sales to nonfarmers (nongovernmental organizations, government projects, cooperatives, and so forth) (% of all sales)	6.7	4.1	5.4	11.8
Estimated sales to farmers from <i>kebele</i> in which selling point is located or neighboring <i>kebeles</i> (%)	75.7	85.2	88.1	46.3
Estimated sales to farmers from outside <i>woreda</i> (%)	2.0	0.3	2.7	3.4
Buyers who purchased single 12.5-kilogram packet of seed (%)	70.5	74.9	43.3	77.6
Estimate of those buyers who would have preferred a smaller packet (%)	19.0	13.8	2.6	27.3
Sold improved seed of other crops (%)	33.7	67.6	21.2	4.0
Teff (% of those selling seed of other crops)	93.5	100.0	71.4	100.0
Wheat (% of those selling seed of other crops)	38.7	30.4	57.1	100.0
Haricot bean (% of those selling seed of other crops)	16.1	13.0	14.2	100.0
Other crops (% of those selling seed of other crops)	9.6	4.3	28.5	0.0
Seed sellers (<i>n</i>)	92	34	33	25

Source: Authors, seed seller survey (2013).

Note: SNNP = Southern Nations, Nationalities, and Peoples. Quintal, the standard unit for grain weight used in Ethiopia, is equivalent to 100 kg.

The DSM program primarily focused on hybrid maize sales. About one-third of sellers in the program also sold improved seed for other crops, primarily teff. As shown in Table 5.3, most of these sellers were in the Amhara region, where two-thirds of hybrid maize seed sellers also sold teff seed, with a smaller group also selling wheat seed. No information about the quantities of seed sold for these other crops was collected, however.

Table 5.4 Unsold stocks of seed at end of the 2013 *meher* seed-selling period among DSM program seed sellers

Unsold stocks of hybrid seed at end of selling season (% of total amount of hybrid seed sold)	Overall	Amhara	Oromia	SNNP
BH-540	6.9	8.8	1.4	7.2
BH-543 (sold only in Oromia)	1.8	—	1.8	—
BH-660	5.2	8.9	4.6	2.9
Pioneer Hi-Bred seeds	1.7	0.3	1.3	4.6
Seed sellers (n)	92	34	33	25

Source: Authors, seed seller survey (2013).

Note: DSM = direct seed marketing SNNP = Southern Nations, Nationalities, and Peoples. Dashes indicate no cases.

The local sellers for the DSM program proved quite successful in selling the stocks that seed producers provided them. Table 5.4 shows that for all of the maize hybrids, less than 7 percent of the seed supplied remained unsold at the end of the selling period. Pioneer seed performed the best in this regard.

In the telephone survey of 16 seed producers that was done after the end of seed sales for the 2013 *meher* season, questions were asked about the amount of seed the producer had not sold relative to the amount of seed that it had available for sale at the start of the season. While some producers reported a small carryover stock of less than 5 percent, including Pioneer and Ayehu Zingini, five of the producers interviewed reported carryover stock in excess of 25 percent of the total stock in seed available at the start of the season. Among those producers with high carryover stocks are some parastatal seed producers.

The problem of high levels of carryover stock in the formal seed sector in Ethiopia is not particularly closely related to factors related to making local sales when the seed is made available to farmers. Rather, the high carryover stocks result from problems with the accuracy of seed demand assessments; variability in determinants of seed demand that are not directly related to seed, such as fertilizer, credit, and output market prices; and poor marketing and otherwise insufficient provision of information to farmers who might use the seed—among other factors (Spielman and Mekonnen 2013). However, it is important to recognize that the 2013 DSM program demonstrated that if seed that farmers are familiar with is made locally available, particularly on a cash-and-carry basis, the seed will sell. Through directly marketing seed to farmers, it is expected that producers will supply locally the amount of seed that local farmers effectively demand. The seed suppliers involved in DSM will need to become more knowledgeable about the incentives and constraints local farmers face to accurately gauge local demand for hybrid maize seed from year to year.

Pricing and Sales Commissions

Reducing the price of its seed relative to the price of the seed of its competitors in the local seed market is one of the principal ways that a seed producer can capture a larger share of the market of local farmers. Competition on price is how firms of any sort seek to capture market share, expecting that the reduction in per-unit price will be more than made up by the increase in the number of units sold due to the lower price. However, within the 2013 DSM, the only competition on price between seed producers was between those producing public hybrid seed, the price of which is essentially fixed by the parastatal seed producers at the start of every seed-selling season, and those producing proprietary seed, notably Pioneer Hi-Bred, which is free to set the price of its seed as it judges best.

Yet even in those DSM sales locations where both Pioneer and public hybrids were offered for sale, no changes were made to seed prices during the seed-selling season as an effort to attract customers. Only three surveyed sellers in Amhara reported changing the price at which they sold seed during the course of the seed-selling period—two of them being a change of less than ETB 5.00 per packet. As

shown in Table 5.5, the range in prices by hybrid type varied little across the DSM program—the mean price per 12.5-kg packet for all of the hybrid types does not vary from the median price by more than ETB 10.00 for the five hybrids considered. For the public hybrids, the difference between the mean price and the median price is less than ETB 2.50, confirming that sellers respected the prices set by the parastatal seed producers for the season. However, even for Pioneer Hi-Bred, experimenting with different price levels was not done.

Table 5.5 Hybrid maize seed prices

Characteristics of hybrid seed sales and prices		Overall	Amhara	Oromia	SNNP
Sellers that changed seed price during course of selling season (%)		3.3	8.8	0.0	0.0
Supplier changed sales commission during course of selling season (%)		0.0	0.0	0.0	0.0
BH-540					
Sellers who sold (%)		56.5	70.6	18.2	88.0
Total sales per seller who sold (quintal)					
Average		217	161	290	259
Median		156	141	260	199
Price per 12.5-kilogram packet (ETB)					
Average		274.28	274.89	277.96	271.91
Median		272.00	272.00	272.00	271.90
Sellers that received commission on each sale (%)		55.8	95.8	100.0	0.0
Commission per 12.5-kilogram packet (ETB)					
Average		4.45	4.36	5.10	—
Median		4.37	4.37	5.00	—
BH-543					
Sellers who sold (%)		14.1	0.0	39.4	0.0
Total sales per seller who sold (quintal)					
Average		192.3	—	192.3	—
Median		80	—	80	—
Price per 12.5-kilogram packet (ETB)					
Average		207.00	—	207.00	—
Median		207.50	—	207.50	—
Sellers that received commission on each sale (%)		100.0	—	100.0	—
Commission per 12.5-kilogram packet (ETB)					
Average		4.76	—	4.76	—
BH-660					
Sellers who sold (%)		58.7	50.0	60.6	68.0
Total sales per seller who sold (quintal)					
Average		194	199	107	290
Median		147	150	69	260
Price per 12.5-kilogram packet (ETB)					
Average		188.41	187.49	190.64	187.56
Median		187.50	187.50	189.75	187.50
Sellers that received commission on each sale (%)		68.5	100.0	100.0	0.0
Commission per 12.5-kilogram packet (ETB)					
Average		8.01	10.05	4.46	—
Median		5.00	5.00	5.00	—

Table 5.5 Continued

Characteristics of hybrid seed sales and prices		Overall	Amhara	Oromia	SNNP
Pioneer Hi-Bred seeds					
	Sellers who sold (%)	35.9	41.2	45.5	16.0
P30G19— <i>Shone</i>					
	Pioneer sellers who sold (%)	57.6	—	100.0	100.0
Total sales per seller who sold (quintal)					
	Average	89	—	94	73
	Median	28	—	24	63
Price per 12.5-kilogram packet (ETB)					
	Average	471.07	—	477.29	447.72
	Median	475.00	—	476.50	470.00
Sellers that received commission on each sale (%)		42.1	—	53.3	0.0
Commission per 12.5-kilogram packet (ETB)					
	Average	5.98	—	5.98	—
	Median	5.00	—	5.00	—
P3253— <i>Javi</i>					
	Pioneer sellers who sold (%)	66.7	100.0	26.7	100.0
Total sales per seller who sold (quintal)					
	Average	90	103	30	105
	Median	50	47	12	85
Price per 12.5-kilogram packet (ETB)					
	Average	499.47	506.07	500.25	475.60
	Median	509.17	510.00	501.50	498.00
Sellers that received commission on each sale (%)		27.3	21.4	75.0	0.0
Commission per 12.5-kilogram packet (ETB)					
	Average	7.00	5.96	8.04	—
	Median	6.25	2.50	7.50	—
Seed sellers (<i>n</i>)		92	34	33	25

Source: Authors, seed seller survey (2013).

Note: SNNP = Southern Nations, Nationalities, and Peoples. ETB = Ethiopian Birr. Quintal, the standard unit for grain weight used in Ethiopia, is equivalent to 100 kg. Dashes indicate no cases.

Both seed producers and local seed sellers, discussing this apparent lack of price competition, made the point that price competition actually is going on with the public hybrids; however, it is not apparent dynamically. No producer was willing to set a price for a public hybrid that was higher than that of its local competitors. All asserted that farmers are price sensitive for the same hybrid seed type—they will purchase from whichever producer is selling locally the same BH hybrid at the lowest price. This point was made most clearly by public hybrid producers selling seed far from where the seed was produced and that, in consequence, had incurred significant transport costs in bringing the seed to the local market. These producers were unwilling to add the costs of transport to the local price for the seed they sold in the distant markets for fear they would end up making no sales there at all. All sales would go to whichever producer supplying the local market posted the lowest price for their public hybrid maize seed.

The recognition that farmers are quite sensitive with regard to the price that they pay for seed of the same maize hybrid type, however, does not mean that farmers are unwilling to pay a considerably higher price for hybrid maize seed that they judge to be of superior quality. As has been noted, farmers purchase most of the seed that Pioneer Hi-Bred brings to the market each year in Ethiopia. As shown in Table 5.5, the price for Pioneer seed was around Br 500 per 12.5-kg packet, more than double the price

for BH-660. The national average hybrid maize seed prices for 2012 for Kenya, Malawi, Mozambique, Tanzania, Uganda, and Zambia were between the equivalent of Br 490 (Kenya) and Br 640 (Tanzania) per 12.5-kg packet (Regional Agricultural Input Market Information and Transparency System 2014). Pioneer hybrid seed prices in Ethiopia are at the lower end of this range. In terms of hybrid maize seed price to maize grain price ratios, the average ratios in 2012 for Kenya, Malawi, Mozambique, Tanzania, and Uganda ranged from 4.9 (Mozambique) to 8.4 (Malawi) (Regional Agricultural Input Market Information and Transparency System 2014; Food Security Portal 2014). For Ethiopia, assuming a maize grain price of Br 510 per quintal (100 kg), the seed to grain price ratio in 2013 was about 2.9 for BH-660 and 4.3 for BH-540, while it was about 7.6 for the Pioneer hybrids. While the public hybrids in Ethiopia are priced considerably lower in maize grain terms than hybrid maize seed sold in other countries in the region, prices for the proprietary varieties sold by Pioneer are in line with prices elsewhere. We conclude that, provided the maize hybrids are adapted for their growing conditions and the seed is of good quality, Ethiopian farmers are willing to pay commercial, market-determined prices for hybrid maize seed, similar to what other smallholder farmers in the region pay for hybrid maize seed.

Although there is little evidence of seed producers' competing on the basis of the prices that they set for their seed, the commissions that seed producers paid local sellers in Amhara and Oromia constitute another element of the seed business on which competition could be exercised. Median commissions per seed packet sold were around Br 5 across all hybrid types. However, there was some variation in commissions for BH-660 in Amhara, as is evidenced by somewhat larger differences shown in Table 5.5 between median and mean commissions for this seed in this region than for other hybrid types or other regions. Box 5.1 provides more detail about this case of competition between seed producers on the basis of commissions that the evaluation team observed early in the season in Amhara. Ethio Agri-CEFT maintained a higher sales commission for its BH-660 seed than did most of its competitors. However, we do not know whether this strategy enhanced sales and eliminated carryover stocks for Ethio Agri-CEFT relative to other producers selling seed through the same cooperatives in Amhara, since the seed seller survey collected information about carryover stocks of seed sellers by hybrid type and not by producer.

Box 5.1 Competition between seed producers on the basis of sales commissions

When we made our initial visit to Amhara just as the first seed sales were starting there, it was reported in Debub Achefer *woreda* that Ethio Agri-CEFT was at that time offering sales commissions of ETB 150 (150 Ethiopian Birr) per quintal of seed sold (ETB 18.75 per seed packet) to the cooperatives selling their BH-660 seed under the direct seed marketing (DSM) program. The other suppliers of BH-660 were offering ETB 40 per quintal (ETB 5.00 per seed packet). We were informed that the context for this decision was that Ethio Agri-CEFT had large stocks of BH-660 that was unsold carryover stock from the 2012 season. They urgently wanted to dispose of this older stock.

Quite a bit of discussion among DSM participants and considerable dismay among Ethio Agri-CEFT's competitors ensued. This competitive approach of Ethio Agri-CEFT was felt to be somehow not right. Essentially Ethio Agri-CEFT was paying cooperative employees to direct farmer-customers to the stocks of Ethio Agri-CEFT BH-660 that they had in their storerooms and not to the BH-660 stocks of Ethiopian Seed Enterprise, Ayehu Zingini, or other producers that were stacked next to those of Ethio Agri-CEFT. Moreover, the benefits of the higher commission went solely to the cooperative selling Ethio Agri-CEFT's seed: farmers received no direct benefit from the higher commissions Ethio Agri-CEFT offered.

However, in spite of the generally negative light in which this approach was viewed by DSM stakeholders in Amhara, Ethio Agri-CEFT maintained these commission rates into the selling season. The data on sales commissions in the seed seller survey show that, of the other seed producers in Amhara, only Ayehu Zingini matched the higher commission paid to sellers by Ethio Agri-CEFT, and then only in selected *woredas*.

Source: Authors, field notes from DSM evaluation (2013).

The approach that Ethio Agri-CEFT took in Amhara (Box 5.1) provides a useful case study for considering how the objectives of DSM can best be achieved. Successful competition for market share may not result in direct benefits for the individual buyer, as in this case. However, such competitive practices will strengthen the business of the seed producer employing them, enabling it to continue to supply through the market the improved seed demanded by farmers and contributing to a stronger formal seed sector in Ethiopia.

Marketing and Provision of Information about Hybrid Maize

Seed sellers were asked about the degree to which they engaged in seed-marketing efforts of any sorts and how the producers of the seed they sold supported them in this regard. As has been alluded to, most sellers or producers engaged in virtually no advertising or provision of information to their potential customer-farmers. This is shown in Table 5.6. The most exceptional of the sellers might have put up a signboard or poster, as shown in Figure 5.1. However, most simply relied on word of mouth and the efforts of local agricultural extension staff to direct customers to their selling points.

Table 5.6 Marketing of hybrid maize seed

Characteristics of hybrid seed marketing	Overall	Amhara	Oromia	SNNP
Supplier provided training to seller on how to advise farmers about use of seed (% of sellers)	18.5	5.9	45.5	0.0
Supplier provided training to seller on how to manage seed stocks in store (% of sellers)	20.7	11.8	45.5	0.0
Supplier provided commercial signboard to seller to advertise seed (% of sellers)	6.5	0.0	15.2	4.0
Supplier provided to seller pamphlets about seed use to distribute to farmers (% of sellers)	9.8	0.0	24.2	4.0
Supplier advertised using radio or posters (% of sellers)	8.7	17.6	3.0	4.0
Sellers who planted one or more hybrid maize seed demonstration sites (% of sellers)	10.9	2.9	15.2	16.0
Number of sites (average)	6.6	4.0	2.0	13.0
Number of varieties demonstrated (average)	3.1	1.0	2.6	4.2
Supplier received support from seed producer for demonstration sites (% of sellers)	4.3	2.9	3.0	8.0
Seed sellers (n)	92	34	33	25

Source: Authors, seed seller survey (2013).

Note: SNNP = Southern Nations, Nationalities, and Peoples.

Figure 5.1 Photographs of direct seed marketing selling points in East Wollega, Oromia, May 2013

Source: Authors.

Information was collected about which seed producers supported the local sellers in these different dimensions of marketing the seed. The results show that no one producer was consistent across them all—sellers noted that ESE, OSE, and a couple private producers advised them on proper seed storage and on the content of messages to convey to farmers on proper seed use; ESE and Homa provided commercially printed business signboards to some sellers; SSE provided pamphlets for farmers at some selling posts; Pioneer was the best at supporting sellers in mounting demonstration plots. However, as is evident by the low numbers in Table 5.6, overall most sellers did not receive these marketing support services from seed producers.

There are a couple of reasons that account for this lack of attention to the marketing side of selling seed in the DSM *woredas*. First, as has been highlighted several times, marketing to farmers has not been a part of the business model of seed producers in Ethiopia. The principal customers for seed producers up until now has been government and, secondarily, agricultural cooperatives. Advertising to ensure that farmers are aware of the hybrids that seed producers have on offer and how best to use them has not been required until now with the start of the DSM program.

Second, with the essentially fixed price regime for the public hybrids, the costs of marketing are not taken into account in setting the prices. Rather, the parastatal seed producers reported that the cost of producing the seed for each hybrid is the basis that they use for setting the price of seed for each public hybrid, with some limited allowance for covering the costs of transport from the producer's premises to local sales points. Of the several informants who discussed how the price for the public hybrids is set by the parastatal seed producers, none mentioned that the costs of marketing, of establishing local demonstration plots to allow farmers to compare the performance of available hybrids, or of otherwise providing information to farmers so that they can make an informed choice as to which hybrid seed to purchase were factored into the price calculation. If DSM is to become an important mechanism for distributing improved seed in Ethiopia and if the sales price for public hybrids will continue to be regulated closely by the parastatal seed producers, allowance for marketing and information provision costs must be factored into those prices. The public hybrid prices set by the parastatal producers likely are now too low to cover the costs that producers and local sales agents incur to market them properly to farmers. Those seed prices certainly appear to be too low to provide much incentive for such marketing efforts.

Finally, in both SNNP and Amhara, effectively the same hybrid type from different producers was sold on the same premises. (In SNNP, the seed was sold by different agents managing the stocks of ESE and SSE, respectively, but often in adjoining offices.) This constrained marketing efforts by the seed seller for any one seed producer. First, there is a free-rider problem. If a producer or local seller markets a particular maize hybrid seed type that a competitor is selling in the same location, unless the marketing effort diminishes the attractiveness of the seed for the competitor in some way, the competitor will derive some benefit from those marketing and other promotional efforts for the hybrid at no cost to itself. So there are limited incentives to market one's seed if seed of the same type and quality produced by competitors is available for sale at the same location. Second, particularly in Amhara, it was expected that the employees working for the cooperatives where the DSM seed was sold would operate in an impartial manner. Employees working to specifically market the seed of one producer at the expense of the other producers with seed stocked at the same cooperative would go against this expectation. However, the discussion above about the higher commissions paid by Ethio Agri-CEFT in Amhara represents an effort by one producer to induce some degree of partiality on the part of the cooperative employees in this regard.

Seed Quality

One of the medium- to longer-term goals of the DSM program is to improve the quality of the seed that farmers obtain from seed producers by encouraging competition between producers on the basis of seed quality. The important investments that the government of Ethiopia has made in regulatory systems for the formal seed subsector in recent years were made primarily to ensure that quality seed was produced and producers were held accountable for any quality deficiencies in the seed.

Table 5.7 provides results from the survey of seed sellers on the quality problems that they observed in the seed that they sold. An important challenge in recent years with hybrid maize seed quality in Ethiopia has been the marketing of carryover stocks of seed two or three years after the seed was produced. As the germination rate of seed declines over time and pests and moisture damage may occur in storage, farmers are increasingly skeptical of being offered old seed. In 2011, there was significant carryover seed of BH-660 due to the late onset of the planting rains, forcing farmers to choose to plant medium-duration varieties of hybrid maize, like BH-540, rather than long-duration BH-660. Some of this carryover stock was still in the formal seed sector at the start of the 2013 *meher* season.

However, the seed seller survey results reported in Table 5.7 show that carryover seed was not as prevalent as one might have expected. Less than a quarter of sellers reported receiving anything but fresh seed that was produced in 2012 for planting in 2013. Moreover, of the carryover seed marketed through the DSM sellers, more sellers reported receiving stocks of old BH-540 seed than old BH-660. Of those who received old seed, about a third of the stocks of seed that they received was carryover seed.

The sellers were also asked about any customer-farmers' observing at the time of purchase or reporting back to them problems with the seed. Here too quality problems were lower than one might have expected. Depending on the problem, between 19 and 30 percent of sellers had farmers who reported problems with germination, small or misshapen seed, or insect damage. The number of complaints of these sorts that each seller received were typically a few dozen, which is a small proportion of the average of slightly less than 2,000 customers each DSM seed seller served. Slightly more than 7 percent of sellers, primarily in Amhara, reported that farmers had complained to them of seed packaging problems that resulted in moisture damage to the seed. However, the number of complaints of this sort received by each of these sellers was quite high—in the hundreds—indicating that batches of poorly package seed were distributed in these cases.

Table 5.7 Quality of hybrid maize seed sold

Seed quality characteristics	Overall	Amhara	Oromia	SNNP
Only sold fresh seed produced in previous 12 months (% of sellers)	78.3	67.6	81.8	88.0
BH-540 (% of seed sellers reporting carryover seed of all reporting carryover)	55.0	72.7	16.7	66.7
Estimated % of stock that was carryover	33.1	31.7	50.0	30.0
BH-660 (% of seed sellers reporting carryover seed of all reporting carryover)	40.0	27.3	66.7	33.3
Estimated % of stock that was carryover	35.5	39.3	35.2	25.0
Other seed varieties (% of seed sellers reporting carryover seed of all reporting carryover)	20.0	9.1	21.1	33.3
Sellers who had farmers reporting germination problems with seed sold (% of sellers)	23.9	11.8	27.3	36.0
Mean number of farmers complaining, for sellers that received complaints about germination problems	19.4	11.8	16.9	26.6
Sellers who had farmers reporting small or misshapen seed (% of sellers)	19.6	29.4	15.2	12.0
Mean number of farmers complaining, for sellers that received complaints about small or misshapen seed	59.7	38.6	48.0	149.7
Sellers who had farmers reporting insect-damaged seed (% of sellers)	29.3	41.2	24.2	20.0
Mean number of farmers complaining, for sellers that received complaints about insect-damaged seed	17.1	25.5	6.7	10.2
Sellers who had farmers reporting packaging problems (% of sellers)	7.6	17.6	3.0	0.0
Seed sellers (n)	92	34	33	25

Source: Authors, seed seller survey (2013).

Note: SNNP = Southern Nations, Nationalities, and Peoples.

Farmers were also asked about hybrid maize seed quality issues that they experienced in 2013. These results are presented in Table 5.8, disaggregated by hybrid type and seed producer, and provide a different perspective on seed quality, given that these numbers include farmers who experienced a problem with the quality of their seed but may not have reported it to the seller of the seed. We see higher levels of small and misshapen seed problems with BH-540 across producers. However, insect damage was seen more frequently in ESE hybrids than in those of other producers. But different prevalence in insect damage was seen for different hybrids for the same producer—see SSE and Pioneer.

Table 5.8 Problems with hybrid seed by producer, percentage reported by farmers using seed

Hybrid seed type and producer	Misshapen seed	Insect damage	Poor germination	Other ^a	Multiple tassel colors	Tasseling Period, days, average
BH-540						
ESE (<i>n</i> = 60)	36.1	42.6	9.8	11.5	20.0	18.4
OSE (<i>n</i> = 21)	28.6	14.3	0.0	4.8	14.3	19.6
SSE (<i>n</i> = 30)	26.7	46.7	16.7	3.3	20.0	20.0
ASE (<i>n</i> = 18)	22.2	22.2	22.2	0.0	44.4	16.0
Other producers ^b (<i>n</i> = 13)	7.7	38.5	30.8	0.0	23.1	19.0
BH-543						
ESE (<i>n</i> = 9)	11.1	33.3	11.1	22.2	55.6	18.9
OSE (<i>n</i> = 15)	20.0	26.7	6.7	0.0	20.0	17.3
BH-660						
ESE (<i>n</i> = 99)	23.2	34.3	15.2	13.1	45.5	20.0
OSE (<i>n</i> = 20)	10.0	5.0	20.0	15.0	10.0	22.1
SSE (<i>n</i> = 37)	16.7	21.4	4.8	9.5	18.9	22.2
ASE (<i>n</i> = 24)	25.0	12.5	20.8	4.2	54.2	16.0
Other producers ^b (<i>n</i> = 33)	31.4	25.7	2.9	8.6	33.3	21.4
Pioneer Hi-Bred						
PHB-3253 (<i>Javi</i>) (<i>n</i> = 46)	34.8	34.8	8.7	8.7	34.8	17.9
PHB-30G19 (<i>Shone</i>) (<i>n</i> = 43)	25.6	2.3	9.3	9.3	14.0	19.2

Source: Authors, farmer survey (2013).

Note: ESE = Ethiopian Seed Enterprise; OSE = Oromia Seed Enterprise; SSE = South Seed Enterprise; ASE = Amhara Seed Enterprise. ^a Other problems include unexpected seed color, broken seed, or mixed seed from several varieties. ^b Other producers include Anno, Homa, Yimam, Ayehu Zingini, Ethio Agri-CEFT, Merkab Cooperative Union, Meki Batu, Beyene Mekonnen, and any unspecified producers.

The last two columns in Table 5.8 give some insight into the genetic quality of the hybrids of each producer. Generally a high-quality maize hybrid will not display much variation in the color of the tassel, and the tasseling period will be relatively well defined. Particularly the hybrids of ESE and ASE were reported by farmers to show considerable variation in tassel color. However, this does not apply to all hybrids that they produce, as the BH-540 that ESE produced was observed to have a consistent color by most farmers who used the seed. Similarly, the *Javi* hybrid of Pioneer was observed to have multicolored tassels, while the Pioneer *Shone* hybrid had much less variation. Most hybrids across the different producers had similar-length tasseling periods; only farmers who grew ASE hybrids reported somewhat shorter tasseling periods than did farmers using seed from other producers.

In general, the reasons for the differences in quality seen between producer or between hybrid type cannot be specified at the level of the analysis here, so it is difficult to draw too many lessons from Table 5.8. Nonetheless, it is clear that ensuring seed quality remains an important challenge for Ethiopian hybrid maize seed producers. Fostering competition between producers on the basis of the quality of the seed they offer farmers is an appropriate ambition for the DSM program in coming years.

Satisfaction of Participants with the DSM Program in 2013

When DSM was designed, one criterion on which the success of the program was to be assessed as put forth by the national stakeholders in the program was the satisfaction of participants in the program. Consequently, qualitative questions were asked in the four surveys about the satisfaction of farmers, seed sellers, DAs, and WoA officials, respectively, with the provision of hybrid maize seed through the DSM program or otherwise. Overall, quite a high level of satisfaction was expressed.

Survey farmers ranked the quality of their experience using hybrid maize seed in 2013 on a five-point scale—*very good, good, average, bad, very bad*. Some of the results are presented in Table 5.9. Program-wide, the two areas where farmers resident in DSM program *woredas* ranked their experience better overall than did hybrid maize seed-using farmers elsewhere was in the quality of the seed that they obtained and in the timeliness of seed supply. For the other aspects considered, there was not a defined difference in the quality of the experience of the two groups of farmers. For most aspects, a majority of farmers viewed their experience in 2013 to be good or very good. As might be expected, of the aspects reported in Table 5.9, only the price of seed was seen to be negative, with farmers in Amhara being particularly unenthusiastic about this aspect of hybrid maize seed use. Moreover, farmers in non-DSM *woredas* viewed the seed prices that they paid more negatively than did farmers in the DSM program *woredas*.

Table 5.9 Satisfaction with use of hybrid maize seed in 2013, proportion of farmers stating

Dimension of satisfaction	All		Amhara		Oromia		SNNP	
	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM
Quality of seed supplied								
Good or very good (%)	70.0	59.4	65.0	68.3	74.0	68.3	70.8	41.7
Bad or very bad (%)	9.1	20.0	9.0	20.0	9.0	11.7	9.2	28.3
Amount of seed obtained								
Good or very good (%)	68.4	66.1	70.0	70.0	79.0	70.0	58.3	58.3
Bad or very bad (%)	2.8	6.7	3.0	6.7	2.0	6.7	3.3	6.7
Varietal choice in seed								
Good or very good (%)	62.5	58.9	67.0	51.7	72.0	66.7	50.8	58.3
Bad or very bad (%)	9.7	10.6	5.0	8.3	11.0	13.3	12.5	10.0
Price of seed								
Good or very good (%)	15.0	7.8	4.0	5.0	31.0	6.7	10.8	11.7
Bad or very bad (%)	52.8	65.0	78.0	80.0	37.0	60.0	45.0	55.0
Sufficient information to make choice								
Good or very good (%)	67.5	71.7	55.0	61.7	77.0	80.0	70.0	73.3
Bad or very bad (%)	0.9	2.2	1.0	3.3	2.0	1.7	0.0	1.7
Timeliness of seed supply								
Good or very good (%)	84.7	71.7	86.0	78.3	85.0	80.0	83.3	56.7
Bad or very bad (%)	2.5	11.1	2.0	6.7	2.0	8.3	3.3	18.3
Convenience of location where obtained seed								
Good or very good (%)	49.1	51.1	50.0	55.0	62.0	63.3	37.5	35.0
Bad or very bad (%)	17.8	12.2	18.0	10.0	13.0	6.7	21.7	20.0
Farmers (n)	320	180	100	60	100	60	120	60

Source: Authors, farmer survey (2013).

Note: SNNP = Southern Nations, Nationalities, and Peoples; DSM = direct seed marketing. Responses for *average* and *do not know/not applicable* are not reported.

With regard to the experience of the seed sellers in the DSM program, those interviewed were asked if they would be willing to sell seed again under a similar program. Almost 90 percent of the seed sellers interviewed reported that they would be willing to participate in the DSM program in the future, suggesting that in many ways the local implementation of DSM is on the right track.

However, as shown in Table 5.10, 40 percent of the sellers in SNNP did not wish to continue their role in the DSM program in future years. Only one other seller in the program—one in Amhara—expressed the same sentiment. The poor experience of the SNNP sellers is certainly linked to the modality used in SNNP to sell the seed to farmers. The sellers were, at best, temporarily transferred from their duties within WoA to sell seed under the DSM program or, at worst, simply assigned DSM duties in addition to their other work. Consequently, these sellers complained of overwork. Commissions were paid to sellers in other regions for every seed packet sold. Sellers in SNNP did not have this incentive. Although likely all seed sellers had some level of responsibility and accountability for the seed stocks and sales receipts that they managed, several sellers in SNNP felt that the level of personal financial risk that they had to shoulder in selling seed under the DSM program was excessive. Several reported having to cover from their own pockets any losses that were incurred in the local business under DSM of the producer for whom they sold seed. The manner in which seed sellers handled their role in the SNNP DSM program will need to be changed in the future if the program is to be sustainable and expand in the region.

Table 5.10 Seed sellers who do not want to sell seed in future years of the DSM program

Reasons for not desiring to continue participation in DSM	Overall	Amhara	Oromia	SNNP
Based on experience with DSM in 2013, not interested in participating in DSM in 2014 (% of sellers)	12.0	2.9	0.0	40.0
Report heavy workload as reason (% of those unwilling to sell seed in 2014)	63.6	—	—	70.0
Report high personal financial risk	45.5	—	—	50.0
Report poor incentives	63.6	—	—	70.0
Report poor seed quality	18.2	100.0	—	10.0
Seed sellers (n)	92	34	33	25

Source: Authors, seed seller survey (2013).

Note: SNNP = Southern Nations, Nationalities, and Peoples; DSM = direct seed marketing. Dashes indicate no cases.

The agricultural extension service of the government has an important role to play in the current primary way in which hybrid maize seed is supplied to farmers. One of the benefits of the DSM program was that the work that the extension staff must do in procuring seed for local farmers should be significantly less under the DSM program. Although the importance of the extension staff for the implementation of the DSM program in 2013 varied from region to region, both DAs and WoA officials in those *woredas* in which the DSM was implemented were actively involved in the program. In the surveys of these extension officers, they were also asked what were the main advantages and disadvantages of DSM that they observed or expected. The results from the DA survey are presented in Table 5.11, while those of the WoA officials are presented in Table 5.12.

Table 5.11 Development agents' opinions of advantages and disadvantages of DSM

Aspects of attitude towards DSM	Overall	DSM	Non-DSM	Amhara	Oromia	SNNP
Knew about DSM program (% of DAs)	61.7	72.4	44.4	62.5	46.2	72.2
Would want next year to allow seed producers to directly sell seed to farmers in <i>kebele</i> (% of DAs)	86.0	90.6	77.8	87.5	81.2	88.9
Most mentioned advantage of DSM	More seed choice	More seed choice	More seed choice	Lower prices through competition	More seed choice	More seed choice
Second most mentioned advantage of DSM	Lower prices through competition	Lower prices through competition	Lower prices through competition	More seed choice	Better quality through competition	Lower prices through competition
Most mentioned disadvantage of DSM	Expect that bad seed will be sold	Expect that bad seed will be sold	Expect that bad seed will be sold	No compensation for bad seed	Expect that bad seed will be sold	Expect that bad seed will be sold
Second most mentioned disadvantage of DSM	No compensation for bad seed	No compensation for bad seed	No compensation for bad seed	Expect that bad seed will be sold	No compensation for bad seed and remote farmers will not get seed	No compensation for bad seed
DAs (n)	50	32	18	16	16	18

Source: Authors, DA survey (2013).

Note: DSM = direct seed marketing; SNNP = Southern Nations, Nationalities, and Peoples; DA = development agent.

Table 5.12 Opinions of the officials of the WoAs about advantages and disadvantages of DSM

Aspects of attitude towards DSM	Overall	DSM	Non-DSM	Amhara	Oromia	SNNP
Knew about DSM program (% of WoA officials)	90.5	100.0	77.8	100.0	75.0	88.9
Would want next year to allow seed producers to directly sell seed to farmers in <i>woreda</i> (% of WoA officials)	96.0	100.0	88.9	100.0	87.5	100.0
Most mentioned advantage of DSM	More seed choice	More seed choice	More seed choice	More seed choice	More seed choice	More seed choice
Second most mentioned advantage of DSM	Lower prices through competition	Save time	Lower prices through competition	Better quality through competition	Lower prices and better quality through competition	Lower prices through competition
Most mentioned disadvantage of DSM	Expect that bad seed will be sold	Expect that bad seed will be sold	Expect that bad seed will be sold	Expect that bad seed will be sold	Expect that bad seed will be sold	Expect that bad seed will be sold
Second most mentioned disadvantage of DSM	No compensation for bad seed	Remote farmers will not get seed	No compensation for bad seed and remote farmers will not get seed	Remote farmers will not get seed	No compensation for bad seed and remote farmers will not get seed	No compensation for bad seed
WoA officials (n)	25	16	9	8	8	9

Source: Authors, WoA survey (2013).

Note: WoA = *woreda* offices of agriculture; DSM = direct seed marketing; SNNP = Southern Nations, Nationalities, and Peoples.

Although the proportion of DAs who were aware of the DSM program in each region was somewhat lower than one might have wished, most DAs viewed direct marketing of seed in their *kebeles* to be a welcome development. The principal advantages seen were increased seed choice and some positive effects from competition. The principal disadvantages stated were a fear that farmers would be sold bad seed without any accountability from the seller.

WoA officials were more aware of the DSM program than were DAs. They also had the opinion that DSM would be a welcome change in the manner in which farmers in their *woreda* obtain improved seed. The principal advantages noted were the same as those mentioned by the DAs, with the addition of their recognizing that there might be some time or workload savings associated with DSM. However, an additional possible disadvantage that they highlighted was that farmers located in more remote areas would see a reduction in the access that they have to improved seed.

Issues Facing Seed Producers Engaging in DSM

In this subsection we consider some of the perspectives of seed producers about the DSM program and more generally. This information was obtained through a half dozen individual interviews with general managers or regional managers of seed production firms, both parastatal and private. Further information was obtained through telephone interviews with managerial staff members of 16 seed production firms that were carried out after the end of the seed-selling period.

Among the issues raised through these interviews were the following:

- While the social benefits of the parastatal seed producers' establishing fixed prices for public hybrids are well recognized, most producers felt that this approach increased the financial risks for their businesses. The primary problem with the fixed prices is covering costs of running the seed business other than simply the costs of production. For example, under the DSM program, stocks of seed had to be transported into the field both locally and possibly to DSM program *woredas* several hundred kilometers away. Producers of public hybrids found it difficult to cover the costs of transport, particularly in competing with other producers who had lower costs—notably with ESE, which has a fleet of trucks and several seed depots across the three regions.
- We highlighted earlier that the low prices for these public hybrids may also account for the poor marketing efforts of most Ethiopian seed producers since such costs also would be difficult to cover. However, it also was mentioned that marketing of the public hybrids results in a free-rider problem. If your competitor is selling the same hybrid, it will derive some benefit from your marketing and other promotional efforts at no cost to itself. There is recognition of the value of having proprietary hybrids for building a sustainable and profitable seed business.
- Related to this, the seed producers feel that setting low public hybrid prices is unnecessary. Although farmers are extremely price sensitive, they recognize the economic value of good-quality improved maize seed in terms of greater productivity and a larger marketable surplus. Many interviewees highlighted Pioneer in this regard. Pioneer sells its seed at about double the price of the public hybrids and generally sells all of the seed that it produces every year, so it has low seed carryover costs.
- All seed producers fear carryover stock. The costs of carryover stock are high. Private seed producers can easily go out of business with too much carryover stock. As part of their jobs, managers of parastatal seed firms incur severe reprimands from their political overseers every time large carryover stocks result in unbudgeted allocations of funds to the parastatal seed enterprises to cover the costs of properly storing the carryover seed. Farmers recognize that older seed is of lower quality than fresh seed. There is little that

one can do with old seed that has been chemically treated except destroy it, which costs more money. Carryover stock results from poor assessment of seed demand. Poor assessment of seed demand stems in part from an inadequate understanding of the market. Under a DSM system of seed distribution, producers will not be able to rely on the government to define seed demand for the next cropping season but will need to conduct their own market studies and better understand their farmer-customers in the various maize-growing areas in which they sell seed.

- Little improved seed gets onto the open market and into the hands of traders who are not directly affiliated with seed producers, the agricultural extension service, or cooperatives. Repeatedly, seed producers and extension officials justified the close oversight given to seed sales as necessary to keep the seed out of the hands of illegal traders. Such traders, it was said, would sell the seed to farmers at much higher prices without any accountability for the quality of the seed sold. The role that such traders might play in distributing seeds to farmers who are willing to pay for it at the price the trader asks was not recognized to be of value. Nonetheless, it would seem prudent to explore how traders who are well established in a locale and are well known by farmers in the area—and, as such, have a reputation as honest traders to protect—might be encouraged to market improved seed as part of their broader businesses. Some initial steps of this sort were seen in the DSM program, particularly in East Wollega, Oromia region.
- Seed producers generally felt that there are poor linkages in Ethiopia between crop breeders, seed promotion efforts by government agricultural extension staff, and input suppliers (including seed producers), so the entire system really is not efficient in disseminating promising new hybrids or improved varieties. There is no coordination of these elements to get new, improved seed to farmers on time and in the quantities demanded.
- Some of the complementary services to improved seed supply are deficient. In this regard, seed producers highlighted the need for more attention to what are the determinants of the yield gap for hybrid maize in Ethiopia. Under ideal conditions, the hybrids now provided to farmers can yield 8 to 10 mt/ha. The best farmers will attain yields of 6 mt/ha, while the average farmer using hybrid seed will attain yields of 4 mt/ha. These yield gaps result from inappropriate agronomic recommendations for the production of hybrid maize, including recommendations for the proper hybrid to plant in a particular agro-ecology and the amount and timing of fertilizer application, proper plant populations, and weed and pest control. Better crop management information for farmers is required if production levels close to the potential of the hybrid maize types are to be achieved.
- Seed producers are generally supportive of the seed law that has been put in place in Ethiopia in recent years. The regulations that are being formulated and that have started to be applied to implement the law were found to be generally clear and relatively easy to follow. However, it was noted by informants that the regulators are unable to fulfill their mandated duties of regular field visits and seed testing because they lack the resources to do these tasks effectively and consistently. In consequence, the overall quality of seed in the formal seed subsector suffers.

The post-seed-selling period survey was conducted with most, but not all, hybrid maize seed producers. The total quantity of hybrid maize seed delivered to farmers reported by the 16 firms interviewed was 15,400 mt. Accounting for the sales of producers who were not interviewed, we estimate total hybrid maize seed sales in 2013 of about 16,500 mt, or about one-third of the seed required for the total maize area planted in Ethiopia. Of this amount, less than a quarter was reported sold through the DSM program.

The telephone survey also asked about the capital assets of the producers. ESE is the best capitalized of Ethiopian seed producers with several large seed multiplication farms, several dozen tractors, a half dozen seed-cleaning machines, and two dozen transport trucks. Much of this capital stock reflects its history as the sole seed producer in the country and the legacy of regular government support to cover the costs of its operations. Although no other producer has capital assets that come close to those of ESE, there are a handful of private and parastatal producers that have established a foundation in terms of farms or seed-processing facilities to enable at least some of them to sustain their operations into the future and possibly grow. However, there are also quite a number of seed producers that are undercapitalized, with minimal equipment and limited production capacity. If DSM will become an increasingly important way for improved seed to be distributed in Ethiopia, these firms will face significant challenges in successfully competing with the larger seed-producing firms for market share. It is uncertain whether any of these smaller firms will prove to be viable businesses within a more competitive formal seed sector in Ethiopia.

In spite of the focus of this paper on the commercial production of hybrid maize seed, it bears reemphasizing that most maize farmers in Ethiopia continue to obtain their seed from informal sources, primarily through recycling seed from the previous harvest. As such, there is considerable scope for entrepreneurial seed producers in Ethiopia to significantly expand hybrid maize seed production and distribution. We should expect continued dynamism in the formal seed sector in Ethiopia, particularly for hybrid maize, in the coming decade. While many of the current seed producers may be forced out of existence or merge with other, stronger firms, overall a growing market for hybrid maize seed will lead to an expansion of the formal seed industry in the country.

6. FINDINGS AND RECOMMENDATIONS

This evaluation of the 2013 DSM program sheds light on several questions related to the current structure and operations of the formal seed subsector of the Ethiopian seed system. The broader value of the evaluation is in providing guidance about how the government might strengthen Ethiopian seed systems. It is clear that the evaluation provides insights about the scope for competition among suppliers of improved seed in Ethiopia, the information that must be disseminated with the seed, and the merits and problems associated with a seed system dominated by public seed varieties. In this final section, we provide brief synopses of the issues that must be addressed and describe some of the avenues by which stakeholders can work to move forward on these issues to strengthen and expand Ethiopia's seed system, particularly in the formal subsector.

Role of Parastatal Seed Producers in Hybrid Maize Seed Production

Should parastatals be in hybrid maize seed production at all? Answering this question, while ultimately a policy decision, will require consideration of which components of the public interest are being better served by parastatal seed producers than could be served by private seed producers. The functions of the seed enterprises that serve these components are what would justify their continued existence. Some possibilities include the provision of

- improved self-pollinated crop seed for which there is not a ready market that private seed producers can serve,
- hybrid maize seed to farmers in more remote and marginal areas where private seed producers feel they cannot profitably engage in hybrid seed marketing given the high transaction costs, and
- high-quality parental lines of public hybrid seed varieties for use by private seed producers, as is already being done by ESE.

However, if it is decided that the scope of engagement in seed provision by the parastatal seed enterprises is to be limited, the financing of their operations that are more in the public interest becomes an issue. The current model appears to involve the parastatal seed producers' directly competing with private seed producers in the supply of hybrid maize seed to high-potential maize areas. A model seen in many countries with parastatal seed producers is that the state firms then use the revenue from these commercially viable operations to cross-subsidize or otherwise finance the production of self-pollinated crop seed or the distribution of hybrid maize seed to more remote and marginal areas not reached by private seed producers. However, this cross-subsidization is done at the expense of private seed producers that must compete with the public firms. Often some private firms are crowded out of the market by the public seed enterprises. Would government be willing to provide sufficient operational funding to these parastatal seed enterprises so that they can undertake the operations that are identified to be in the public interest but that do not allow cost recovery? If government will not do so, then the expectation that these parastatals will need to operate in a financially self-supporting manner will lead to crowding out of some private firms and work against the interests of putting in place a formal seed subsector in Ethiopia that operates on market principles.

Extension of Information to Farmers

The dominance of old public maize hybrids in the system reflects in part the lack of information about new varieties being made available to farmers. Farmers appear to remain content using traditional maize hybrids and production practices because no other options are presented to them. Setting aside the issue of a lack of choice in hybrid maize types, in general, farmers also do not have sufficient information about alternative hybrids to make an informed choice about the variety of hybrid maize that they plant when a

choice in varieties may be available. This situation reflects in part the strong reliance on the government's seed demand assessment and procurement system that is the principal manner in which Ethiopian farmers obtain hybrid maize seed.

The evaluation of DSM provides insights about the information that flows to farmers with the seed. The sustainability of a market-driven seed subsector requires that the customer be informed and, in consequence, be responsive to changes in the seed varieties on offer from seed producers. Similarly, information is required about how best to produce maize using hybrid seed. The incentive to use hybrid maize seed stems from the prospects of increased productivity and income that the seed offers. Maximizing this potential requires appropriately presented information to farmers about how they should plant the seed and manage and protect the crop to maximize production. Scaling up DSM without a significant increase in the information provided about hybrid seed varieties and their use is unlikely to prove sustainable.

Optimizing Public Hybrid Maize Varieties in a DSM System

The evaluation of DSM also provides insights into the strengths and weaknesses of having a hybrid maize seed system dominated by public hybrid varieties. The dominance of public seed varieties whose multiplication effectively requires all producers to sell seed at low set prices sharply limits one of the principal ways in which producers might compete for customers to the benefit of those farmers. At the same time, the success that Pioneer Hi-Bred has enjoyed in Ethiopia in selling its proprietary hybrid maize varieties at a much higher cost provides an important and insightful contrast as a model of DSM. The higher price at which Pioneer is able to sell its seed enables it to do a somewhat better job than other producers in providing information to farmers in the field and other support services to those farmers growing its seed since Pioneer is able to cover the costs of providing those services in the price of its seed. Some of the weaknesses of using a set price for the public hybrid varieties are brought into consideration through this evaluation.

Another aspect of this is the efficiency of the process by which the results of the work of seed breeders in Ethiopia and the region eventually is made available to farmers as sufficient quantities of new and better crop varieties. As was noted, currently, the system does not operate efficiently. Few new hybrid maize varieties are being popularized. Most observers view the predominant public maize hybrid varieties, BH-540 and BH-660, as old and ready to be improved on using new germplasm. However, delinking the marketing of new public varieties from their production and distribution by considering only the costs of seed production in setting seed prices results in inadequate marketing and popularization efforts and, consequently, limited markets for these new varieties, with most remaining on the shelves of the maize breeders who produced them. The evaluation of DSM provides insights into this area of how best to manage how public varieties of seed are distributed to farmers.

Limits to the Scope of the Evaluation

Finally, there are several important components of how the Ethiopian seed system might best be strengthened to support the transformation of agriculture in the country on which this operational evaluation of the DSM program is unlikely to provide much new insight.

A central element in the strengthening of the formal subsector of Ethiopia's seed system is putting in place an adequate regulatory framework for seed producers so that farmers using their seed have strong assurances about the likely performance of that seed. In the course of the evaluation, information was collected about any quality problems that users of hybrid seed in 2013 experienced and how those problems were addressed. However, the evaluation generated little insight about issues like the guarantees a farmer should obtain from a seed producer or how any dissatisfaction on the part of the farmer is documented and addressed. In this regard, it should be highlighted that there is an element of farmer education related to the regulatory framework on seed quality—farmers will need to be certain of the rights that they have with regard to the quality of the seed that they purchase and what recourse for

compensation they have if they find that the quality of that seed when planted is not as good as advertised. This is of consequence if DSM is to become increasingly important as the modality through which farmers obtain improved seed—reiterating the need for increased flows of information to farmers if DSM is to be sustainable. The DSM program provides an important platform through which the seed regulatory systems can be better established in Ethiopia. Should the DSM program continue and possibly even expand in future years, attention should be paid to its design of how regulatory oversight of the enforcement of seed quality standards will operate as a component of the program. However, for now we can speak to this issue only in theoretical and qualitative terms.

Second, maize, although an important crop in Ethiopia, is only one of several that are critical to the food security of Ethiopian households. Most of the other crops, such as wheat and teff, are self-pollinated, and no hybrid seed is produced. The lessons from hybrid maize seed marketing for marketing of these other crops will provide only indirect insights. We expect that any constraints observed in the direct marketing of hybrid maize seed will also apply to these other crops. However, because of the more challenging business model for these other crops, it is likely that the other crops will face more binding constraints to direct marketing than does hybrid maize. The public interest is served by enabling farmers to obtain seed for self-pollinated crops that has been selected on the basis of quality, so providing such seed is an important element with which stakeholders in the seed system of Ethiopia must grapple. Among the approaches being considered for doing so include expanding local community-based seed production systems across the country and ensuring that these local seed production systems are providing farmers with appropriate seeds with the characteristics that local farmers demand. Some lessons from this evaluation of hybrid maize seed marketing will be applicable to the marketing or distribution of seed from these other crops being produced through community-based or other efforts, but it should be emphasized that problems related to hybrid maize seed marketing are likely to be dealt with more easily than problems arising from self-pollinated crops.

Finally, there are several aspects of the provision of improved maize seed to farmers about which the evaluation will not provide much guidance. This includes how hybrid maize seed can be supplied to economically marginal crop producers—marginal due to spatial remoteness and high marketing costs related to transport or marginal due to local agro-ecological conditions’ being suboptimal for hybrid maize production. In the case of spatial remoteness but high production potential, it is a question of the transaction costs that seed producers face in providing seed to such farmers. In the case of suboptimal areas, it is more a question of the economics of hybrid maize production in those areas not being attractive. If private seed producers decide that they cannot profitably supply hybrid maize seed to maize producers in such areas without government subsidies or other support, should government intervene to ensure that these two types of maize producers obtain access through the market to such improved seed at a cost similar to that the cost farmers face in higher-potential areas or areas with better access? Or should the price of hybrid maize seed at any location reflect the full costs of providing the seed there? As our study focuses on high-potential maize areas in Ethiopia that are well connected—most of the *woredas* in which DSM was implemented have tarred roads running through them—these questions were not considered closely. Somewhat related, the evaluation also provides little guidance about where improved open-pollinated varieties of maize might be a better option to promote among farmers than hybrid maize.

Taking Action

The DSM program is built on the notion that farmers benefit when seed producers compete for their attention and business through price, quality, varietal characteristics, and information provision. At present, Ethiopia’s formal seed system precludes seed producers from effectively competing, and private seed firms must play on an uneven playing field that affords parastatals significant advantages in the country’s seed markets. The DSM program aims at providing evidence of whether competition can, in fact, work in Ethiopia’s hybrid maize seed market.

This evaluation provides informative insights into both strategic and operational issues for expanding DSM to supply seed to Ethiopian smallholder farmers. Specifically, the evaluation is oriented toward informing policy and strategy to strengthen seed systems in Ethiopia, focusing on hybrid maize seed, but with insights for how all improved seed and planting material might be reliably provided to farmers more generally. This evaluation provides a detailed examination of where improvements can be made in supplying farmers with improved seed.

The principal value of the evaluation is to generate evidence to guide future action by government about whether it should allow greater direct interaction between seed producers and Ethiopian smallholder farmers. Many government officials are hesitant to cede responsibility to traders for providing seed to farmers without a high level of oversight on the part of government. Does the evidence gathered through this evaluation justify this suspicion on the part of government officials? The evaluation here provides a detailed and nuanced assessment of how market forces might serve the needs of Ethiopian smallholder farmers for improved seed while also providing guidance about where caution is required in relying on a market-based approach to seed provision. In consequence, we feel that the suspicion of market forces in the formal seed subsector in Ethiopia on the part of government is not justified. At least in the case of hybrid maize, competition between entrepreneurial seed producers to capture a substantial portion of the market of farmer-customers for their seed to enable their firms to remain in business will propel wider and more effective distribution of new and improved hybrid maize to more and more farmers. This is a useful and necessary element in the transformation of Ethiopia's agricultural sector and will contribute to improved welfare for many farming households across the country.

Appendix A: Comparison of Sample Farmers to General Population of Farmers Using Hybrid Maize Seed in Ethiopia

The farmers who were surveyed for this evaluation of the DSM program in 2013 are not representative of all smallholder farmers in Ethiopia. The population from which the sample of farmers was chosen consists of maize farmers who use hybrid seed in the high-potential maize production areas of Ethiopia where the DSM program was carried out. The fact that they use hybrid maize seed significantly differentiates the sample farmers from most smallholder farmers in the country who do not grow hybrid maize.

However, how different are the sample farmers from all Ethiopian farmers who use hybrid maize seed? Gaining insight into this question will assist in determining how widely the lessons learned from the survey of farmers for the DSM program operational evaluation can be applied to the design of efforts to supply hybrid maize seed to farmers in other areas of Ethiopia outside of the DSM program areas. To do this, we compare the characteristics of the farmers in the DSM evaluation farmer survey to the characteristics of hybrid maize seed-using farmers who were sampled in the 2012 Ethiopian ATA baseline survey that was conducted between June and September 2012 by EIAR and IFPRI. The ATA baseline survey used a sample of 3,000 farming households across 99 *woredas* in Tigray, Amhara, Oromia, and SNNP. In each *woreda*, two *kebeles* were randomly selected for inclusion in the survey sample, and within each *kebele*, 15 farming households were randomly selected. The survey covered agricultural production and marketing, use of inputs, soil conservation, storage, livestock activities, nonfarm income, the role of cooperatives, and credit, among other topics, for the 2011 *belg* season and the 2011/2012 *meher* season.

Out of the 3,000 sample farmers in the ATA baseline survey, the total who reported using hybrid maize seed was 532 across Amhara, Oromia, and SNNP. (No ATA baseline survey farmers in Tigray reported using hybrid maize seed.) Many of these were located in the high-potential maize production areas in which the DSM program was implemented in 2013. However, a sizeable number were growing hybrid maize elsewhere.

Table A.1 compares the demographic characteristics and the characteristics of the household heads of the two samples of hybrid maize-growing farmers. There are few statistically significant differences between the two samples overall. At the regional level, SNNP subsamples show some significant differences in household size, dependency ratio, and sex ratio. In the other two regions, the demographic characteristics of the two samples are similar. While there are some differences across regions in the proportion of heads of household who are women, they are not large, and the absolute numbers of female-headed households that grow hybrid maize are quite small overall. Farmers in the DSM evaluation survey were more likely to have attended school than the hybrid maize-growing farmers in the ATA baseline survey sample. However, although they attended school, many of the farmers in the DSM evaluation survey sample never completed primary school, as there is no significant difference between the two samples in the proportion of heads of sample households who completed primary school.

Table A.2 compares household asset ownership and travel time to public services between the two samples. We find that the DSM survey sample tends to be better endowed than the subsample of hybrid maize seed users from the ATA baseline survey. This is most apparent in comparing cattle ownership and size of landholding. The farmers surveyed in the DSM implementation areas are more likely to own cattle and have larger landholdings than do Ethiopian hybrid maize farmers more generally. Cattle ownership differences are most striking between farmers in Amhara, while the differences in area of land owned are consistently seen across the three regions. This difference is not unexpected. The DSM program was specifically targeted to high-potential maize-growing areas where production levels and, hence, asset accumulation opportunities over time are likely to be somewhat higher than in lower-potential areas where farmers also grow maize using hybrid seed.

The physical access that farmers have to services bears out these differences. Farmers in the DSM survey sample tend to be located nearer to key public services than those in the ATA baseline survey subsample. This also is not unexpected, as areas of high agricultural potential generally are more likely to receive public investments than are lower-potential areas.

The characteristics of the farm households in the two survey samples overall are quite similar. The farmers surveyed for the DSM operational evaluation have larger farm sizes and somewhat more assets than do the broader population of hybrid maize growers who were surveyed in the ATA baseline survey. The principal lesson for expansion of the DSM program to other areas where hybrid maize is grown in Ethiopia is that the current design of the DSM program should reasonably be transferrable. It is unlikely that any farmer characteristics in new areas will lead the program to be less successful than it was in 2013. However, given that farmers are likely to be somewhat poorer and farming in more remote locations in the areas where the DSM program may expand, greater attention may be required to issues of input credit for farmers and the possibly higher transportation costs that both seed suppliers and farmers might be forced to bear in acquiring their hybrid maize seed.

Table A.1 Comparison of demographic characteristics and characteristics of heads of household of DSM evaluation survey sample farm households to those of general population of farmers using hybrid maize seed in Ethiopia

	All	Amhara		Oromia		SNNP		
	DSM	ATA	DSM	ATA	DSM	ATA	DSM	ATA
Characteristic	Survey	Baseline Survey	Survey	Baseline Survey	Survey	Baseline Survey	Survey	Baseline Survey
Average household size	6.8 (0.11)	6.4 (0.28)	6.2 (0.15)	6.0 (0.42)	7.0 (0.19)	7.4 (0.37)	7.3 (0.19)	6.0 (0.39)
Overall dependency ratio	0.958 (0.032)	0.998 (0.056)	0.801 (0.044)	0.845 (0.083)	1.173 (0.066)	1.169 (0.085)	0.921 (0.054)	1.010 (0.052)
Overall sex ratio (number of males per 100 females)	101.9 (2.83)	104.7 (3.20)	108.6 (5.60)	99.5 (4.59)	100.5 (4.53)	107.8 (6.47)	98.2 (4.64)	107.1 (3.56)
Female heads of household (%)	5.4 (1.01)	4.4 (1.01)	3.8 (1.51)	2.8 (1.27)	6.3 (1.92)	1.8 (1.03)	6.1 (1.79)	8.3 (2.06)
Age group of household head								
Younger than 25 years (%)	2.4	3.3	0.6	2.0	4.4	0.0	2.2	8.4
25 to 34 years (%)	27.2	25.5	21.9	23.3	35.6	33.9	24.4	20.9
35 to 44 years (%)	35.0	43.9	35.6	37.0	33.1	50.2	36.1	45.9
45 to 54 years (%)	20.6	18.0	30.0	23.6	13.8	7.7	18.3	20.8
55 to 64 years (%)	11.0	9.2	8.1	13.3	10.0	3.9	14.4	9.4
65 years and older (%)	3.8	8.5	3.8	6.0	3.1	18.5	4.4	2.7
Attended school (%)	74.2 (1.96)	62.4 (5.86)	61.3 (3.86)	44.1 (4.71)	80.0 (3.17)	72.4 (1.33)	80.6 (2.96)	73.2 (6.09)
Completed primary (%)	35.6 (2.14)	33.5 (6.05)	18.8 (3.10)	16.5 (7.86)	41.3 (3.90)	41.9 (11.21)	45.6 (2.96)	44.4 (7.92)
Completed secondary (%)	2.6	5.4	0.6	2.1	2.5	4.1	4.4	9.8
Farmers (n)	500	532	160	259	160	101	180	172

Source: Authors, analysis of data from DSM evaluation farmers survey (2013) and the ATA baseline survey (2012).

Note: DSM = direct seed marketing ATA = Agricultural Transformation Agency. SNNP = Southern Nations, Nationalities, and Peoples. Standard errors are provided for selected statistics and are shown in parentheses on the second line in each cell.

Table A.2 Comparison of housing quality, asset ownership, and travel time to public services of DSM evaluation survey sample farm households to those of general population of farmers using hybrid maize seed in Ethiopia

Characteristic	All		Amhara		Oromia		SNNP	
	DSM Survey	ATA Baseline Survey	DSM Survey	ATA Baseline Survey	DSM Survey	ATA Baseline Survey	DSM Survey	ATA Baseline Survey
House walls of brick, stone, or concrete (%)	1.2	0.1	0.6	—	1.3	—	1.7	0.2
House roof of corrugated metal (%)	66.2 (2.12)	68.8 (5.25)	97.5 (1.24)	88.7 (6.54)	65.6 (3.77)	74.3 (5.37)	38.9 (3.64)	43.2 (9.32)
Uses electricity for lighting (%)	14.6	27.0	20.6	43.6	13.1	21.2	10.6	14.2
Owns bicycle (%)	9.0	2.5	13.1	1.8	10.0	1.5	4.4	4.1
Owns motorcycle (%)	1.0	0.6	0.6	—	1.3	—	1.1	1.7
Owns <i>gari</i> (animal-drawn cart) (%)	13.0	no data	12.5	no data	17.5	no data	9.4	no data
Owns any livestock (%)	99.4	97.8	99.4	98.8	98.8	98.0	100.0	96.4
Owns oxen for plowing (%)	82.0	82.7	93.1	95.9	89.4	90.5	65.6	62.3
Owns cattle (%)	93.2 (1.13)	78.3 (5.69)	90.6 (2.31)	66.6 (10.26)	94.4 (1.83)	90.6 (4.98)	94.4 (1.71)	80.5 (7.19)
Owns sheep or goats (%)	56.2	62.9	56.3	57.2	56.3	83.4	56.1	52.1
Owns horses, mules, or donkeys (%)	46.8	42.0	42.5	46.1	55.0	53.7	43.3	28.1
Engages in off-farm work (%)	36.0 (2.15)	51.3 (3.87)	30.6 (3.66)	36.1 (8.05)	31.9 (3.70)	66.4 (5.28)	44.4 (3.71)	54.9 (6.83)
Engages in <i>belg</i> crop production (%)	51.2	33.6	42.5	15.4	40.6	48.5	68.3	40.4
Engages in <i>meher</i> crop production (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total size of landholding for cultivated crops (hectare)	2.12 (0.06)	1.62 (0.12)	2.10 (0.08)	1.88 (0.22)	2.60 (0.14)	2.13 (0.14)	1.71 (0.09)	0.94 (0.16)
Travel time using usual form of transportation to								
Nearest dry-season road (mean)	14.1 (0.97)	36.6 (7.83)	15.5 (1.64)	58.8 (14.51)	8.6 (0.97)	30.2 (16.04)	17.8 (2.05)	18.6 (8.10)
Nearest asphalt road (mean)	117.5	184.5	185.1	233.7	77.9	178.1	92.5	138.4
Nearest marketplace (mean)	62.1 (2.02)	73.3 (9.60)	77.9 (4.14)	98.7 (5.76)	59.2 (3.18)	54.6 (19.03)	50.5 (2.82)	62.1 (16.90)
Woreda administrative center (mean)	110.6	140.4	122.5	202.8	103.3	129.8	106.6	83.5
Nearest agricultural cooperative (mean)	37.4 (1.68)	66.3 (9.44)	34.4 (2.17)	64.0 (17.17)	30.0 (2.61)	73.6 (10.66)	46.7 (3.46)	62.3 (16.73)
Farmers (<i>n</i>)	500	532	160	259	160	101	180	172

Source: Authors, analysis of data from DSM evaluation farmers survey (2013) and the ATA baseline survey (2012).

Note: DSM = direct seed marketing; SNNP = Southern Nations, Nationalities, and Peoples. ATA = Agricultural Transformation Agency. Standard errors are provided for selected statistics and are shown in parentheses on the second line in each cell. Dashes indicate that data on characteristic is not available in data set.

Appendix B: Comparison of Subsample of Farmers in the Direct Seed Marketing *Woredas* to the Subsample of Those Resident Elsewhere

A key consideration in making comparisons between the experience of farmers growing hybrid maize in 2013 in the DSM program *woredas* and those growing hybrid maize elsewhere is how comparable those farmers are in terms of their farming practices. Table B.1 shows how survey farmers in the DSM *woredas* differ in their maize production practices from those who were surveyed in the control *woredas* in which the DSM program was not implemented in 2013.

Few differences are seen between these two groups of farmers. The average cropped area for the two groups of farmers is the same. For those growing maize in the *meher* season, the farmers in the non-DSM *woredas* are shown to plant a somewhat larger area with maize, primarily in Oromia. Hybrid maize occupies more of the farmer's crop area dedicated to maize in *meher* in Amhara in the DSM *woredas* than in the non-DSM *woredas*, but this pattern is not seen in Oromia and Southern Nations, Nationalities, and Peoples. Generally the same hybrid varieties are used by farmers in both the DSM and the non-DSM *woredas*. The farmers have similar levels of experience in growing hybrid maize and sell similar proportions of their maize harvest. Except for the price of BH-540, the price of hybrid maize seed in the DSM *woredas* is slightly less than in the non-DSM *woredas*.

In spite of these small differences, broadly the two subsamples of farmers are quite similar in their characteristics. We can expect that had the DSM program been implemented in the non-DSM *woredas* used to select the subsample of control farmers for our survey, those farmers would have engaged with the DSM program in a manner similar to that of the farmers surveyed in the *woredas* targeted by the DSM program in 2013.

Table B.1 Comparison of maize production characteristics of DSM evaluation survey sample farmers in DSM program *woredas* to those of sample farmers in non-DSM *woredas*

Characteristic	All		Amhara		Oromia		SNNP	
	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM
Cropped area, total, average (hectare)	2.12	2.12	2.01	2.24	2.63	2.56	1.78	1.55
Produce maize in <i>belg</i> (% farmers)	17.2	10.0	10.0	5.0	16.0	3.3	24.2	21.7
Produce hybrid maize in <i>belg</i> (% farmers)	12.8	7.8	10.0	3.3	8.0	3.3	19.2	16.7
Produce maize in <i>meher</i> (% farmers)	97.2	98.3	100.0	100.0	99.0	100.0	93.3	95.0
Produce hybrid maize in <i>meher</i> (% farmers)	97.2	98.3	100.0	100.0	99.0	100.0	93.3	95.0
Produce maize in both <i>belg</i> and <i>meher</i> (% farmers)	14.4	8.3	10.0	5.0	15.0	3.3	17.5	16.7
Area on which maize was planted in <i>meher</i> for those producing maize in <i>meher</i> , average (hectare)	0.83	1.05	0.73	0.72	1.21	1.74	0.57	0.67
Percentage of maize area in <i>meher</i> planted with hybrid, of those producing maize in <i>meher</i>	92.7	88.5	97.5	75.1	92.7	95.8	88.5	95.0
Hybrid maize seeding rate, <i>meher</i> , kilogram per hectare (median)	25.0	24.7	24.0	24.0	25.0	25.0	25.0	25.0
Principal <i>belg</i> hybrid, most common (% <i>belg</i> growers)	BH-540 (34.1)	BH-540 (64.3)	BH-660 (50.0)	BH-660 (50.0) and PHB-30D79 (<i>Agar</i>) (50.0)	BH-540 (37.5) and BH-543 (37.5)	BH-540 (50.0) and PHB-30G19 (<i>Shone</i>) (50.0)	PHB-30G19 (<i>Shone</i>) (39.1)	BH-540 (80.0)
Principal <i>meher</i> hybrid, most common (% <i>meher</i> growers)	BH-660 (41.4)	BH-660 (40.7)	BH-540 (36.9)	BH-660 (74.6)	BH-660 (40.8)	BH-540 (50.6)	BH-660 (50.9)	BH-660 (39.7)
Second most common (% <i>meher</i> growers)	BH-540 (22.0)	BH-540 (34.3)	BH-660 (32.4)	BH-540 (22.2)	BH-543 (22.4)	PHB-30G19 (<i>Shone</i>) (18.1)	PHB-30G19 (<i>Shone</i>) (23.7)	BH-540 (24.1)
Open-pollinated maize varieties, maize farmers growing in <i>meher</i> (%)	12.2	10.6	2.0	16.7	19.0	5.0	15.0	10.0

Table B.1 Continued

Characteristic	All		Amhara		Oromia		SNNP	
	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM	DSM	Non-DSM
Experience growing hybrid maize (years, average)	8.5	9.0	11.1	10.6	8.7	8.2	6.1	8.2
Sell maize (% of maize growers)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Portion of maize harvest that farmer sells (% , average)	51.5	53.1	48.3	45.6	52.2	58.1	54.7	53.2
Most important source of information about hybrid maize production (% farmers mentioning)	DAs or other government agriculture agents (93.8)	DAs or other government agriculture agents (90.6)	DAs or other government agriculture agents (100.0)	DAs or other government agriculture agents (98.3)	DAs or other government agriculture agents (91.0)	DAs or other government agriculture agents (90.0)	DAs or other government agriculture agents (90.8)	DAs or other government agriculture agents (83.3)
Second most important source (% farmers mentioning)	Own farming experience (44.4)	Own farming experience (46.7)	Own farming experience (64.0)	Own farming experience (48.3)	Own farming experience (27.0)	Own farming experience (43.3)	Own farming experience (42.5)	Own farming experience (48.3)
Have received training on hybrid maize from DA-led agricultural extension activities (%)	83.4	86.7	85.0	90.0	85.0	90.0	80.8	80.0
Visited a hybrid maize demonstration plot in past two years (%)	56.3	65.6	54.0	56.7	49.0	65.0	64.2	75.0
Received printed literature about hybrid maize seed use in 2013 (%)	13.8	9.4	25.0	20.0	7.0	6.7	10.0	1.7
Heard radio program or read poster on hybrid maize seed use in 2013 (%)	52.5	49.4	57.0	43.3	53.0	58.3	48.3	46.7
Price, Ethiopian Birr per 12.5-kilogram packet (median)								
BH-540	289.83	287.00	285.00	287.00	400.00	307.50	284.00	275.00
BH-660	188.00	204.00	188.66	210.00	188.00	250.00	188.25	189.33
PHB-3253 (<i>Javi</i>)	511.00	531.25	511.17	—	—	—	500.00	531.25
PHB-30G19 (<i>Shone</i>)	474.00	518.75	—	—	475.00	499.00	472.50	519.79
Farmers (<i>n</i>)	320	180	100	60	100	60	120	60

Source: Authors, analysis of data from the DSM evaluation farmers survey (2013).

Note: DSM = direct seed marketing; DA = development agent. Dashes indicate no cases for table cell. The columns headed “DSM” contain statistics from the farmers in the survey sample resident in *woredas* where the DSM program was carried out in 2013. The statistics in the columns headed “Non-DSM” are from sample farmers who produce hybrid maize but do not live in *woredas* in which the DSM program was carried out in 2013.

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