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SYNOPSIS OF [ESSP WORKING PAPER 94](#)

***Synopsis:* The rapid expansion of herbicide use in smallholder agriculture in Ethiopia: Patterns, drivers, and implications**

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We use qualitative and quantitative information from a number of datasets to study the adoption patterns and labor productivity impacts of herbicide use by farmers in Ethiopia. We find a four-fold increase in the value of herbicides imported into Ethiopia over the last decade, primarily by the private-sector. Adoption of herbicides by smallholders has grown rapidly over this period, with the application of herbicides on cereals doubling to more than a quarter of the area under cereals between 2004 and 2014. Relying on data from a large-scale survey of producers of teff, the most widely grown cereal in Ethiopia, we find significant positive labor productivity effects of herbicide use of between 9 and 18 percent. We show that the adoption of herbicides is strongly related to proximity to urban centers, levels of local rural wages, and access to markets. All these factors have changed significantly over the last decade in Ethiopia, explaining the rapid take-off in herbicide adoption. The significant increase in herbicide use in Ethiopia has important implications for rural labor markets, potential environmental and health considerations, and capacity development for the design and effective implementation of regulatory policies on herbicides.

INTRODUCTION

Agricultural economies in developing countries, like Ethiopia, have transformed rapidly over the past 50 years. Adoption of modern inputs, such as improved seeds and chemical fertilizer, has played an important part in this transformation. Research on agro-chemicals, including insecticides, fungicides, and herbicides, and their role in the agricultural transformation process, however, has received relatively less attention, despite their crucial role in modernizing farming systems.

In this research note, we explore the relatively high use of herbicides by smallholders in Ethiopia, what determines uptake of the input, and its effect on labor productivity in farming systems. In particular, we examine the impact proximity to cities, rural wages, and access to markets have on herbicide adoption and how changes in these factors have led to rapid growth in herbicide use.

For this research, we collected data by interviewing key informants from the agro-chemical sector between April and July 2016. In addition, we relied on four sources of quantitative data: Ethiopian Revenues and Customs Authority data (2004-14); survey data on agricultural production and practices from the Central Statistical Agency (CSA); Agricultural Growth Programme baseline survey data (May 2011); and ESSP teff field survey data (Nov-Dec 2012).

ETHIOPIA'S POLICIES AND INSTITUTIONS

Smallholder farmers dominate the use of agricultural land in Ethiopia. Absolute increases in the number of farmers nationally has led to a decline in the average landholding size by 1.4 percent over the last decade. This has added pressure on land resources and a greater need for intensification of agricultural production. Herbicide use can contribute to higher crop output per farm.

There are three public enterprises active in the distribution of agro-chemicals in the country:

- Adami Tulu Pesticide Processing Share Company, a government-owned enterprise importing, distributing, and formulating agro-chemicals.
- Agricultural Inputs Supply Enterprise, which is accountable to the Ministry of Agriculture and Natural Resources.

- Oromiya Agricultural Cooperatives Federation, which coordinates about 62 cooperative unions in Oromiya region, including the inputs that they provide to farmers.

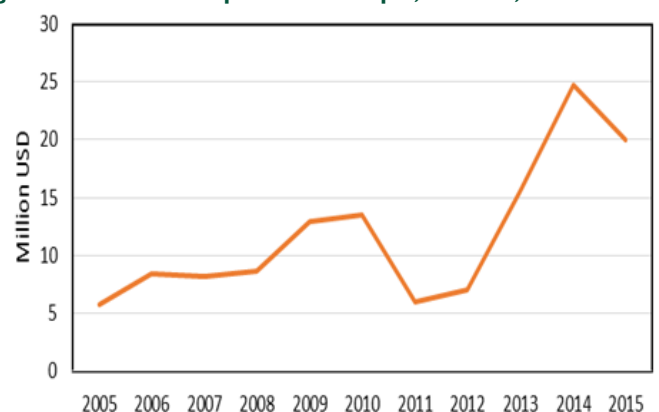
However, the majority of herbicides available in Ethiopia are imported and distributed by the private sector. Private enterprises that import such products are responsible for registering and certifying the specific herbicides they import. Typically, importers sell their products to government enterprises and private wholesalers in major cities. In June 2016, more than 100 herbicide brands were registered by 28 importing companies.

Herbicides can be potentially harmful to human health and the environment. Of late, there has been public concern expressed about counterfeit products found in the market, unqualified individuals handling herbicides, and farmers not adhering to safe practices when using herbicides. The regulatory authorities do not yet have adequate capacity and resources to ensure the proper design and implementation of needed regulatory policies for herbicides.

IMPORTS OF HERBICIDES AND THEIR DISTRIBUTION

No herbicides are produced in Ethiopia; all agro-chemicals are imported. The biggest share of agro-chemical imports are insecticides, making up 52 million USD in 2015. The second most important agro-chemicals are herbicides, with imports quadrupling in value over the last decade (Figure 1).

Figure 1: Herbicide imports to Ethiopia, 2005-15, value



Source: Based on data from Comtrade (2016)

2-4-D is the most important herbicide imported into Ethiopia, both in value and quantity terms. Even though its share of the market declined over the last decade, 2-4-D still made up 41 percent of the value of all herbicide imports in 2015. This compares to 78 percent in 2005. 2-4-D has a lower price relative to other types of herbicides.

Since 2-4-D kills only broadleaf weeds, weeding is often still required after its use. Therefore, other broader spectrum herbicides are increasingly being imported and used to deal with a wider range of weeds. For example, brands of glyphosate, a broad-spectrum herbicide, made up only 3 percent of all imports in 2005, while their share increased to 23 percent in 2015. Glyphosate is applied to the field before the crop is sown, killing all weeds. It therefore considerably reduces the labor required for land preparation. On average between 2005 and 2015, more expensive herbicides rose in price, while cheaper ones decreased in price.

Most distribution of chemical fertilizer and improved seed is assured by the government through its networks of agricultural cooperatives. The distribution of agro-chemicals, in contrast, is mostly in the hands of private distributors. Notably, almost 70 percent of smallholder farmers reported that they obtained herbicides through a private channel.

Furthermore, we find that larger farms are more likely than smaller farms to adopt herbicides. We estimate that herbicide is used on more than a quarter of the area under cereals, and even more so on the commercial cereals, such as teff and wheat.

EFFECTS OF HERBICIDE ON LABOR

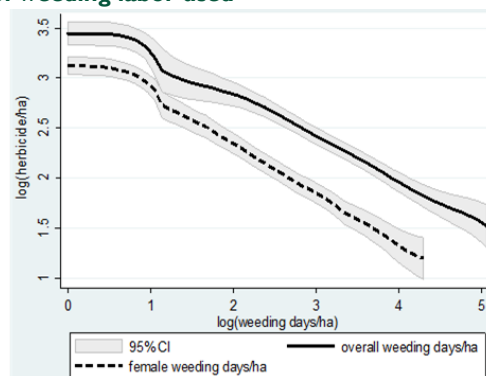
Herbicides mainly save on weeding effort. Consequently, there is a strong negative association between the amount of labor a farmer uses on labor and use of herbicides (Figure 2). Farmers with higher spending on herbicides employ relatively less weeding labor. The dashed line in Figure 2 further shows how the increasing application of herbicide specifically reduces the time women spend on weeding. The substantial reduction in labor indicates that farmers are substituting weeding labor with herbicides, and more notably, releasing women from weeding tasks. This may have considerable positive implications on the daily workload of rural women, and thus on the welfare of rural households in general, since it affects the time women might allocate for childcare, other income-generating activities, or housekeeping.

Similarly, our econometric analyses using fixed effects and matching techniques confirm that herbicide application by a farmer is associated with higher labor productivity on the farm.

DRIVERS OF HERBICIDE ADOPTION AND EXPANSION

A number of patterns emerge on what drives herbicide adoption. We identify the following contributing factors: **transport cost** to Addis Ababa is negatively related with both the decision to use herbicides and the amount used, **connectivity of agricultural markets** through the improved road network has reduced travel times and costs between wholesale markets, and **higher rural wage** rates increase the likelihood of adoption. We also find that specific

Figure 2: Relationship between the value of herbicide and the amount of weeding labor used



Source: Authors' calculation based on the 2012 teff producer's survey

aspects of the demographic composition of the farm household and the ownership of land and other assets are also associated with herbicide use.

In addition to the above, other factors driving herbicide use were raised during stakeholder discussions, including:

- **Crop rotations** are practiced less than in the past, e.g., with increased monocropping, weeds become more prevalent.
- **Commercial farming** is increasing. These larger farms rely on herbicide use for weed management.
- **Mechanization** – Combine-harvesters, for example, contribute to the spread of weeds, as they often travel large distances, inadvertently carrying weed seeds to new areas.
- **Conservation agriculture**, with some practices involving the use of herbicides, is being promoted and adopted in areas.

CONCLUSION AND POLICY IMPLICATIONS

These research results have several important implications.

First, the labor-saving aspect of herbicide use, especially in relation to liberating women from weeding tasks, may result in improvements in social, health, and economic outcomes. Women in herbicide-using farm households, for example, will have more time to spend on childcare or on off-farm income generating activities.

Second, proximity to cities and to the nearest all-weather road are found to be important determinants of herbicide application. As the government is planning further large-scale investments in road infrastructure and urban development, increased herbicide use will further release labor in rural areas, which will have significant impacts on local labor markets, both in rural and urban areas.

Finally, regulatory bodies need to adjust their capacity for the increase in herbicide use to ensure the proper design and implementation of much needed regulatory policies to govern the safe distribution and use of the input. In this regard, greater attention should be directed towards gathering better evidence on agro-chemical adoption and the impacts of use, as well as gaining a better understanding of the benefits and possible disadvantages of increased agro-chemical use in rural Ethiopian communities in order to enhance and guide policies, regulations, and investments.

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