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Could low adoption of modern maize varieties in Malawi be explained by farmers' interest in diverse seed characteristics?

Monica Fisher and John Mazunda

Food security in Malawi depends on production of enough maize, the country's staple crop. In Malawi, more than 90 percent of farm households grow maize and this grain accounts for 60 percent of total calorie consumption. As opportunities for land-extensive agricultural growth are reduced, use of modern maize production technologies has become essential for producing sufficient maize to feed Malawi's people. Although the use of high-yielding modern maize seed is important for food security, some farmers are resisting complete adoption of these varieties. Understanding how farmer preferences and circumstances influence their decisions to adopt or increase the use of modern maize seed varieties is necessary. Otherwise, researchers may not develop appropriate technologies and policymakers may not design and execute the most effective policies for promoting improved varieties and technologies. This policy brief draws on key findings from a recent study by Lunduka, Fisher, and Snapp (2011) in which factors that influence the decisions of Malawian smallholder farmers to grow modern maize varieties were examined.

Availability and use of modern maize varieties in Malawi

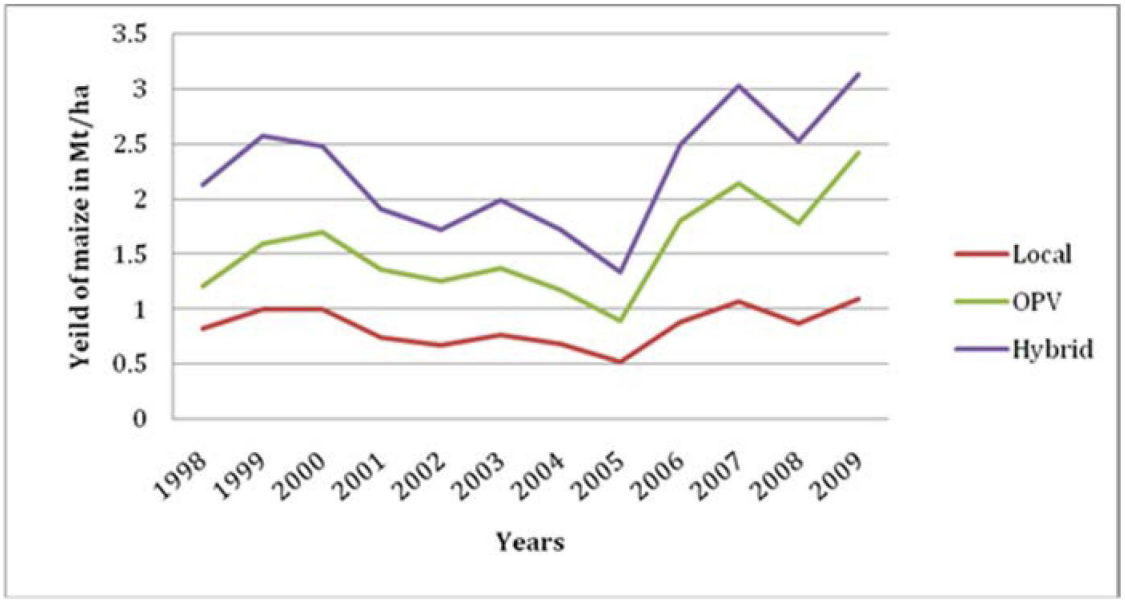
An efficient maize breeding program, which began in Malawi in the early 1940s, has ensured wide availability of high-yielding hybrid maize varieties. National yield estimates from the Ministry of Agriculture and Food Security show that, in some years, yields of hybrid varieties were more than twice the yields of local maize (Figure 1). For many years, the entire effort of the agricultural extension staff was devoted to teaching farmers about the use and advantages of hybrid maize and inorganic fertilizers.[i] Furthermore, in recent years hybrid and open pollinated maize varieties (OPVs) and chemical fertilizer have been highly subsidized or distributed for free by the Malawian government, except for a few years in the mid-1990s, when agricultural input subsidies were temporarily discontinued. Therefore, smallholder farmers have had ample opportunity to try out and learn about new varieties and technologies.

Nevertheless, adoption and use of modern maize varieties has remained surprisingly low, even compared to other countries in Sub-Saharan Africa (Figure 2). One hypothesis is that low adoption levels for modern maize in Malawi partly reflect farmers' preferences for different characteristics of the various seed varieties available. Previous research indicated that Malawian farmers perceive modern maize varieties as advantageous from a production standpoint, but favor local varieties from a consumption standpoint.[ii] As a result farmers often grow several varieties.

What factors influence the use of modern maize varieties in Malawi?

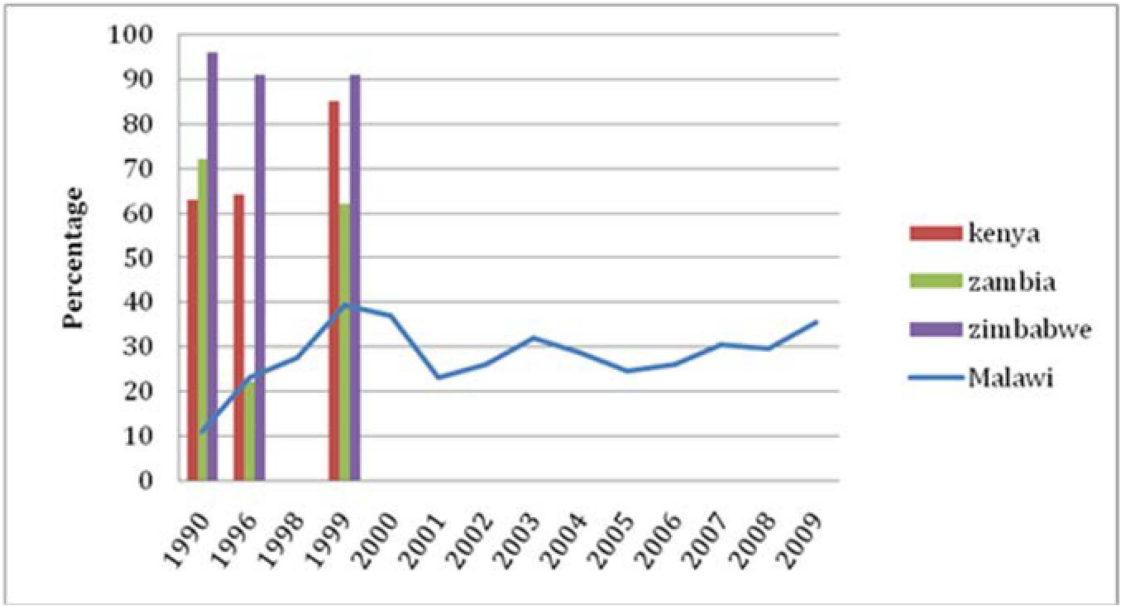
To investigate the factors contributing to low levels of adoption of modern maize varieties, Lunduka et al. developed a multivariate regression model that examined the relationship between four dependent variables—the proportions of maize seed planted of a specific type (local, hybrid, OPV, or recycled hybrid)—and several independent variables that were hypothesized to influence a farmer's decision to grow a specific type of maize. These included socio-economic characteristics of farm households (age and education of the household head, household size, landholding size, and wealth status); access to extension information; distance to agricultural markets; receipt of a subsidized maize seed voucher (these cover up to 90 percent of the cost of a number of modern maize varieties); maize seed production attributes (high yield, drought tolerance, and early maturity); and processing/consumption attributes of the maize seed (storability; flour-to-grain-ratio; taste; and poundability, which refers to the amount of husk relative to grain produced).

Figure 1: Yields of various types of maize in Malawi during 1998-2009



Source: Malawi Ministry of Agriculture and Food Security Crop Estimates, 1998-2009.

Figure 2: Percentage of total maize area planted with hybrid varieties during 1990-2009 for selected African countries



Sources: Smale and Jayne (2004)[iii]; Malawi Ministry of Agriculture and Food Security Crop Estimates, 1990-2009.

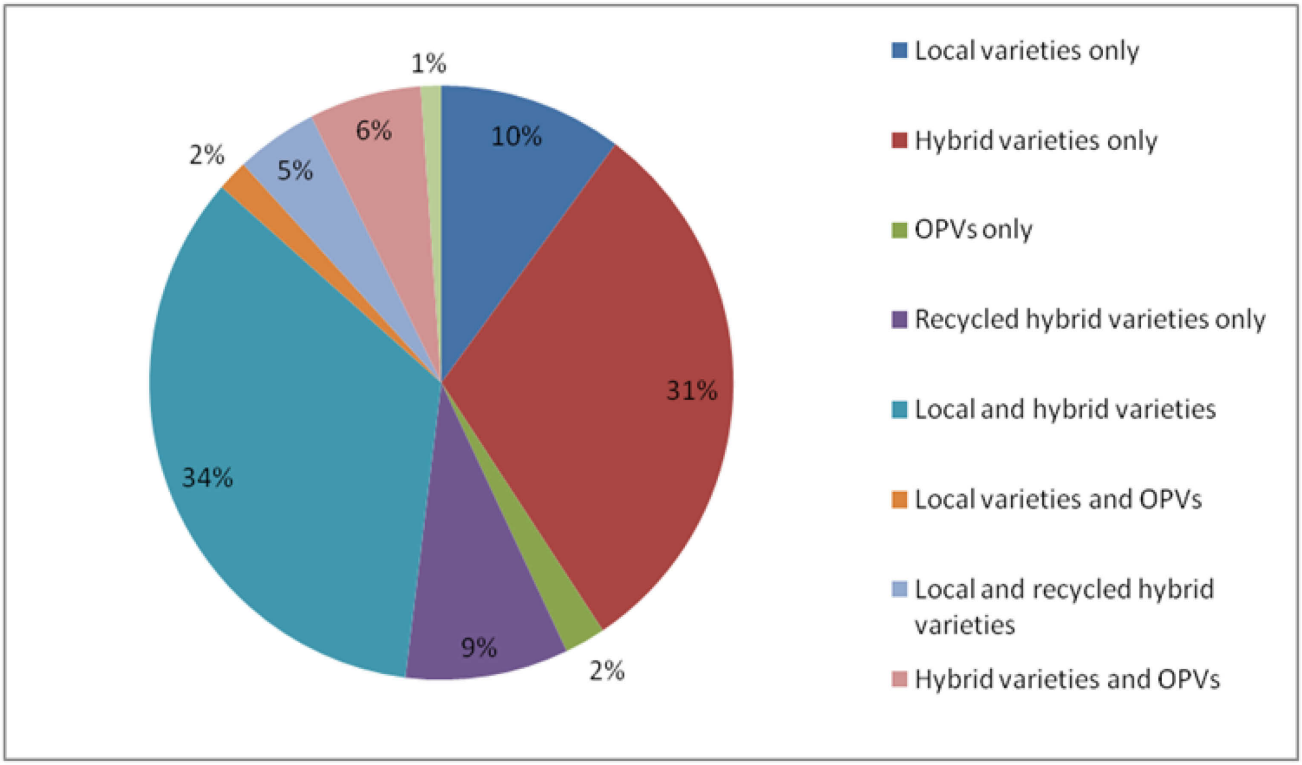
The regression model was run using data from the Mulanje Household Survey conducted in 2010.[iv] In the study area, as in many other places where maize is the dominant crop, individual farmers grow different combinations of maize varieties (Figure 3).

Results of the model indicate that education of the household head and access to seed influenced adoption of modern maize varieties. Planting of hybrid and OPV varieties was higher among farmers who were more educated, wealthier, and lived close to markets. Not surprisingly, adoption of modern varieties was high among farmers that received government vouchers for maize seed and/or fertilizer. However, vouchers appeared to have a short-term effect: the relationship between adoption of hybrid maize and voucher receipt was significant only for vouchers received in the current agricultural year (2009). The number of years the household received a voucher did not influence use of hybrid varieties, and had a slight positive influence on the proportion of land planted with local varieties.

The study documents that farmers valued diverse traits of maize varieties. Many farmers grew several varieties (Figure 3), and regression results indicate that each variety was chosen for a different group of traits. Hybrid varieties were favored for high yield and drought tolerance, but had relatively poor performance in storability, flour-to-grain ratio, and taste. OPVs were selected for early maturity. Local varieties were preferred for ease of storage, high poundability, high flour-to-grain ratio, and good taste.

The short-lived impact of government-subsidized access to modern maize varieties is likely related to the affordability of hybrids relative to locals, but also provides further evidence of farmer interest in diverse traits – farmers initially increased use of hybrid varieties, but soon reverted to pre-subsidy use of local varieties. In fact, a global survey of crop diversity found that farmers often adopt modern varieties, while retaining local varieties. [v] This behaviour is in keeping with an agro-ecological approach to farming, which uses crop diversity to provide resilient production systems that are less reliant on large doses of chemical inputs.[vi]

Figure 3: Percentage of surveyed farmers using different types of maize seed (*n* = 177)



Source: Mulanje Household Survey (2010)

Policy recommendations

Policy interventions to promote the adoption and use of modern maize varieties in Malawi should be based on sound understanding of the preferences and circumstances of smallholder farmers. Lunduka et al.'s main policy recommendation is that crop breeding programs need to be well informed of the preferences and circumstances of the farmers who are meant to use the new varieties. Thus, diverse traits need to be taken into account to encourage Malawian smallholder farmers to adopt new varieties of maize. Malawian farmers have strong preferences for the ease of storage, high poundability, high flour-grain ratio, and taste of local maize varieties.[vii]. These traits should be considered, in addition to grain yield, in breeding new varieties that will be widely adopted by farmers. Breeding programs should also focus on OPVs which allow recycling of seeds, which is important to Malawi smallholders who often have cash constraints and limited access to purchased seeds. In short, results of the study demonstrate that agricultural development policies should prioritize diversification of seed options, rather than emphasize modern, high-production maize varieties. Additionally, efforts should be made to conserve the genetic material of local maize varieties to allow for their use in future breeding programs.

Endnotes

i. See Carr, S.J. 1997. A green revolution frustrated: lessons from the Malawi experience. *African Crop Science Journal* 5(1): 93-98.

ii. See Holden, S. and Lunduka, R., 2010. Impacts of the Fertilizer Subsidy Program in Malawi: Targeting, Household Perceptions, and Preferences. Report to NORAD, Norwegian University of Life Sciences; and also Heisey, P.W., Smale, M., 1995. Maize Technology in Malawi: A Green Revolution in the Making? CIMMYT Research Report No. 4, Mexico.

iii. Smale. M., Jayne, T.S. 2004. Maize in Eastern and Southern Africa: "Seeds" of Success in Retrospect. Paper presented at the NEPAD/IGAD regional conference "Agricultural Successes in the Greater Horn of Africa", November 22-25, 2004, Nairobi, Kenya.

iv. IFPRI-Malawi's Mulanje Household Survey was conducted in four rural villages in Mulanje District in southern Malawi. The sample of $n = 177$ randomly-selected farm householdswere surveyed during May–July 2010.

v. Jarvis, D.I., Brown, A.H.D., Cuong, P.H., Collado-Panduro, L., Latournerie-Moreno, L., Gyawali, S. et al., 2008. A global perspective of the richness and evenness of traditional crop-variety diversity maintained by farming communities. Proceedings of the National Academy of Sciences 105, 5326-5331.

vi. Lin, B.B., 2011. Resilience in agriculture through crop diversification: adaptive management for environmental change. *Bioscience* 61(3): 183-93.

vii. See also Holden and Lunduka (2010) as cited above; and Chinsinga, B., 2010. Seeds and Subsidies: The Political Economy of Input Programmes in Malawi. Future Agricultures, Working Paper No. 013, United Kingdom.

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The Malawi Strategy Support Program of the International Food Policy Research Institute (IFPRI) works closely with the government of Malawi and other development partners to provide information relevant for the design and implementation of Malawi's agricultural and rural development strategies.

IFPRI HEADQUARTERS
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
2033 K Street, NW • Washington, DC 20006-1002 USA
Tel: +1-202-862-5600 • Skype: IFPRIhomeoffice
Fax: +1-202-467-4439 • E-mail: ifpri@cgiar.org

IFPRI- LILONGWE
P.O. Box 31666 • Lilongwe 3, Malawi
Tel: +256-1-789747 • E-mail: ifpri-lilongwe@cgiar.org

Contact: Klaus Droppelmann, Senior Program Coordinator (k.droppelmann@cgiar.org)

MINISTRY OF AGRUCULTURE AND FOOD SECURITY
Capital Hill, • Lilongwe , Malawi
P. O. Box 30134 • Lilongwe 3, Malawi
Tel: +265-1-789033 • Fax: +265-1-788003

Contact: Edson Mphande • Acting Director of Agricultural Planning Services (ekmphande2000@yahoo.com)