Drought-tolerant seeds are designed to protect farmers from moderate, mid-season drought, but can still fail when conditions are severe. In Tanzania and Mozambique we paired drought-tolerant maize (DTM) with index insurance designed to protect farmers when even drought-tolerant seeds fail. The project generated resilience in two ways. DTM effectively maintained yields during mid-season droughts. After severe droughts, DTM bundled with insurance helped farmers recover from their losses and return production to even higher levels than in the year before the drought.

Since 2006, the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute for Tropical Agriculture (IITA) have developed DTM varieties to address a widespread risk of drought in Sub-Saharan Africa. These varieties were bred to maintain high yields even in a moderate, mid-season drought.

Our analysis of CIMMYT on-farm trial data showed that DTM had higher yields overall than other improved varieties. This advantage increased with drought. In years of average rainfall of about 650 mm, DTM yielded nearly 12 percent more. In years with only 400 mm of rain, the yield advantage increased to about 20 percent.

We further found that this yield advantage is concentrated when drought comes in the middle of the season. The presence of early drought completely wipes out this advantage. This confirms that while DTM seeds are drought tolerant, they are not drought-proof.

While these results are impressive, they are not as large as what was observed under.

- For farmers without drought-tolerant maize (DTM), yields fall by 15% after a mid-season drought, with higher food insecurity in the following year.
- DTM seeds offer a modest 12% yield advantage in normal years and insulate farmers against the negative consequences of mid-season drought.
- For farmers without DTM, yields decline by 40% and food insecurity jumps by 45% following a severe drought not attributable to low mid-season rainfall.
- While DTM seeds do not insulate farmers against severe shocks, farmers with DTM seeds resiliently bounce back following a severe shock. This is especially true for farmers with insured DTM seeds.
the carefully controlled environments where the varieties were first bred and tested. There is also evidence that field trial benefits mainly accrue to farmers with above average productivity. This raises the question of how DTM performs for the average small-scale maize farmer.

### Testing Drought Interventions

To test DTM with average farmers, and its complementarity with index insurance, we conducted a randomized controlled trial (RCT) in Mozambique and Tanzania. The insurance, which added 20 percent to the seed cost, replaced seeds in the season following severe droughts if yield losses reached 35 percent. We divided our sample of 3,004 farm households into three groups. DT farmers were offered only DTM seeds. DTII farmers were offered DTM seeds bundled with the insurance. A control group was offered neither.

Farmers in our sample all managed small, rainfed maize plots exposed to moderate to high drought risk. We collected yearly data after maize harvest from 2016-18. Seed and insurance marketing took place in partnership with five local seed companies and two local insurance companies prior to planting for the 2016-17 and 2017-18 seasons.

### A Lack of Resilience

Control-group farmers, who were not offered any DTM seeds, experienced low levels of productivity that were very sensitive to drought. We collected yearly data after maize harvest from 2016-18. Seed and insurance marketing took place in partnership with five local seed companies and two local insurance companies prior to planting for the 2016-17 and 2017-18 seasons.

### Resilience Two Ways

Data from the RCT show that DTM seeds increased yields in normal years and stabilized yields during mid-season droughts. We estimate that DTM seeds increased yields by about 12 percent in normal years and nearly 50 percent in years with mid-season drought. DTM almost completely offset drought losses due to mid-season drought. These benefits are similar to those we found for farmers in CIMMYT on-farm field trials. While the evidence is less precise, DTM seeds also appear to offset increases in food insecurity induced by mid-season droughts.

In years when severe shocks were not caused by mid-season drought, yields for DTM farmers also fell precipitously. But, as Figure 1 shows, in the wake of these severe shocks, farmers with insured seeds more than fully recovered from the prior season’s shock and even achieved higher yields. This indicates that the insurance payouts encouraged farmers to deepen their investments in maize production.

### Complementary Drought Innovations

USAID defines resilience as the capacity to anticipate, prepare for and recover from shocks and stressors. Resilience+ results from investments shifted to productive uses when effective tools for managing risk are available. DTM promotes resilience, but bundling it with insurance promotes Resilience+ in seasons after farmers suffer significant losses. As seeds are a primary form of capital for many small-scale farmers, this paired intervention can transform how families recover from a shock like drought in areas where food security is driven by rain-fed agriculture.

For more information, visit [https://basis.ucdavis.edu](https://basis.ucdavis.edu).