Drought tolerant maize varieties (DTMA, WEMA and others)

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Summary

Many manufacturers and suppliers of seed in Africa are marketing varieties of maize that are able to get satisfactory grain yields when there is short supply of water and/or severe water stress, making it possible for farmers to tackle unfavorable rainfall conditions. Conventional breeding, marker-assisted breeding, and biotechnological modification are used by local and international breeders for making drought tolerant maize varieties that are adapted to the specific conditions in growing areas. Seed technology is a valuable asset towards mitigating the impact of dry spells and low rainfall which are limiting production ever more frequently; and it has widely been shown to increase productivity, improve yield stability, and reduce the risk of complete crop failure in maize production zones of Sub-Saharan Africa.

Technical Description

Unfavorable rainfall conditions are an important cause of maize yield gaps and losses in farming systems of Sub-Saharan Africa as more than 90% are rainfed and not irrigated, making the crop highly susceptible to the whims of the weather. The two main solutions on the market are drought tolerant maize (DTMA) that has enhanced ability to withstand periods of acute soil drying, and water efficient maize (WEMA) that is adapted to growing under low supply of water. Breeders develop these seed technologies so they outperform common non-tolerant varieties under severe to modest levels of water stress and shortage that occur routinely in dry climates and intermittently in wet climates. Scaling programs that have taken place for DTMA and WEMA in several major African growing areas have generated large increases of maize grain production and resilience of crops to dry spells and low rainfall. Progress in access to meteorological and market information for farmers on the continent, together with local knowledge, offer powerful means for supporting the decision when to invest in drought tolerant maize.

Uses

Drought tolerant maize varieties provide a safeguard for farmers when unfavorable rainfall conditions take place seasonally or erratically, and are useful in all growing areas of Sub-Saharan Africa as periodic dry spells and low rainfall occur widely. Water efficient maize varieties are particularly developed for semi-arid and dry sub-humid climates where levels of precipitation are chronically low and sandy soils have low moisture

holding capacity. As of 2016, more than 2 million farmers in Africa were reportedly growing drought tolerant maize varieties showing there are high levels of costumer trust and demand for the solution. The use of DTMA and WEMA presents major opportunities to mitigate the short and long term challenges of African farmers that arise due to climate change, such as expansion of drylands, and increased frequency and severity of seasons with poor rainfall. Also, these seed technologies can be used to grow maize in arid regions with irrigation, allowing farmers to tap into non-traditional growing areas.

Composition

There is a wide range of drought tolerant and water efficient maize varieties available to African farmers that are adapted to specific conditions in their growing area. More than 200 distinct lines of DTMA have been released in 13 sub-Saharan countries up to date, and about 50 lines of WEMA in 7 countries, which include hybrid varieties for which seed got to be repurchased (purchased under license) and open-pollinated varieties for which seed can be reused (royalty-free purchase and multiplication).

Means of application

Investments by farmers in drought tolerant maize varieties are ideally guided through warnings and likelihood scenarios drawn from rainfall prediction engines and local observations, and various platforms are now available that give recommendations on their use to ensure positive impacts on crop production and agricultural incomes. Seed of DTMA and WEMA varieties are planted as any normal maize crop following best soil and fertilizer management prescribed for particular growing areas and conditions. Appropriate inputs and formulations of inorganic fertilizers are widely shown to get farmers higher yields from drought tolerant maize because the applied nutrients are addressing limitations in soils that make the crop to grow stronger. On farmlands with low soil fertility status, like there are many in Africa, the use DTMA and WEMA should be combined with legume intercropping, manure application and mulching in order to improve nutrient and water retention.

Agroecologies	Dryland area, Highlands, Moist savanna.
Regions	Africa.
Developed in Countries	Kenya, Malawi, Mozambique, Nigeria, South Africa, Tanzania, Uganda, Zambia, Zimbabwe.
Available in	Kenya, Malawi, Mozambique, Nigeria, South Africa, Tanzania, Uganda, Zambia, Zimbabwe.
Solution Forms	Genetics.

Solution Applications	Improved variety.
Agricultural Commodities	Maize.
Target Beneficiaries	Small-scale farmers, Commercial farmers.

Commercialization

Commercialization Category

Commercially available

Startup Requirements

1) Manufacturers of maize seed need to breed drought tolerant varieties that are adapted to other conditions in growing areas, 2) Awareness-raising with farmers about benefits of drought tolerant maize on food production and risk mitigation, and 3) Creating equitable access and financial support for local suppliers and smallholder farmers that catalyzes investments and purchases of DTMA and WEMA seed.

Production Costs

Development of these drought tolerant and water efficient maize varieties involves advanced breeding techniques in the lab and screen house, and extensive testing of varieties in the field that require significant investment from commercial and non-commercial breeders. The costs associated with producing DTMA and WEMA are not substantially different from common non-tolerant maize varieties, and large agro-input suppliers are currently selling these resilient seed technologies at USD 0.8 to 1.2 per kilogram.

Customer Segmentation

Seed manufacturers, Agro-input suppliers, Commercial and subsistence maize growers

Potential Profitability

Evidence from major growing seasons in Sub-Saharan Africa shows that drought tolerant maize varieties have a 20 to 35% larger grain harvest than common non-tolerant crop types when there are severe to moderate drought conditions. A study in Zimbabwe on the use of DTMA has demonstrated that economic yields increased on average by 0.6 ton per hectare compared to the usually cultivated variety, and that the change of maize seeds gave an extra income USD 240 per hectare, or food stuffs for nine months. Risk-mitigating technologies such as DTMA and WEMA are leading to stable production and income levels in the face of shocks, and have a risk reduction dividend. By reducing

risks, seed technologies have the potential to catalyze investments in production and achieve higher returns.

Licensing Requirements

Hybrid varieties of DTMA and WEMA are be marketed under a commercial license, while open pollinating varieties are royalty-free for multiplication and sales by farmers.

Innovation as Public Good

CIMMYT is responsible for the public development of drought tolerant and water efficient varieties that are released royalty-free.

Solution Images







Institutions

IITA
Transforming African Agriculture

Accompanying Solutions

Imazapyr resistant maize for Striga management (IR maize), Specialized pre-plant fertilizer blending and N topdressing, Maize-legume rotation and intercropping