

# Pack 104, Item 15

# Type: Backgrounder

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**Backgrounder: Maize production**

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***Introduction:***

Maize is the most important cereal crop in sub-Saharan Africa, and can be grown by farmers in many different environments without irrigation. In addition to being an important source of food for humans, it is the most effective of all the cereal grains as a source of animal fodder. Both the grain and other parts of the plant can be fed to animals. Maize was first domesticated 10,000 years ago in modern-day Mexico. Today, farmers produce more maize around the world than any other grain, and demand for maize in the developing world is expected to double by 2050.

***Key facts:***

* Maize has a very high potential yield, and is well-adapted to many tropical environments.
* Maize grains are about 10% protein and 70% carbohydrate, and also provide vitamins A, E, and riboflavin. However, maize must be eaten as part of a varied diet to ensure proper nutrition.
* Maize can be a good food for both humans and animals. Parts of the plant that remain after harvest can be used to feed livestock, or left on top of the soil or mixed into the soil to increase yields and resistance to drought.

***What are the big challenges of growing maize?***

* planting the right variety at the correct time
* preventing drought or disease from ruining a crop
* lack of access to improved seeds, fertilizers, advice, farm machinery, or labour in many areas
* taking care of soils
* integrating maize into your farming system

***Predicted impact of climate change on production***

* Reduced rainfall and increased temperatures in many areas will generally reduce maize yields. In some areas, climate change may actually increase maize yields in the medium-term.
* Climate change will increase extreme weather events—drought, flooding and storms—which can damage or destroy a maize crop.
* Climate change will also change how diseases are spread, and maize farmers will have to adapt.

***Key information about growing maize***

1. **Suitable land and land preparation:**

Maize can be grown in highland and lowland areas, in flat areas and on slopes. Good soil depth and structure is needed, in addition to adequate moisture and drainage. Flooding can occur if there are low spots in the field. To avoid crop losses, you can level the field, avoid planting in low areas, add drainage canals, or plant in wide raised beds or ridges.

*When?*

* Land preparation should take place shortly before maize is planted, in order to reduce the opportunity for weeds to grow.

*It is possible to grow a crop without tilling the land*

* No-till practices avoid disturbing the land, with plant materials covering the ground or mixed in with topsoil (mulching). This allows soil to absorb more water from rain and stay moist, and also improves soil fertility, while requiring less labour.
* When trying no-till, some farmers find it difficult to control weeds at first, or wish to use plant materials to feed livestock. You may prefer to try no-till first on a smaller section of land (about 10%), and seek information from experienced farmers or extension workers.

More information: [Conservation Agriculture: A Sustainable System](http://repository.cimmyt.org/xmlui/handle/10883/4250)

1. **Climate conditions**

* Maize prefers warm temperatures, but can grow between 5 and 45 °C. Very cold or warm temperatures (above 32 °C) will cause yields to decline.
* Maize can be adapted to many climates and altitudes. Depending on the variety and environment, the growing time can vary between 70 to 210 days.
* Maize can grow with as little as 300 mm rainfall, but the optimal range is 500 to 700 mm. Maize can tolerate up to 1200 mm of rain if the soil is well-prepared and has good drainage.

Using drought-tolerant varieties and leaving plant residues on top of the soil can improve resistance to drought.

1. **Seeds**

There are two main kinds of seed on the market: open-pollinated varieties (OPVs) and hybrid varieties:

* Seed from OPVs can be planted for up to three seasons, but OPVs usually have lower yields than hybrids.
* Hybrid maize produces much reduced yield the next year. It is necessary to buy new hybrid seed for each planting.

Whenever possible, use certified seed that has been inspected for disease and pests at all stages of seed production.

1. **Soil fertility**

Soil is an important resource that should be maintained. Fertilizers can increase yields, but if the soil is not cared for properly, yields will fall over time and soils may even erode.

* If soil is very sandy, add manure or nitrogen fertilizer (urea). Rather than broadcasting fertilizer or spreading manure, it is more efficient to micro-dose. Place a small mound of manure near where the plant will grow, or bury small amounts of fertilizer 5 cm away from where the plant will grow.
* Heavy use of the same soil can reduce its fertility. Rotating crops or allowing the field to lie fallow will help soil recover.
* Maize grows well between pH 5.5-7.8. If soil is too acidic, it may be necessary to apply lime before planting maize.

More information:

* [The Problem of Soil and Land Degradation](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/4249/bulletin%201.pdf?sequence=1&isAllowed=y)
* [Video](http://www.accessagriculture.org/node/370/en) on Soil Fertility in Africa

*Diagnosing nutrition deficits*

The three main nutrients needed for maize growth are nitrogen, phosphorous, and potassium, but several other micronutrients are needed.

* Pale yellow plants with small leaves and slow growth indicate a nitrogen deficiency, or less commonly, sulphur deficiency.
* A red-purple colour on the leaf and stem indicates a phosphorous deficiency.
* Yellow leaf edges may indicate a potassium deficiency.
* Pale stripes on the upper leaves indicate a deficiency of iron or copper; white bands on new leaves indicate a shortage of zinc; and yellow stripes on lower leaves mean a magnesium deficiency.

More information: [Field Guide: Identifying Production Problems in Tropical Maize](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/726/43155.pdf?sequence=1&isAllowed=yhttp://repository.cimmyt.org/xmlui/bitstream/handle/10883/726/43155.pdf?sequence=1&isAllowed=y)

1. **Planting practices**

* Farmers should plant after the first significant rains. Seeds should be planted at a depth of 5-10 centimetres, but heavier soils require shallower planting.
* If the ground isn’t tilled, special methods and tools are needed to plant seeds. Farmers can use a hoe or pointed stick to create holes for the seed, with fertilizer or manure placed in another hole a few centimetres away. A ripper tine (*see the resource on manual and animal traction below*) can be attached to an animal-drawn plough to create a shallow furrow for seeds and fertilizers. Other direct seeding tools designed for this purpose may also be available.
* After plants have emerged, you can fill the gaps where crops have not emerged with more seed.

More information:

* [Agriculture Republic of South Africa Factsheet on Maize Production](http://www.arc.agric.za/arc-gci/Fact%20Sheets%20Library/Maize%20Production.pdf)
* [Manual and Animal Traction Seeding Systems in Conservation Agriculture](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/4253/bulletin%205.pdf?sequence=1&isAllowed=y)

*Intercropping*

* Maize can be grown alongside other crops such as cowpea, groundnuts, beans, and pigeon pea on the same piece of land and in the same season. This allows for more crops to be produced, and can protect against diseases, and improve soil fertility. Choose crops with different heights, and different rooting and growth habits.

More information: [Cereal and Legume Intercropping in Smallholder Conservation Agriculture (CA) Systems](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/4262/bulletin%2014.pdf?sequence=1&isAllowed=y)

*Crop rotations*

By not growing the same crop throughout the year, it is possible to prevent the soil from being exhausted, to increase yields, and to ensure that the best crop is being grown for each season.

More information: [The Importance of Crop Rotations](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/4252/bulletin%204.pdf?sequence=1&isAllowed=y)

1. **Weeds**

* To avoid future weed pressure, it is necessary to weed the land all year round, even when crops are not growing. Destroying weeds by hand while they are still small (less than 10 cm) can be very effective but is time-consuming.
* Ploughing the land breaks up weeds, but can bury weed seeds deep in the ground so that they emerge in the next season.
* Ground cover crops and crop rotation will help supress weeds, as will leaving plant residues on the ground, but will make weeding more difficult.
* Herbicides can be used to control weeds, but should only be applied by someone who knows how to apply them without poisoning humans, animals, or the wrong crops.

More information: [Weed control in smallholder Conservation Agriculture](http://repository.cimmyt.org/xmlui/handle/10883/4254)

1. **Pest and disease management**

* Disease and pest-resistant varieties, and good crop management practices are among the methods that can be used to control pests.
* Regular monitoring throughout the field is the basis for effective pest and disease control.
* Healthy soils and crops are a good protection against many diseases.
* Intercropping and crop rotations can help reduce pest and disease levels

More information:

* [Maize diseases: A guide for field identification](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/775/78507.pdf?sequence=4&isAllowed=y)
* [Insect pests of maize: A guide for field identification](http://repository.cimmyt.org/xmlui/handle/10883/700)

1. **Harvest**

* Maize can be harvested when green, for some cooking purposes, or after the cobs have dried.
* After harvest, maize grain can be dried in the sun so that it lasts longer, can be safely stored, and fetches a greater price on the market.
* To find out if maize is dry enough, shake salt and maize grains together in a glass bottle and then seal. If the salt is stuck to the sides of the bottle after a few minutes, then the maize is not dry enough.

***Where can I find other resources on this topic?***

1. IIRR and ACT, 2005. *Conservation agriculture: A manual for farmers and extension workers in Africa*. International Institute of Rural Reconstruction, Nairobi; African Conservation Tillage Network, Harare. <http://www.fao.org/ag/ca/AfricaTrainingManual.html>
2. Access Agriculture is a web resource for instructional videos on farming topics, including maize production: <http://www.accessagriculture.org/category/53/Maize>
3. Lafitte, H. R., 1993. *Identifying Production Problems in Tropical Maize: A Field Guide*. Mexico, D.F.: CIMMYT. [Identifying production problems in tropical maize: A field guide](http://repository.cimmyt.org/xmlui/bitstream/handle/10883/726/43155.pdf?sequence=1&isAllowed=yhttp://repository.cimmyt.org/xmlui/bitstream/handle/10883/726/43155.pdf?sequence=1&isAllowed=y)
4. TECA: Technologies and practices for small agricultural producers <http://teca.fao.org/>
5. [CIMMYT Conservation Agriculture Technical Bulletins](http://repository.cimmyt.org/xmlui/discover?filtertype_1=author&filter_relational_operator_1=contains&filter_1=thierfelder&filtertype_2=dateIssued&filter_relational_operator_2=contains&filter_2=2015&submit_apply_filter=&query=technical+bulletin&rpp=10)

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