GMOS in South Africa Series

An introduction to GM seeds: why they’re so different to what we know

What is genetic modification (GM)?

Genetically modified (GM) seeds have been created in a laboratory. The process of creating them is completely new and does not happen in nature. Since farming began people have worked with nature to breed plants and animals to suit human needs. Usually this breeding can only happen within the same “species” or family. For example, we breed a tomato with a tomato but we cannot breed a tomato with maize or with a pig.

In the last 30 years scientists have used genetic engineering (GE) techniques, also known as genetic modification, to create plants and animals with novel (new and unique) characteristics. In genetic engineering, the ‘genes’ responsible for a specific characteristic (called traits) are taken from one organism and forced into the DNA of another organism. In this way the characteristics of one species can be unnaturally bred into a completely unrelated one – across the boundaries between species and even plant and animal kingdoms. The resulting new species is called a genetically modified organism (GMO). Genetic modification allows scientists to mix the genes of unrelated species.

GM seeds are patented

Because scientists have inserted novel genes into the GMO, they argue that they have “created” something new. When a farmer plants GM seed he or she is doing this by permission of the company that owns the patent, for example, from Monsanto. This ‘permission’ is paid through a higher cost for the seed. Farmers are not allowed to save the seed to replant because it belongs to the company. Or, in the case of some crops like Soya, where the seed is saved and replanted the farmer must pay a license fee to the company or face being sued in court. This is the reason that GMOs are even more expensive than hybrid seed and why multinational corporations try by any means to get farmers to switch to GM crops.


What are the differences between farmers varieties, hybrids and GMOs

<table>
<thead>
<tr>
<th>Farmers varieties</th>
<th>Hybrid</th>
<th>GMO</th>
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<tbody>
<tr>
<td>Breeding process</td>
<td>Developed through farmer observation, cultivation, experimentation, selection and sharing. Knowledge passed down from generation to generation.</td>
<td>Developed in a laboratory by breeding two “distinct varieties”, e.g. drought tolerant and high yielding.</td>
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<tr>
<td>Seed saving</td>
<td>Seed can be freely selected, saved and planted year after year.</td>
<td>Performs well for one growing season only. Seed has to be bought fresh every year.</td>
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<tr>
<td>Who is it for?</td>
<td>Suited to local conditions, taste and cultural needs.</td>
<td>Commercial varieties, used by commercial farmers often for export or large markets.</td>
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<tr>
<td>Type of Agricultural system</td>
<td>Fits into diverse cropping systems, agro-ecology, traditional agriculture.</td>
<td>Usually developed to work within monocrop systems supported by irrigation, fertilisers, herbicides and pesticides.</td>
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<tr>
<td>Intellectual property</td>
<td>No legal ownership rights. Seed is enriched and developed through sharing.</td>
<td>These are corporate owned seeds and are usually protected by Plant Breeder Rights which does not allow farmers to exchange seed.</td>
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</tbody>
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What are genes?
The smallest part of a life form (organism) is a cell. Micro-organisms, such as bacteria, have only one cell whereas plants and larger animals have many cells that are stacked together to make up their tissues, organs or structures e.g. brain, bones, fruit etc.

Inside every cell we find DNA, which carries the full ‘instructions’ for how the organism will look, grow, function and reproduce. The DNA is inherited from the organism’s parents. Genes are small sections that make up the DNA containing the codes for specific proteins. For example, a goat’s DNA will ensure the goat looks like and behaves like a goat but a specific gene in the DNA will make the goat have white hair or brown hair.

The traditional foods that we know were developed by farmers over the last 10 000 years. We know that these foods are safe and which ones are likely to cause allergies because humans have been eating them for such a long time. These natural foods are part of our culture of eating and our bodies are adapted to them. The same is not true of GMOs. Scientists are not sure what impacts these new crops might have on our bodies or on the environment over time. It is just too soon to tell as the science is too new and not enough independent research is being done.

Once GMOs are released into the environment, for example when GM seeds are sown, these are impossible to control as they will reproduce and spread. The pollen from plants will drift in the wind or be carried by insects to other plants. Seeds will fall in fields and GM seeds may spill from trucks and begin to grow on sidewalks. We often hear about products that have design faults, which must be brought back to the factory because they don’t work or are dangerous. However, if we find there are problems with GMOs, these cannot be returned to the lab. GMOs will continue to spread and we will not be able to undo the damage that has caused.

Getting to know about seeds

Seeds can be categorised into three groups: those that are farmers’ varieties have been selected and bred naturally over time, hybrid seeds that are specially bred and GMOs that are artificially made in laboratories using genetic engineering techniques.

Farmers varieties

Farmers have experimented with seeds for thousands of years. Farmers have selected and bred seeds to suit and adapt to local environments, increase yields, taste better and for good storage, pest resistance and much more. Farmers also have a tradition of saving and exchanging their seeds through well established social networks. For these reasons, farmers’ seeds are very diverse. For example, when a farmer grows a traditional maize variety, he or she will notice all sorts of characteristics in their field in a season. The farmer will select the best performing seeds to plant the following year. There is a deep relationship between farmers, seeds, and the local environment.

Many of the farmer varieties include open pollinated seeds (OP). OP seeds are cultivars that will grow out ‘true to type’ when the seed is collected and planted. This is of benefit to farmers because when they save this seed to plant, their next crop will be like the parent. OP varieties are usually old cultivars that have developed over many generations of seed saving and sharing to have good qualities and are stable.

Hybrids need to be bought every year to ensure a reliable crop. Why is that?

Hybrids work very differently; they are bred to be uniform (to be all the same), not to be diverse. The advantage of hybrids is that farmers know exactly what kind of crop they will get when they plant because every single seed has the same characteristics.

Open pollinated varieties, or farmers varieties are very different. They have been bred over generations through selection and swapping. Each seed is a mixture of many characteristics, making them very stable and robust. The farmers field will always have a variety of characteristics. The plants that display the most useful characteristics will be chosen for seed. This is how the farmer interacts with nature to develop useful varieties. Seeds can be saved and planted year after year and they will continue to give good results.

Source: Steinbrecher, R. 2012 Genetic Engineering: The risks to food, farming and biodiversity. Presentation at Regional Biosafety Meetings: 2012