Transitioning from GM maize to agroecology for sustainable, socially just and nutritional food systems in SA

Current agro-food systems are inequitable, ecologically unsustainable, nutritionally deficient and hazardous for farm workers. They fit within the Green Revolution approach, that is, they focus on increasing crop production through the use of artificial fertilisers, pesticides and developing high-yield crop varieties. A growing body of organisations, including the International Panel of Experts on Sustainable Food Systems (IPES-Food), the IAASTD,[1] and the United Nations are calling for a transformation towards food systems that are ecologically sustainable and socially just.

South Africa is reliant on a genetically modified (GM) maize monoculture to provide staple food for millions of people and fodder for animal farming, especially poultry. In the face of increasing drought and an ever-weakening exchange rate, our dominant agro-food system is deeply fragile:

- It creates nutritionally deficient soils, and thus nutritionally deficient produce.
- It is associated with high input costs (seeds, fuel, fertilisers, herbicides).
- Maize is an inappropriately thirsty crop in a country that depends on rain-fed crops (about 10% of crops are under irrigation).
- It entrenches systems and structures that further inequality, poverty and unemployment, thus adding to hunger and malnutrition.
- It introduces biosafety risks to human health and the environment.

How can we develop and support agricultural practices that build healthy ecosystems, economies and societies and adapt to climate change: how can we move from food inequality to food sovereignty? The following are central concepts to understand:

Agroecology: a food production system that is guided by natural processes and draws from both scientific and indigenous knowledge. It builds locally appropriate food systems that are productive and nutritious, environmentally sound and socially and culturally just. Agroecology is considered as a key form of resistance to an economic system that puts profit before life.

Agricultural biodiversity (agrobiodiversity): includes a range of processes and products in agriculture that have resulted from natural selection processes, and inventions and developments that have taken place over millennia, through co-evolution within local social and cultural contexts.

Conservation agriculture: draws from the logic of agroecology in which natural processes are reinforced – in this case protecting soil quality and assisting in

1. The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) was launched as an intergovernmental process under the co-sponsorship of the FAO, GEF, UNDP, UNEP, UNESCO, the World Bank and WHO. The assessment ran from 2005–2007, involving 900 participants and 110 countries from all regions of the world.

water management through keeping the soil covered and no-tillage farming. Industrial agriculture is adopting this method to remedy destroyed soils, however, in order to continue planting monocrops, the extensive use of toxic herbicides to manage weeds is necessary. Implemented in this way, it cannot be considered an agroecological practice.

Food security: access to a sufficient quantity of affordable, nutritious food.

Food sovereignty: the right of people to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.

Green Revolution: a large increase in crop production achieved by the use of artificial fertilisers, pesticides, and high-yield crop varieties.

Staple food production in South Africa

Maize

There is high demand for white maize for human consumption both in SA and the Southern African region (of which more than 80% produced in SA is GM), while yellow maize is used mainly as animal fodder. During 2016 South Africa has had to import an unprecedented amount of white and yellow maize to meet local demand. The long drought has impacted on food availability and affordability: white maize yields dropped from 14.2 million tonnes in 2014 to 7.16 million tonnes in 2016. It is estimated that South Africa will import 5 million tonnes of maize between May 2016 and April 2017. Climate change is resulting in shifting bio-climatic zones, and over the long term maize production will decline, especially over much of the Highveld. While maize planting may expand in the Eastern Cape, this will threaten biodiversity and protected areas.

Food price inflation

South African consumers are feeling the impact of food price inflation. Between January 2015 and January 2016, 5kg of maize meal increased 43.7% in cost (NAMC, 2016). This increase also has serious implications for the costs of animal production and hence the cost of meat.

It is estimated that, while affluent shoppers spend about 2% of their income on food, the poor spend about 33%. Currently, approximately 50% of South African households experience hunger; this is set to increase with rising inflation.

'Drought tolerant' GM maize

In response to the drought and the failing maize crops, seed companies have promoted both hybrid and GM 'drought tolerant' maize varieties. However, in the United States, where Monsanto's GM 'Droughtgard' maize (MON87460) has been introduced in drought prone maize growing areas, it is estimated that it will increase productivity by 1% – roughly the same as annual maize productivity increases resulting from conventional breeding for drought tolerance (Gurian-Sherman, 2012).

With such a minimal yield increase, the decision by the South African biosafety authorities to grant approval for the commercial growing of MON87460 is highly questionable. Concerns about the promotion of GM and hybrid varieties include the additional costs of purchasing seed each year, use of agricultural chemicals, the prohibition from saving seeds for the purposes of replanting, and other social costs that may emerge from the use of GM and hybrid seed by smallholder farmers. Despite widespread objections supported by more than 25,000 signatories, field trials involving drought tolerant GM maize varieties stacked with herbicide tolerant and insect resistant GM traits being grown in SA are likely to go ahead in South Africa in the near future.

2. While hybrid seeds only produce reliable yields for one season and must therefore be bought annually, harvested seed from OPVs can be replanted for several seasons (subject to breeders' rights).

Farmers' responses to drought

South Africa has a dualistic agricultural system: a concentrated commercial agriculture sector consisting of fewer than 40,000 farming units, covering about 82 million hectares and responsible for 99% of marketed agricultural outputs; and small-scale farmers consisting of more than 2.5 million households, covering about 14 million hectares of marginal agricultural land, some of which lacks water and infrastructure.

For commercial farmers, drought and low yields – coupled with a high exchange rate and the problem that South Africa is a net importer of agricultural inputs – lead to high debt or even bankruptcy. Some farmers are shifting to open-pollinated varieties[2] (OPVs) to reduce production costs and increase profitability. OPVs are cheaper than hybrid and GM varieties, and require fewer additional inputs. GM maize is double the price of popular hybrids, and five times the price of popular OPVS, with stacked GM maize seed around 42% higher than single trait GM maize (Fischer *et al*, 2015).

Some 40% of commercial maize farmers, amongst others, are also moving in the direction of conservation agriculture. This practice potentially reduces input costs in the long term; and with no tillage, the use of cover crops and intercropping improves the soil conditions. Regrettably, however, current crop rotations are really 'glorified monocultures' with farmers rotating between GM soya and GM maize – and in the western parts of the country between GM maize and sunflower – and extensive use of toxic herbicides is used to manage weeds.

Small-scale farmers, generally situated in the former homelands, are involved in livestock and grain (mostly maize) farming. In the context of the 2015/16 drought, many households that would have previously produced their own maize for consumption now have to purchase maize at high prices, causing concern for low-income household food security and local economies. Farmer support programmes are embedded in an industrialised and commodified model and thus benefit a few established farmers, maintaining disparities within the sector, and failing to support those most in need.

Working towards change

There is general global acceptance that industrialised agriculture, which has been able to produce food on a large scale, has not curbed widespread food and nutritional insecurity. The industrial model of agriculture is deeply embedded within inequitable and environmentally destructive global commodity trade systems. Due to the model's heavy reliance on chemicals, South Africa's soil has lost 50–70% of its carbon and is much degraded.

At the same time as experiencing rapid resource depletion, South Africa has the double burden of severe undernutrition and overweight/obesity, due to a rapid increase in cheap, over-processed, single-food diets. We urgently need to support and strengthen dietary diversity, in order to sustain an increasing urban population. Product-based agricultural solutions that are linked to profit-making from the sales of, for example, GM seed and chemicals neglect the right to safe and nutritious foods.

Agroecological systems can simultaneously address the climate, ecological, nutritional and social injustice crises that beset the current food system. According to the UN, agroecological farming methods could double global food production in just 10 years and create more jobs than conventional agriculture, as more money is invested in people in an organic farm operation (Rodale Institute, 2011). Indigenous, traditional foods, such as sorghum and millet can play a transforming role if they are invested in and promoted

appropriately, and if people are empowered to make better decisions around diet, nutrition and health. By promoting agricultural biodiversity, thousands of years of co-evolution and knowledge sharing can be drawn on to address the problems of drought and environmental destruction.

Conclusion

So, how can we develop and support agricultural practices that build a healthy ecosystem, economy and society?

We need to shift focus from high-yielding crops with high-calorie content to a diverse range of foods that are accessible, affordable, sustainable and culturally appropriate. Nutritional value and cultivar performance under diversified farming practices are essential. This requires:

- shifting away from monocultures, including GM crops and GM maize, in particular, and from the use of agrochemicals;
- public funding for appropriate research and development;
- a policy shift away from a focus on yield and volume only (in South Africa represented by a GM-dominated maize monoculture) and towards a focus on a diversity of crops and seeds, especially indigenous African summer grains;
- appropriate agriculture and seed policies and laws;

public funding to support a transition to agroecology; and

- nurturing markets for diverse crops and enable the participation of small-scale farmers and producers in our food system.

Ultimately, we need to work towards food sovereignty: the right of people to healthy and culturally appropriate food, produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.

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