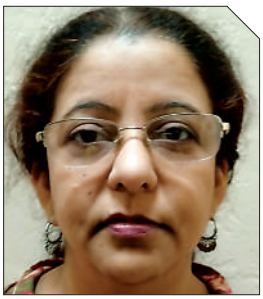
DR RAM KAUNDINYA
Director General,
Federation of Seed Industry of India

DR RATNA KUMRIA
Director of Biotechnology,
Federation of Seed Industry of India



Organic, ZBNF, Biodynamic or GM – Way for future farming in India

The challenges of meeting the food security and nutritional security of the country in a profitable way for the farmer and in an environmentally sustainable way are enormous. We have to get ready to feed 150 crore population in the next ten years, with the bottom of the pyramid requiring food at affordable prices.

Science helped our country to achieve a breakthrough in crop yields and ensure food security except in oil seeds. Starting with High Yielding Varieties (HYV) of Rice and Wheat fifty years back we passed through hybridization and Genetic Modification in some crops to achieve this success. Our food grains production quadrupled in last fifty years. Genetically Modified (GM) Cotton helped the country and the farmer to prosper. Hybrids in Maize, Millets, Sorghum, Vegetables and other crops helped us to meet increasing demand. Input intensive and high yielding agriculture helped us to keep food prices affordable. However, the debate continues about what technologies we should use for the future. Lack of profits for farmers and the adverse impact of some of the inputs on soil health coupled with the depletion of natural resources like water pose this question before us: what is the way forward for our agriculture?

Some recommend organic as the way forward. Organic farming produces food according to certain production methods like cultivating without chemical pesticides and fertilizers and processing the output without ionizing radiation or food additives. Zero Budget Natural Farming (ZBNF) does not use any purchased inputs and instead uses cow as the central resource for managing several aspects of farming. Another method quite similar to ZBNF and organic farming is Biodynamic agriculture that considers animals, crops, and soil as a single, self-sustaining living system. It insists on the use of manure and compost along with herbal and mineral additives. The system uses astrological calendar for sowing to engage spiritual and cosmic forces.

Agriculture involves de-forestation, loss of biodiversity, eutrophy and acidification of the land and aquatic ecosystems. Globally agriculture emits 25 to 33 per cent of the total GHG emissions, uses 40 per cent of the land and 70 per cent of the available freshwater. These resources are not completely renewable, making the agricultural essentials continually scarce for the growing population. Similar studies show that 25 to 110 per cent higher land acreage is used in organic farming for obtaining similar production as conventional farming. Although organic farming utilized 15 per cent less fuel

ZERO BUDGET NATURAL FARMING

energy, it had 37 per cent higher eutrophication potential. There was no significant difference for Greenhouse gas (GHG) emissions (4 per cent lower in organic) and acidification potential (13 per cent for organic) between the two practices.

Despite lower fossil fuel consumption in organic farming due to non-use of fertilizers and pesticides, the GHG emissions are not lower as more land needs to be tilled and planted to obtain output comparable to input intensive farming. The acreage increase further leads to loss of biodiversity thereby negating the positive impact of low fossil fuel usage.

Organic farming as well as biodynamic agriculture yields are lower than high input agriculture yields by about 10 to 45 per cent. Since organic farms use manure that releases nitrogen as per the environmental temperature and moisture, the release and thus the availability of nitrogen for crops is not uniform, impacting the yield and increasing the land required for equivalent produce. The reactive nitrogen released by the manure forms nitrous oxide, which is GHG, hence there is no difference in GHG emissions either, even though the GHG types may vary for the two systems.

Organic and ZBNF farms are more labour intensive than regular farms due to manual weeding and pest control though it does generate more rural jobs. Human and animal labour costs ranges between 40 and 60 per cent of the operational costs and these are higher in organic/ZBNF system. In the tropical and sub-tropical nations, the soil health is poor due to heavy rains and no external inputs, the soil nutrients are not replenished by nutrient cycling or mobilisation from the subsoil. This is very different from the winter rest for the soil that helps in mineralization in the Temperate nations. Large-scale organic farming does utilize approved pesticides and hence the produce is not completely free of pesticide residue. A US Department of Agriculture (USDA) report has shown that pesticide residues are found on both organic and conventional crops.

Usage of manure in organic farming on the other hand has led to many human health crises, including most importantly, E. coli outbreaks due to faecal contamination from manure. A comparative study in vegetables found E. coli traces on 10 per cent of organic but only 2 per cent of conventionally farmed vegetables.

BIODYNAMIC AGRICULTURE

Similarly, fungal infections during production or storage of produce may lead to poor quality toxin contaminated food.

The organic produce may have higher micronutrient content but is very similar to produce of high input cultivation in nutritional value and taste. It is estimated that the lower productivity from organic farms and higher pricing of organic produce will increase stress on global food security. According to a paper in the Nature (Nature volume 564, 249–253, 2018), if one nation takes more land and grows the same amount of organic food, it would result in more deforestation in the tropics which would contribute to more carbon dioxide in the atmosphere. Research shows that organic peas, farmed in Sweden, have close to 50 per cent higher climate impact than conventionally farmed peas. Scientists have also shown that organic meat and dairy products are climatically worse than their conventional counterparts. Since organic farming requires higher farmland use, its impact maybe observed more in the developing nations than the developed ones.

The promotion of ZBNF promises reduced input costs, higher yields and better pricing for the produce. Unfortunately, the input costs are lower only when family labour does all the hard work and hired labour is not utilized for cultivation. It is much more labour intensive than conventional farming. A dramatic drop in yield is observed in the initial years of adopting ZBNF, which tapers off in 3-4 years, though higher yields have not been observed later. Similarly, there is no clear price advantage for ZBNF produce. Continued adaptation of ZBNF would require advantageous output markets along with farmers holding power, considering the low initial output.

HIGH YIELDING VARIETIES

The future

Our population will reach 170 crore by 2050. The food basket is undergoing a huge change with increasing demand for nutritional, chemical free food. Demand for organic food is growing as income levels increase. Farmers profitability is not improving. Environmental impact of agriculture has to be reduced. We have to reduce the consumption of water in agriculture. Soil heath is to be improved with more organic matter. In the midst of all this is the threat of climate change which can reduce yields drastically. We need reorientation of the package of technologies we use in our agriculture.

There is no doubt that we have to reduce use of chemicals. Science & Technology supported high input farming helps to feed our growing population and work towards ensuring food security. Planting crop varieties that uptake and utilize lower amount of minerals and water to efficiently produce higher yields, have resistance to plant pests and tolerance to adverse climatic conditions, so that crop losses are minimized, is the sustainable way forward. Such biotechnology and mechanization supported produce that will be available in sufficient amounts and devoid of microbial infections and toxins will address the Sustainable Development Goals (SDGs) of no poverty, zero hunger and good health and well-being much better than highly priced low yielding organic food. Such produce will not only be profitable for the farmer but also safer for the consumer and the environment. Such an amalgamation of conventional and organic farming will improve the soil-plant environment and strengthen the coordination between promotors of organic and conventional agriculture towards food security and accessibility for consumers worldwide.

ORGANIC FARMING

Every technology comes with its advantaged and disadvantages. We need to make available a basket of technologies including chemicals, HYVs, Hybrids, GM, Organic, ZBNF, etc to the small holder farmer. It is for him to decide what he wants to use in his field. Each technology must be used where it gives best results compared to others. No single technology can be a silver bullet for meeting our agricultural challenges. AS