

The Effect of Technological Advancements on the Life of a Farmer

Suman Bahniwal Kuhar, Bhagat Phool Singh Mahila Vishwavidyalaya, Sonipat, India

Abstract—The human race has not worried much about climate in the past few years but now everyone is worried. And, why not? The climatic changes will slowly hit the most important thing to mankind – food. And the worst part is that the human race is responsible for this climatic change.

I. INTRODUCTION

Even after many movements to better the planet, there has never been actual worry in the minds of humans regarding climate change. Obviously, the changes have slowed down but in the past few years, it has really hit humans how they have ill-treated the planet. And during this payback time, the resource that has been hit the worse is food. But it is not just the climate that we need worry about. The population is also rising. It has increased to almost 6 billion and in the next 50 years, it is expected to double! How will mankind manage to deal with both these changes – climate and the population? How will the increasing demand of grain going to be met with.

Famines in Somalia, the floods in Pakistan in 2010, droughts and other frustrating natural calamities bother not only the people but also the farmers. The need of the moment is an integrated research to adapt to the climatic changes and also ensure that farmers are aware of these changes and they can be prepared. Each country will need a different solution or rather it would be better to say that climate will need a different agricultural solution. With this in mind, a number of solutions are already in place. But they have their benefits and pitfalls.

Genetically Modified Foods (G.E.M)

One of the changes in place is the genetically modified foods that first began as an experiment to resolve the hunger caused by increase in population, while preserving the environment by reducing dependency on herbicides and chemical pesticides. It also

sought to solve any malnutrition problems.

G.E.M have a lot of advantages –

1. **Pest Resistant Crops** – A lot of crop losses occur from pests, resulting in starvation and losses to farmers. Farmers use a lot of chemical pesticides to protect the crops but consumers do not wish to eat these types of foods to protect their health. Now what is the solution? The solution is to grow GM crops like B.t corn. This has a double advantage – use of pesticides is eliminated and the cost of marketing the crop is reduced. Both the farmer and the consumer is happy.

2. **Herbicide Tolerance** – In the U.S, farmers are transitioning from traditional methods of farming to organic farming. And so, they are changing to producing feed grains using organic methods. But organic farming has its pitfalls – one of the biggest being weeds. A 4-year study by Penn State University and University of New Hampshire discovered that for weed management, full tillage was needed. But it is not a cost effective method. So, using herbicide is the solution. But, the herbicide should not harm the crops.

This is where genetically engineered crop plants that are herbicide-tolerant can help. One example is of the genetically modified soybean strains created by Mosanto that are unaffected by herbicides. So, when the farmer growing these soybeans can use weed-killers that will kill the weeds without affecting the crop. The result is increased productivity and reduced costs of production.

3. **Disease Resistance** – The genetically modified crops used are also disease resistant. The bacteria, fungi and viruses that attack plants are ineffective against G.E crops.

4. **Climate tolerance** – Climatic changes such as frost, drought, salinity and others do not affect these genetically modified plants. For example, plants like potato and tobacco have been 'introduced with an anti-freeze gene from a fish that helps them to tolerate low temperatures. Similarly, the

example of Subamarino rice, bred by International Rice Research Institute of Philippines, that managed to recover even after being submerged for nearly 14 days during the flooding in parts of Philippines, shows how beneficial G.E.M can be.

5. **Nutrition** – In the 3rd world countries, malnutrition is a major problem. In these countries, the staple diet is rice, which does not contain adequate nutrition, resulting in malnutrition. Genetically engineered rice, containing essential minerals and vitamins can alleviate the nutritional deficiencies. One example is the 'golden' rice created by researchers of Swiss federal Institute of Technology Institute for plant sciences that contain a high quantity of beta-carotene. Consumption of this form of rice can alleviate Vitamin A deficiency. This rice has not yet been marketed as yet due to protests in Europe. But it is hoped that the Institute's hopes for offering this 'golden' rice free of cost to the third world countries will soon come to effect.

But the farmers of the 3rd world countries who grow rice to earn their living will lose out till they are able to make the transition from the traditional rice to this 'golden' rice.

G.M. crops are also adversely affecting the lives of farmers. One of the biggest disadvantages of G.M. plants is that they cannot always be grown as crops as underwater pollution and contaminated soil can result in their damage. Although some plants like the poplar trees have been engineered to clean the soil, till the time that soil pollution can be eliminated, these will be grown in controlled conditions. This is not good news for the farmers for the consumers will surely prefer the G.M. crops.

Environmental Hazards of G.E.M and Solution

While G.E crops are beneficial, they also have some environmental hazards like affecting mortality rates of some organisms, the reduction in effectiveness of pesticides and gene transfers to species that are not targeted.

It is a concern that some insects will become B.t resistant or to other crops genetically produced. It is also a concern that the herbicide tolerant plants and weeds may cross-breed resulting in transfer of the herbicide resistant gene to the weeds that will not be responsive to herbicides.

But there is a solution to these problems. One is to modify G.M. crops and create male sterile plants so that the carried pollen does not have the new gene. Hence, cross-pollination can be prevented and other harmless species can be protected.

Also, creating buffer zones around the GM crop fields can ensure that beneficial pests are unharmed and the crop destroying pests do not develop B.t pesticide resistance. But this solution does not seem to be feasible for farmers as it can be expensive. It will required a lot of acreage so that buffer zones can be created.

Economic Concerns of G.E.M

Marketing - Marketing the G.E crops is an expensive and lengthy process. Agri-biotech companies can make a tidy profit out of these crops but what of the farmers? The crops are undoubtedly, of superior quality but can the farmer afford to buy the seeds for G.E crops? They will be expensive because of the cost that goes into their creation. The biggest fear is that the gap between the poor and the wealthy will widen noticeably. Farmers of the third world countries and small farmers will not be able to afford these seeds.

Patent Enforcement - Patent enforcement is another concern. Farmers contend that the Monsanto strains involuntarily grew in their farms when they were cross-pollinated. To resolve the patent infringement issue, the only solution seems to be to introduce a 'suicide gene' so that the plants do not regrow after one season. The farmers will have to buy genetically engineered seeds to grow crops in the next season. But this will place a financial burden on the farmers, leading to financial disasters.

Tillage - In the US, in the cropping experiments conducted in Central Pennsylvania, it was found that the growers wishing to change to organic production would face varying economic success as it involved compost and manure costs. It would depend on the source of manure – whether it was purchased or available on-site.

At present, G.E.M foods are not very prevalent in the market, which show that not too many farmers have adapted to these

techniques owing to the costs involved and the fact that there are only a few crops or plants that have completed the federal requirement for commercialization.

Use of Wind Farms in Agriculture

When it comes to dealing with climatic changes, wind farms help grow some crops like soybean and corn grow better. The wind turbines cool the surrounding areas during the day, thereby reducing the temperature. A study conducted by the University of Colorado on soybean and corn crops also found that wind turbines preventive autumn and spring frosts resulting in reduction of action of the pathogenic fungi that grow on leaves of these crops.

It was also found that the reduction in temperature made a positive difference to the maize cultivation.

But the noise, especially during night-time, is causing health concerns. In UK, the permitted noise levels is 42 decibels, but can still cause stress related disturbances, especially, since the wind turbines are so close to the houses.

The wind-farm industry has been recently attacked and if the directive goes through, will it sound the death knell for them? These farms are, no doubts, very useful as they generate energy and wind power, which is subsidized. What will it mean for the farmers who depend on wind farms for their source of energy and for their crops?

Farmers in countries are slowing making use of science in agriculture. Although the transition from traditional methods to scientific methods is slow, it is hoped that soon all the troubles involved in the transition can be resolved to the mutual satisfaction of both the consumer and the farmer.

Weed Management

How is it possible to talk of agriculture without any mention of weeds? This unwanted plant is something that the farmer dreads as it can cause harm to the plants or crops that he needs for his survival. Sometimes, excess growth of weeds can also be harmful to livestock. However, the good news is that

weed control is possible by various methods.

1. **Organic Gardening** – This form of weed control makes use of systems like Square foot gardening, humus, mulch and fertilizers to control the growth of weeds. While square foot gardening can be time-consuming and leads to wastage of space, using humus, mulch and fertilizers is another way to control weed growth. These organic products are effective and inexpensive. Also, they can be made using materials that the farmer has.

2. **Application of Various Herbicides** – Herbicides, on the other hand, is another form of weed control that may or may not be effective. The reason why the herbicides become ineffective is that weeds develop resistance after some time. However, researchers have come up with a way to reduce weeds – by strategically applying herbicides in different ways. It may be an expensive way to control and reduce weeds but it is immensely effective.

One of the herbicides commonly used was glyphosate. Horseweed, a type of weed, developed a resistance to this herbicide and the product started losing its effectiveness.

A five-year study, conducted by Purdue University, shows that if farmers keep rotating various herbicides, then they can easily control weeds. It was found that fields using 3 kinds of herbicides reported nearly 95% decrease in horseweed, thereby proving that application of various herbicides can control weeds.

For the farmer, this is good news as decreased weeds means increased crop yield.

Climatic Changes

Before the farmer starts worrying about weeds, there is another danger looming – climate change. The increase in temperatures is no doubt, going to change to face of the planet but another thought is how it is going to affect our food production. It is going to mess with global agriculture leading to famines and hunger. This is when people are talking about global agriculture.

So, what is global agriculture and what does climate change actually mean for the farmer?

If you are talking about global agriculture, then the need is to ensure there is an increased production of food globally as the population is increasing.

And, since the world is becoming a warmer place to live, changes will have to be made so

that agriculture adapts to this new world soon so that no one goes hungry. Whether it is the 2010 floods in Pakistan or the droughts of East Africa, unless agriculture adapts, the human race has no hope of surviving.

The burden now falls on the farmer to continue producing crops and keep feeding the human race. In this, he has help from the researchers who have worked to grow crops that are not easily damaged.

Growing Wheat

Wheat is one of the most important crops in the world. Scientists have now found the hidden components of its genetic code. This discovery will help in breeding more varieties of disease and climate resistant wheat that will help reduce crop losses. This discovery is a major breakthrough in the field of agriculture.

Wheat resistant to Stripe Rust

Researches in wheat have been continuing since long and researchers have already discovered a gene that is resistant to stripe rust. Yr36, the resistant gene, was extracted from wild wheat and introduced into domesticated bread wheat. This wild wheat is native to Fertile Crescent, Israel, where many varieties of wheat have been grown since ancient times.

Stripe rust is one of the major diseases that wipes out wheat crop. Stripe rust outbreaks have occurred since the 1950s. Since the fungus causing this disease spreads by wind, it ruins crops during wet summers and springs and mild winters. Yr36 provides protection against this dreaded fungus and is effective in fighting Stripe rust.

Wheat Resistant to Rot

Crown rot is yet another disease that results in major crop losses every year in Australia. It is a chronic problem in the country, caused by Fusarium, a fungus. Scientists in Brisbane are working to find and develop wheat strains that are resistant to Crown Rot. Their success will help farmers grow wheat that can feed the country and also, escape losses.

Salt Tolerant Wheat

Meanwhile, wheat farmers in Australia have cause to rejoice. Researchers have developed

wheat that is not only salt-tolerant but also yields 25% more crop in saline soils.

Salinity was a big environmental issue in Australia that affected its wheat-growing regions. The saline soil destroyed durum wheat. The introduction of genes that left out salt in durum wheat enabled the crop to survive in a saline environment. This genetic modification of salt-tolerant wheat is good news for all the saline wheat growing regions in the world. These experiments are not only for wheat but also for rice and the results are very promising. Soon farmers in saline areas will not have to experience crop losses.

Genetically modified food is good on one hand for the farmers who will not have to suffer crop losses due to climatic and other reasons. But what stand do the governments of various countries take on these GM foods? How are they regulated?

A regulatory process is yet to come into place for GM foods. Governments have to work out ways to monitor and approve newer varieties of crops that provide more yield and are disease resistant.

In Japan, GM food testing is voluntary and supermarkets are offering both unmodified and modified food.

The Indian government has yet to take a stand, as GM crops are not grown in the country. Therefore, these foods are not available in the supermarket. But, considering India's endemic poverty and population explosion, the country will have to take drastic measures that can counteract the poverty and feed the population. If given the chance, Indian farmers can grow various crops like wheat and rice, that are disease resistant and those that can grow in various climatic conditions.

In total contrast to Japan, there are some Brazilian states where there is a ban on GM crops. It is believed that importing GM crops into the country will cause economic harm and the country will not be able to compete globally with other agricultural countries.

Europe has its share of anti-GM workers too. US regulations are confused about GM crops.

Conclusions

There is no doubt that adapting agriculture

to the climatic changes and growing genetically modified crops will benefit human race. Will it benefit the farmers too? Yes, if they are given sufficient economic support. It is the farmers who will be growing these crops and it would not be fair to burden them economically. The governments have to find a way to introduce these globally beneficial crops into the country without harming them that grow the crops.

Growing GM crops does not mean just getting GM seeds and sowing them. It also means using different pesticides, managing weed and monitoring the effects of this new generation of crops. The results of crops grown in fields may be different from those grown in labs.

The government and the researchers share the responsibility with the farmers for producing crops that can benefit mankind without destroying other plants or species.

References

- [1] <http://www.sciencedaily.com/releases/2011/02/110222140548.htm>
- [2] <http://www.telegraph.co.uk/earth/energy/windpower/9653429/Wind-farm-noise-does-harm-sleep-and-health-say-scientists.html>
- [3] <http://www.time.com/time/health/article/0,8599,2105169,00.html>
- [4] <http://www.csa.com/discoveryguides/gmfood/overview.php>
- [5] <http://www.sciencedaily.com/releases/2012/08/120814100319.htm>