International Journal of Academic Research
ISSN: 2348-7666; Vol.3, Issue-10(7), October, 2016
Impact Factor: 4.535; Email: drtvramana@yahoo.co.in

Impact on use of new seed technology on agricultural productivity

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Abstract: *Seed is the first critical input needed by farmers to improve and maintain their crop productivity. On this basis, seed security has been defined as the availability of the appropriate variety, at the right place and time, in sufficient quantity and quality. It is important from two reasons. Firstly, it is interesting to remember that around 40 per cent of the total increase in agricultural production registered in the last 50 years at a global level has derived from the introduction of new varieties. The other reason is about how farmer decides to select a variety on the basis of its agricultural characteristics, such as resistance to stress or disease, or its productivity and the recognized value of its products.*
Key words: *seed, cultivation, economic framework*

Introduction

This paper intends to describe the benefits and concerns about the use of GM seeds and high yielding variety seeds that are provided to farmers. In agriculture, seed is considered as one of the means of production. Moreover, the seed is the starting point, the first determinant of plant and consequently the master key to success with its cultivation. The correlation between the quality of the seed used for cultivation and the yield obtained from this cultivation is universally recognized. Depending on the type of crop, the relationship between seed quality and crop yield is different and differently relevant. The "seed quality" describes the overall value of the seed for its intended purposes. It is a multiple concept resulting from the genetic characteristics of the seed and from other factors affecting its development, maturation and storability. Seed quality is a combination of different characteristics. Focusing on the effect of seed quality on crop productivity and improvement of agriculture in India, the topic intends to discuss the issues concerned surrounding seeds technology.

Importance of seed:

Seed is the first critical input needed by farmers to improve and maintain their crop productivity. On this basis, seed security has been defined as the availability of the appropriate variety, at the right place and time, in sufficient quantity and quality. It is important from two reasons. Firstly, it is interesting to remember that around 40 per cent of the total increase in agricultural production registered in the last 50 years at a global level has derived from the introduction of new varieties. The other reason is about how farmer decides to select a variety on the basis of its agricultural characteristics, such as resistance to stress or disease, or its productivity and

the recognized value of its products. Farming community has therefore selected the variety for a specific situation and purpose, so it is essential that they have the correct variety. Thus, the expected potential of a new variety or any well-known variety will not be expressed in actual advantages and profits if poor quality seed is used.

During the last decade, many developing countries have initiated programmes of structural reform in order to correct the severe macro-economic imbalances. Advancement in seed science is often considered to be one of the most important technologies in this regard. On the one hand, as long as other factors are non-limiting, it is genetic quality of seed that plays crucial role on crop yields and therefore on productivity of other agricultural inputs and cultural practices within the farming system. On the other hand, improved seed can make a substantial contribution to productivity independent of other purchased inputs, which is of particular benefit in resource-constrained small farm environments.

In the cultivation of plants for agricultural purposes, satisfactory results are reflected in a high yield of valuable products, resulting in economic benefits for the farmer and others involved in the agriculture and food chain. Many production factors may affect the results of cultivation. Some of these factors depend on the geographical area, such as environmental conditions and soil characteristics; others on the economic framework, such as agronomic management (tillage, irrigation, fertilization, treatments). The farmer is a key factor, due to her/his skills, as far as she/he can take the relevant decisions and have access to suitable means of production. In the end, the market value affects the final result of the cultivation, depending both on local and global trends. Wherever we are and whichever crop is cultivated, the quality of the seed used is the starting point and the most important factor for successful production. Only the use of good quality seed will ensure that the advantages expected after the application of other means of production, such as watering or fertilization, are achieved.

In addition, the use of good quality seed can prevent or at least reduce the use of costly inputs, such as chemical treatments aimed at controlling diseases or weeds, reducing at the same time the potential risks for the environment and human health. In a word, only the use of good quality seed will ensure satisfactory results from cultivation. This is the reason why secure seed supply systems are needed all over the world, in order to get available seed of good quality to all the agricultural communities. This is also the basis of different seed certification schemes established at national or international level and of the Quality Declared Seed System as published by FAO in 1993 and revised in 2006.

The agriculture industry has traditionally been supportive of technological advancement, particularly in the field of genetic crop improvement. For decades, the industry has been mixing naturally the genetic traits of seeds in the search for particularly robust varieties. Genetically modified (GM) seeds are a significant step forward in the production of agricultural crops. GM seeds are seeds that have been modified to contain specific characteristics such as resistance to herbicides or resistance to pests (in the case of Bt cotton, brinjals, maize, corn). But the method of modification used with GM seeds varies

from the traditional method in many respects. The genes have not been modified over generations of cross-fertilization, but rather inserted directly into the DNA of the seed. But the things like environmental and health impacts should be taken care. But as far as Indian farmers are concerned many are illiterate and are unaware about legality and other issues of concern.

The controversies surrounding GM products created fears especially among farmers that made them to hesitate to use GM seeds as part of their agricultural operations. Farmers should understand both the benefits and concerns that are raised by the use of GM seeds. Benefits of the technology include increased crop yields, diminished use of pesticides and herbicides, and increased profits. Concerns that farmers should address before adopting the technology include the private contractual relations between farmers and seed companies, the environmental impacts of the technology, and the potential impacts of consumer concerns (both domestic and international) on the market for GM products. To get satisfactory results from cultivation the seed needs to meet the requirements of the farmer in terms of the genetic characteristics of the variety, the potential yield and the marketable quality of the end product. Moreover, the good quality of the seed should be maintained up to the time of sowing.

There is an expectation widely held by those in agriculture that GM seeds will increase the yields of farmers that adopt the technology. Similarly, farmers expect that, as adoption of GM seeds increases, the use of chemical pesticides and herbicides (and the costs associated with their application) will decrease. The Economic Research Service study found that crop yields "significantly increased" when farmers adopted herbicide-tolerant cotton and Bt cotton. The use of herbicide-tolerant soybeans resulted in a "small increase" in crop yields. Another study performed by Iowa State University found that Bt crops out-yielded non Bt crops. Studies have not found a clear connection between the use of GM seeds and decreased chemical use. In general, studies indicate that farmers' profits increase as they adopt GM seeds.

Irrigation is one of the fundamental factors in the adoption of new agricultural strategy. Assured irrigation specialties not only helping increasing productivity but their availability is a pre-conditions for application of new agricultural strategy. In general, germination capability and seed vigor represent the master keys to achieve the rapid germination and good emergence needed to ensure an appropriate plant population. Germination and seed vigour are however more important for wide-spaced crops (e.g. maize, sugar cane or beet, cotton, sunflower). This Germination and seed vigour are also highly significant for crops harvested during vegetative growth or before full reproductive maturity, such as many vegetable species. In these cases there is no compensatory growth, so a small reduction in the plant population can be the reason for a reduced yield crop yield and productivity are also influenced by seed hygiene, that is, seed health, weed and insect contamination and high quality standards always have a positive effect. On the contrary, a noxious weed infestation or the occurrence of plant diseases can reduce the yield in all crops, directly, or as a result of competition for physical resources or exploitation of plant resources. Of course, some circumstances

make the presence of noxious weed or of pathogens a more serious issue. This is the case of organic farming, where the agricultural practice limits the use of chemical treatments and the possible risk of contamination with weeds and pathogens transmitted by the seed become greater than in conventional systems. This is also the case in some areas where the availability or the costs of herbicides and other chemicals represent a challenge.

Here it is worth mentioning that for some seed-borne pathogens (e.g. bacteria) no effective chemical methods are available and the most suitable way to prevent disease is the use of healthy seed. In order to ensure high yields worldwide and to maintain high productive standards, seed testing again plays a very important role. Evaluation of seed quality by purity and germination tests has been common practice since the beginning of the history of seed testing. Purity and germination still represent the most popular kinds of test many seed testing laboratories are asked to carry out with the aim of ensuring high germination and freedom from undesirable weed seeds. The physical purity test is carried out with the aim of evaluating the percentage of pure seed, of seeds belonging to other species and of inert matter. The identification of the other seeds retrieved is also required. The object of the germination test is the evaluation of the maximum germination potential of the pure seed. The seed is therefore germinated in optimal conditions to allow the maximum expression of its potentiality. Thus the Seed heath testing is also required by some certification schemes or carried out routinely for monitoring purposes. All this is done by the research agencies and scientists related to this but to what extent all this is eco friendly, healthy and farmer friendly is other matter of concern.Though all this activities may create money through marketing, patent rights and at last by high production but is it economically and ecologically sustainability should be kept in mind while developing new seed technologies.

Some of the Issues related to agriculture in introducing hybrid seeds:

1. Prohibit reusing of seeds by the farmer: Seed companies have invested significant funds in the research and development of GM seeds, and they protect this investment through their contracts with agricultural growers. These contracts aggressively protect the biotechnology company's rights to the seeds. Under a private contract between a grower and a biotech company, the grower's rights to the purchased seed are significantly limited. Such contracts generally contain a "no saved seed" provision. This provision prohibits growers from saving seed and/or reusing seed from GM crops.

Binding arbitration, often contracts between seed companies and private growers contain a binding arbitration clause that requires all conflicts arising from performance of the seed (or technological traits within the seed) to be resolved through arbitration. This binding arbitration clause precludes farmers from filing lawsuits. Additionally, the farmer is constrained in terms of the time frame within which he must raise a dispute. Under the contract, the grower is typically given little time from the day that the problem is first observed to file a complaint with the seed company.

2. **Development of resistant weeds and insects**: Farmers may worry that their use of GM seeds will create "superweeds" or "superbugs" that, over time, become resistant to GM seeds and crops and to other herbicides and pesticides. There is some research that suggests that weeds and bugs could possibly evolve into resistant organisms. Gene movement from crop to weed through pollen transfer has been demonstrated for GM crops when the crop is grown near a closely related weed species. Similarly, insects have, in the past, developed a resistance to pesticides. A recent study documented a decreased susceptibility in pests to the use of Bt as a sprayed pesticide. One particular strategy that has been developed to prevent the growth of pests resistant to GM seeds is "refuge areas." These areas are swaths of land, planted with non-GM crops, which act as refuges for the pests. Pests migrate to and remain in these areas, where they eat and breed. Since the refuge area offers the pest adequate food, the pest has no need to become resistant to GM crops, and thus the bulk of the crop is protected.

3. **Problems in preserving the identity of non-GM crops** : Identity preservation in the field Potential cross-pollination of GM seeds onto non-GM crops is also a concern to farmers, particularly those farmers that certify their crops as non-GM crops or organic crops. There is evidence that such crosspollination is already occurring. Plants with GM characteristics have been found in conventional crops as well as in crops that have been grown using only organic farming practices. Tests performed by Successful Farming magazine found evidence of cross-pollination in both corn and soybean crops. Currently, bulk agricultural trading facilities are not able to separate GM crops from traditional crops.

4. **Concerning human health risks:** Critics say that the effects of GM products on human health are not yet fully known. For example, a recent study found that people allergic to nuts reacted to GM soybeans into which a protein from a Brazil nut had been inserted.

5. **Problems with international markets:** GM crops are not universally accepted throughout the international market. Trading blocs such as the European Union (EU) have banned the import of crops with inserted genes, citing concerns about human health and the environment. The hesitancy of the United States' international trading partners to accept GM crops impacts the marketability of these crops. With good reason, farmers fear losing the ability to sell commodities to these partners. The financial impacts have been significant. In 1996, American exports of corn and soybeans to the EU totaled $3 billion. In 2000, these exports had dropped to $1 billion.45 Further actions on the part of the EU to regulate American imports may have a further impact on farmers.

Conclusion:

Under present conditions the benefits and concerns raised in using GM seeds in agriculture is neither can be fully accepted nor rejected. This change in seeds brought through technology can be used by keeping environmental sustainability in view. The technology may be more appropriate for farmers that have difficulty spraying pesticides and herbicides. GM seeds may work well for farm areas that are inaccessible to tractors or close to water bodies, or in places where winds are high. Conversely, GM seeds may be least appropriate for

farmers who are particularly reliant on a stable market. The uncertainty surrounding consumer acceptance of GM products, particularly in foreign markets, is a risk that may simply be unacceptable to some farmers. Certainly, GM seeds are a revolutionary technology in the agriculture and related industry. The potential benefits of these seeds promise to be considerable. But an unmindful acceptance of this technology by farmers is not the proper response. The technology of GM seeds and the related legal issues raise concerns that may work against an individual farmer. The best response of every farmer is to educate himself about this technology and to carefully deal the legal aspects before deciding to plant GM seeds.

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