

Genetically Modified Wheat – Can GM Wheat gives better results to farmers?

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Introduction

Wheat is very popular among all cereals in the world belongs to the *poaceae* family. India and China dominates the world wheat production. In India Punjab, Haryana and Uttar Pradesh have been known as fertile wheat states. The history of wheat cultivation in India is last from more than 5000 years back where the '*Triticum Sphaerococcum*' species known as Indian wheat. Nowadays – *Triticum Aestivum* has known as common bread wheat, *Triticum Durum* known as macaroni wheat and *Triticum Dicoccum* species known as emmer wheat. With the help of genetics and molecular biological approaches, the genetic material is altered to prepare genetically modified wheat. But the methods of modification used with GM seeds have changed from traditional methods to agro-bacterium mediated gene transfer. GM crops are altered by scientists with the aim to introduce some new desirable traits to improve nutritional status, yield and tolerance against drought or stress condition. The main aim of these GM crops is to increase the output of the farmers so that they cultivate pesticide, insecticide free crops with high nutritional content. For example, Bioceres's HB4 and Monsanto's MON 71800 are the two most popular genetically modified wheat varieties in all over the world.

Bioceres's HB4

In Oct 2020, Bioceres crop solutions announce regulatory approval of drought tolerance technology HB4 wheat in Argentina. The HB4 is a drought tolerant technology for wheat and soybean. The Bioceres's scientist claims that it also increases the wheat yield by upto 20%. The country's (Argentina) regulatory has clearance for the import of genetically modified wheat to Brazil, which purchase its 85% of wheat. According to Bioceres Company sunflower gene is the backbone of HB4 technology and since 2009, field trials and testing of HB4 wheat have been under process. Bioceres Company has two promising brands

EcoWheat (brand name of HB4 wheat) and EcoSoy (brand name of HB4 Soybean). Both Brazil and U.S. approved soybeans which contain HB4 technology. Bioceres states that the HB4 wheat and soybeans are important crops in today's climate conditions. Bioceres also working to get approval for HB4 wheat in countries like U.S., Paraguay, Uruguay and Bolivia. Next destination for HB4 wheat is may be Australia, Russia, China and India.

Monsanto's MON 71800

MON 71800 was the first GM wheat developed by the Monsanto. It is glyphosate resistant and contain CP4/maize EPSPS gene. Studies conducted on wheat MON 71800 showed that the nutritional qualities of MON 71800 are comparable with other non-trangenetic varieties. In US, Monsanto gets FDA approval but withdrew its EPA application in 2004 so the MON 71800 was never commercialized. Last year some cases were reported, USDA identifies two strains MON 71300 and MON 71800 of Monsanto through random field testing. However, there is no evidence that any GM wheat has entered commercialization in US. In 2010 Monsanto's partner in India, Mayco announced that they are planning to get approval to GM wheat in India in coming years. But still there is no GM wheat in Indian markets. GM cotton is the only genetically modified crop which is allowed in the country.

Other Popular non-GM Wheat Variety

The popular wheat varieties (other than GM) grown in India are HD 3086, HD 2687, UP-2338, PBW-502, Hi 8759 (Puja Tejas), HD 4728 (Pusa Malawi), HS-562, HD-3171, HD-1605 (Pusa Ujala), VL-832 & HS-365 etc. These varieties cover major wheat growing states in India such as Punjab, Haryana, Uttar Pradesh, Rajasthan, Bihar, Madhya Pradesh and Gujrat. During this pandemic COVID-19 period, around 5,000 farmers of Haryana, Punjab and West U.P. have booked two varieties DBW-187 & DBW-222 on the online seed portal by the Indian Institute of Wheat and Barley Research (IIWBR). Scientists from Agharkar Research Institute (ARI), Maharashtra claims that their wheat variety MACS-6478 helps farmers in Maharashtra to get double yield. There are the number of researchers, plant breeders and molecular biologists working in India for the better results of wheat, but preparing genetically modified wheat is looking a milestone for all of us.



Fig1: The picture were taken in the fields of wheat

Farmer's reaction against GM crops

Genetically modified crops are getting attention worldwide. In India, many groups of farmers agitate time to time to stop the cultivation of illegal GM crops. According to them, there are some illegal GM cultivation happening with the name of Bt cotton, HT cotton, Bt Brinjal and HT Soybean in the country. As the rise of GM crops, farmers are getting confused among organic, non-GM and GM crops. There are some awareness programs started by different-different organizations or government sectors so that farmers can understand what the GM crops are and how to pick the right one. But some unsafe technologies that are trying to fool poor farmers so that they cultivate their varieties. However, farmer's reactions against GM crops are mixed. According to the law, sowing unapproved seeds can risk the farmers in 5 years of jail and Rs 1 lakh penalty. But on the other hand farmers need a variety which is resistant against pests, fruit and shoot borer (FSB) and other insects. Most of the farmers spend a lot of money on pest control and insecticides. Some farmers spray products obtained from soil bacterium, *Bacillus thuringiensis* (Bt) as a bio-pesticide.



Fig2: Farmer working on the field of wheat

Demands, Field Testing & Approvals

The trade of wheat in world is higher as compare to other cereal crops. Demand of wheat in India and world are increasing every year. According to the data, the Indian country has exported 217354.22 MT (metric tons) of wheat to the other countries during the year of 2019-20. Demand of the GM wheat is mainly depends whether the variety are giving better yield and increase farmer's income. Currently, India has no GM wheat variety and if Indian scientists will be able to make GM wheat then it will take time to release. Every new variety has to go under several testing parameters. In India, the *Genetic Engineering Appraisal Committee (GEAC)* which comes under MoEF has the rights to approve GM seeds for field trials. GEAC gives No Objection Letter (NOC) before conducting any trials. After getting GEAC's NOC, the owner of the seeds can send the seed to '*Protection of Plant Varieties & Farmers' Rights Authority (PPV & FRA)*' which comes under MoA (Ministry of Agriculture) for field testing. If the variety fulfills all the testing parameter then it will get certificate from PPV&FRA. However, it is not legally necessary to register your variety under PPV& FRA, the owner can use or sell the seeds without registering. But if you want that nobody stole or

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sells your variety under his name then you should definitely register your variety under PPV&FRA. The Government of India enacted the 'Protection of Plant Varieties and Farmers' Rights' (PPV & FR) Act in 2001 (53 of 2001) to provide for establishment of an effective sui generis system for the protection of plant varieties, the farmer's rights and plant breeder's claims. The aim of this is to encourage the development of new plant varieties of economic importance.

Conclusion

Genetically modified wheat can be a good option for farmer or not is a difficult question to answer. But GM wheat has good promising results like drought tolerance, good yield and food security. In India most of the seed companies are concern about environmental protection, contamination of non-GM crops and organic farming etc. However, lack of awareness and uneducated acceptance of this (GM) technology by farmers is not the proper solution for both farmers and companies. There is one more question raise here that who will more contaminate field GM or non-GM? GM crops contamination of non-GM crops and organic fields is a growing problem in most of the countries that are sowing GM seeds. In this situation, if farmers are adversely affected by contamination or loss of their cost, it is impossible for them to recover from their loss and this will affect indirectly to our economy. To help and support farmers, seed companies who patent GM wheat should take responsibility for any financial loss of farmer if they will not get results as promised.