

# Precautionary principle in biodiversity conservation



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Precautionary approach can be defined as the alternative approach or methodology that can be adopted or is developed if the conventional technology poses a threat to the well being of the society and is a potential agent of disturbing the balance of the ecosystem, thereby disturbing the biodiversity. Precautionary principle can be defined as the step taken towards environmental risk management for situations that may arise due to lack of complete scientific knowledge and inefficient implementation of technology. According to the principle, if a technology poses threat to the environment and the possibility of the danger has not been proven yet, then the use or implementation of the technology is prohibited <sup>1</sup>. In the field of biotechnology, this precautionary approach began in 1970s and was initiated by the German government, under the name of 'vorsorge'. It was aimed at heavy influence of the state, socialized planning, increased participation to reduce the harm, stimulate the economy by incorporating 'green technology', avoiding maximum damage possible and utilization of 'sound science' <sup>1</sup>. The Precautionary Principle plays an important role in the field of Biotechnology. According to the Cartagena Protocol on Biosafety (with regards to GMO regulation), a precaution strategy has to be developed before transferring, using, handling or trans boundary movement of these genetically modified organisms/ foods. Following this strategy, the respective countries apply restriction on the use and release of such GMOs in situations which experience scientific uncertainty in relation to the health hazards posed by these organisms. Not only the Precautionary Principle is applicable for the regulation of the GMOs, but this principle has also been applied in

Norwegian Gene technology Act of 1993, for the intentional release of GMOs into the environment <sup>2</sup> .

Precautionary principles and precautionary approach go complementary to each other. Both aim to address the harmful adverse effects of any new technology or product. For an instance, for development of GMOs, instead of using biotechnology as a means to play with the genome of the conventional plant, natural strategies or the procedures which can guarantee health benefits should be used. Critics generally argue about the fact that development of a precautionary approach is a mere waste of energy and resources, but as discussed, in order to avoid the two types of error, prevention is definitely better than cure. It is important to have a backup plan for developing the same variety of GM crops that can be developed using biotechnology as a tool.

GMO or the genetically modified crops are the crops or food products that are not produced naturally, but undergo some or the other kind of mutation in the gene which can lead to gain or loss of function, thereby creating a crop/ organism/ food which is beneficial to the human race. GMOs are associated with the production of certain toxins, which are absent in traditional crops. These toxins are responsible for various allergic reactions in the consumers. For an instance, in 1989 the GM version of food supplement of L tryptophan was manufactured and sold to the consumers by the company named, Showa Denko. As a consequence of the toxins, more than 1500 people were disabled and 37 people died in US <sup>3</sup> . Many studies have proved the fact that GM crops are entirely different from the traditional

crops and hence consumption of such crops will only result in unpredictable and indistinguishable allergens or toxins, numerous serious diseases and other nutritional problems. The amount of research done in finding out the risks associated with GM crops is endless. Even after having a large collection of such examples, the status of GM crops is still unregulated in most of the countries. In countries like Canada, the health experts believe that each and every GM crop has undergone severe testing by the CFIA (Health Canada) and can be consumed without fear. One of the major reasons for disastrous effect of GM crops on the health is the labeling. Since majority of the GM products are not labeled, it is nearly impossible to detect or find out which products pose a threat. Another reason is the late occurrence of the symptoms of any health hazard which is the case with Trans fats <sup>3</sup>.

Biotechnology is a vast field that encompasses not just one technology but several technologies to produce desired outcomes. Recently, four subdivisions have emerged- green (application in environment and agriculture), blue (involvement of aquatic species and marine processes), red (pharmaceutical and medical activities) and grey or white (involving the industrial processes) <sup>4</sup>. One of the applications of biotechnology is the development of the GMOs. Another application can be seen in the field of pharmaceutical industry, where each day a new drug is developed to cater to the human health. But unfortunately these drugs are now found in water which is consumed by children. Thus the segment of the population, which was abstained from using this high dosage of the drug, is being exposed to the threat in disguise. The genetically modified fish that are collected from the farm stock come with the inherent parasitic infections and lead to

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genetic consequences in the individuals that consume it. Moreover developments of genetically modified crops, organisms, vaccines, pharmaceuticals, all have some or the other consequences. Richmond (2008) has pointed out three areas in biotechnology that can lead to environmental consequences- during the development and research activities, during conduction of biotechnological processes and due to the products that are produced from biotechnology. The scientific community is laying pressure to push forward this field but on the same side, it is very important to regulate the practices so that there are lesser number of risks and problems associated with it. Thus, biotechnology is the industry which requires the introduction of precautionary principle at the earliest <sup>4</sup>. In this paper, we shall discuss about the GMOs and their harmful effects and how can the Precautionary principle be used to regulate the spread of these effects on the environment and health of the human race.

Precautionary Principle is based on two types of statistical errors- one is rejection of a true hypothesis (type I) and the other is acceptance of a false hypothesis (type II). To explain these two types let us assume the case of a gun. There is no means to identify whether or not the gun lying on the table is loaded. Thus, if we assume that the gun is not loaded, then we commit Type I error by rejecting a true hypothesis. Similarly, if we assume that the gun was loaded (but it was actually empty), then again we commit Type II error by accepting a false hypothesis. Therefore, the Precautionary principle suggests that to avoid type I error, all guns must be considered to be loaded unless and until the contrary is proven. Comparing this case with the open cultivation of transgenic crop or plant, the researchers are more likely to

commit type I error by unleashing numerous risk factors associated with the same. Lack of data about something being potentially dangerous does not account to the fact that it is safe to use. In biotechnological context, any kind of modification in the organisms at the genetic level, cause variations in the ecosystem. This can be attributed to the genetic leakage, homogenization of genotypes, loss of biodiversity and the hybridization. Recent studies have shown that the development of terminator genes that lead to the formation of the sterile F2 generation is the major approach in the development of the GMOs. But there are high risks associated with their spread and entry into the wild population. In such cases, the precautionary principles can be exercised by restricting the rearing of such transgenic species to the greenhouse.

Uncertainty of risks also contributes to the implementation of the precautionary principle. Most of the companies try to avoid the restrictions imposed by the precautionary principle to ensure smooth conduction of the research process <sup>5</sup>. For example, when the superweeds were being produced by the hybridization between the wild populations and the transgenic populations having the additional Bt gene for insect resistance (with the effects like that of the Bt gene in the cotton plant), the companies did not pay heed to the regulatory practices and instead practiced open field cultivation of transgenic crops. Here the precautionary principles were ignored because of the lack of facts and evidence related to the potential detrimental effects <sup>6</sup>. In order to prevent this from happening frequently it is important to ask the right questions and to allow rearing of only those crops which have an acceptable experimental set up. The most potential danger

associated with the production and transfer of the GMOs is release of pathogens into the environment. Pathogens are the carriers of disease. Biotechnology utilizes the approach of production of pathogens for biological control of diseases and the pests and thereby reducing the use of synthetic pesticides, insecticides and the fertilizers. Also, we know that plants have an active immune system but still depend upon the innate immune system for defense purposes <sup>7</sup>. On one side biotechnology has helped in the production of plant species with pathogen or transgene derived resistance <sup>8</sup>. On the other side this same research, that aims in protecting plants from viral diseases, can also cause destruction of the plant species. Thus, to prevent this bioterrorism, incorporation of Precautionary principles is very important.

Having discussed the importance of precautionary principle, we cannot deny the fact that production of transgenic crops is essential for human welfare. Various biotechnological crops are in various stages of development. Some of the examples of such crops are the cereals that are tolerant to poor soil and climatic conditions. As these transgenic crops can tolerate aluminium, they can survive in the acidic soils. This property makes them valuable for developing countries. Bioengineered rice is another example. It has a combination of African as well as Asian traits and poses drought resistance qualities. This transgenic variety has helped in reducing the malnutrition rates all over the world. Other products of biotechnology include the rice variety that has the ability to close stomata more readily, rice with different C4 pathways of photosynthesis, crops with resistance to Striga (a parasitic weed), rice with nitrogen fixing ability, potato varieties with increased resistance to insects and bacteria, and many more <sup>9</sup>. Production of GMOs

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also helps in promoting a healthy society by creating and developing sufficient quantities of food. Bioengineering has also found its application in reducing micronutrients deficiencies in populations belonging to countries where appropriate nutrition is not provided. An example of this is the 'golden rice', which is the transgenic form of basmati rice and contains higher quantity of iron and cysteine along with its richness of beta carotene <sup>10, 11, 12, 13, 14</sup> .

There are many concerns related with the consumption of GM crops or plants or foods. The first and foremost area of concern is that when the people consume GM crops, the genetic makeup of the transformed plant make be incorporated into the genome of the consumer and may therefore prove fatal. Secondly, certain genes are transferred from GM foods into the body of the consumer, and may lead to allergies or hypersensitivity reactions. Gm crops are known to address the global problem of hunger and malnutrition, but associated with it are the problems of large land, excessive use of fertilizers and pesticides, use of large quantities of water, etc. These problems not only alter the global biodiversity but are also the source of green house gases leading to increase in the percentage of global warming. A case of post consumption allergic reactions has already happened in the past when the GM soybean was introduced into the market. It was bioengineered using a gene from a Brazilian nut, to increase its nutritional value. The GM product had adverse effects on the health of the people and caused severe allergic reactions. Apart from threats posed to the public in general, there are many environmental concerns as well. Gene escape from the GM crop to the wild type varieties is the major issue of concern. It has <https://assignbuster.com/precautionary-principle-in-biodiversity-conservation/>

been shown that the herbicide tolerant superweeds intrude the natural ecosystem and disturb the balance. As a result there is genetic pollution <sup>15</sup> . Also if all the plants are made pest resistive, it would lead to complete elimination of all the weeds and pests, make the natural biological ecosystem even simpler and eventually reducing the biodiversity <sup>9</sup> .

Risk analysis generally involves identification of the probable causes of risks and the probability of their occurrence. It involves the development of a precautionary approach to reduce or minimize the outcomes <sup>16</sup> . There has been no specific detail as to when should the precautionary approach be implemented or when it should not be implemented. But it depends on the trials of the new products. If the degree of threat posed by the GMO is higher as compared to the conventional organism/ crop/ food, then it is mandatory to implement the alternative precautionary approach. There might also be cases, where precautionary strategies are not developed yet. In such situations it is important to incorporate the precautionary principles such that there is regulated exposure of human population to the health hazards posed by the GM crops. The Precautionary principle includes the following aspects- clean production methods involving the goods manufacturing practices well incorporated, replacement of all the older technologies that are not environment friendly and can lead to environmental pollution, introduction of more comprehensive methods of economic and environmental assessment like the Environmental Impact assessment (EIA), intensive research in the field of causes of environmental harm and the potent hazardous agents <sup>17</sup> .

The precautionary principle is generally implemented in order to revoke the production or generation of GM crops. But this is not right because GM crops provide the human society with health benefits but also decrease the mortality rate across the world. When compared with the conventional crops, GM crops have a better proven nutritional value and are produced in large quantities as well. Reports have also shown that cultivation of GM crops also aids in habitat protection, biological diversity, carbon sinks and stores <sup>9</sup>. These crops have also shown comparatively lesser damage to the environment than the damage caused by the use of synthetic fertilizers and pesticides. Thus, analyzing the benefits of these products, the precautionary principles should be applied in a proper way such that the complete production of such crops is not prohibited but instead some restrictions and regulations should be imposed on the transfer, handling, use and consumption <sup>16</sup>. Therefore, yes I agree that precautionary development approaches are necessary for secure and safe GMO production and also for ensuring reduced or rather no health risks for the human population, who consume these GMOs <sup>18</sup>. But excessive use of precautionary principles can also marginalize the actual role of science. So, all the regulatory measures should be implied on the development procedures, only when the alternative precautionary approaches are not feasible or have not been developed yet. In fact all the countries should somehow implement the precautionary principles as most of them are involved in import and export of the GMOs and thereby expose majority of their workers to the health hazards.