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IMPACT OF BIO-COLONIZATION: A DISOWNMENT OF TRADITIONAL HERITAGE

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- An affirmative action threatening to throw the innate beings into disarray and failed to showcase the truth of the warring duos (Nature v. Technology)

ABSTRACT:
Property is classified into two – *jura in re aliena* and *jura in re propria*. Under *jura in re propria* comes tangible and intangible property. Intangible property includes intellectual property namely patents, copyright, trademarks etc. This paper is based on the concept of impact of patent on genetically modified plants and seed and its impact on Indian traditional knowledge. To that point, Genetic Engineering (GE) which is not a traditional breeding is a curse in disguise. Here, the subject matter revolves around the concept of Bio-colonization, one of the notorious impacts of genetic engineering. It refers to the engineering, patenting and dispersal of new plants and seeds transnationally through the use of biotechnology. Biological pollution from Genetically Modified Organisms (GMO) poses more imperilment for living beings that reproduce uncontrollably. The important causatum to be noted is: firstly, the impact of genetic modification of foods and the quantum of patent protection being acknowledged to GMO companies. Secondly, whether the patent rights have been utilized rightly against farmers without affecting traditional knowledge and the effect of patent on reproduction of crops which in turn divest the society. Thirdly, how genetic techniques affect the environment, conspicuously the land and the changes in farm practice that accompanied the adoption of Genetically Engineered crops. Fourthly, the evidence as to its impact at the individual farm level, landscape level and biological diversity and whether it is a mutagen to human lives. Finally, the myth related to foods produced using biotechnology and how India fits in the picture of Genetically Modified crops.

KEY WORDS:
Bio-colonization, Biotechnology, Copyright, Genetically modified organisms, Genetic Engineering, Mutagen, Patent, and Trademark.

INTRODUCTION

As no other technology in history, biotechnology aggrandizes humanity's reach over the forces of nature. Over the past fifty years, Indian agriculture has transformed from a sustenance system to a surplus system. Bioengineers maneuver life forms in the same way as the engineers of the industrial revolution were able to separate, collect, utilize and exploit inanimate materials. As previous generations manipulated plastics and metals into the machines and products of the industrial age, we are now manipulating and indeed converting living materials into the new

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commodities of the global age of biotechnology. Genetic engineering of food is the science which involves deliberate alteration of the genetic material of plants or animals. The impact of patent on Genetically Modified plants and seeds is increasing day by day and causing more health issues to those who consume them. This study discusses in detail about bio-colonization of crops and seeds i.e.) genetically modified crops and seeds.

ISSUES

The main issues to be noted are as follows:

- To deal with the prospects and effects of Genetically Modified Food Crops
- What advances are made in plant biotechnology
- How much patent protection must be given to GMO companies
- Whether the patent rights have been rightly utilized against the farmers
- India becoming a game of GM crops
- Suggestions to tackle the problem arising out of Patent of GM crops

EVOLUTION OF GENETICALLY MODIFIED CROPS AND SEEDS

Genetically modified foods (GM food) are originated from plants or animals who's DNA has been altered through the process of genetic engineering.[1] Genetic engineering is the process of manipulating an organism's genes directly by transplanting DNA[2] from any other organisms. It is different from the customary method of selectively breeding plants and animals to get desired traits. Genetically modified foods have been used on the US market since 1994. This started with the introduction of **"Flavr Savr" tomatoes**[3] that had been modified to ripen more slowly.

[1]Genetic engineering is the process by which scientists modify the genome of an organism. Creation of genetically modified organisms requires recombinant DNA. Recombinant DNA is a combination of DNA from different organisms or different locations in a given genome that would not normally be found in nature. In most cases, use of recombinant DNA means that you have added an extra gene to an organism to alter a trait or add a new trait. Some uses of genetic engineering include improving the nutritional quality of food, creating pest resistant crops and creating infection resistant livestock. Refer http://agbiosafety.unl.edu/basicgenetics.shtml.

[2] DNA is the recipe for life. DNA is a molecule found in the nucleus of every cell and is made up of 4 subunits represented by the letters A,T,G,and C. The order of these subunits in the DNA strand holds a code of information for the cell. Just like the English alphabet makes up words using 26 letters, the genetic language uses 4 letters to spell out the instructions for how to make the proteins that an organism will need to grow and live. Refer http://agbiosafety.onl.edu/basic-genetics.shtml. Dec 17, 2017, 21:49:00.

[3]Flavr Savr (also known as CGN-89564-2). a genetically modified tomato, was the first commercially grown genetically engineered food to be granted a license for human consumption. It was produced by the Californian company Calgene, and submitted to the U.S. Food and Drug Administration (FDA) in 1992. On May 18, 1994, the FDA completed its evaluation of the Flavr Savr tomato and the use of APH(3')II, concluding that the tomato "is as safe as tomatoes bred by conventional means" and "that the use of aminoglycoside 3'-phosphotransferase II is safe for use as a

Genetic engineering is a tool that can be used for a various purposes. Almost all the corn and soy grown in the United States are genetically modified to be resistant to herbicides. They use weed killer to produce herbicide resistant crops. Other crops are produced to be pest resistant. But genetic engineering could perhaps help create crops that can survive drought, or help produce food that is more nutritious. Even though there is a broad scientific consensus that the genetically modified foods have no health risk than regular foods, still GM foods are debateable. Antagonist argues that genetically modified crops yield foods with increased use of chemical herbicides that are more harmful. They also cite the problems of patenting GMO crops by large companies. This lead to the debate whether GMOs should be used or not.

The genetically modified foods are different from regular traditional way of cultivating foods. Before hundreds of years, the farmers have been selectively breeding plants and animals in order to get the desired traits. In the earlier times, farmers have bred corn to make them larger to hold more kernels and to adapt any climate, which altered corn's genes. This is not considered as "genetic engineering".

There are two forms of genetic engineering. They are cisgenesis[4] and transgenesis.[5]

CULTIVATION OF GENETICALLY MODIFIED FOOD CROPS – PROSPECTS AND EFFECTS

India has made rapid striddle in agriculture and allied sectors after independence. From a net importer of food grains, the country has achieved food security through domestic production and also export of several commodities is being regularly taken.[6] In

processing aid in the development of new varieties of tomato, rapeseed oil, and cotton intended for food use." Calgene made history, but mounting costs prevented the company from becoming profitable, and it was eventually acquired by Monsanto Company.
Refer
http://en.biosafetyscanner.org/schedaevento.php. Mar 16, 2017, 15:41:47.

[4] It involves directly swapping genes between two organisms that could otherwise breed — say, from wheat to wheat. Cisgenic plants are made using genes found within the same species or a closely related one, where conventional plant breeding can occur. Some breeders and scientists argue that cisgenic modification is useful for plants that are difficult to crossbreed by conventional means (such as potatoes), and that plants in the cisgenic category should not require the same regulatory scrutiny as transgenics. Refer http://www.vox.com Dec 11, 2017, 01:50:42.

[5] It involves taking well-characterized genes from a *different* species (say, bacteria) and transplanting them into a crop (such as corn) to produce certain desired traits. Genetically modified plants can also be developed using gene knockdown or gene knockout to alter the genetic makeup of a plant without incorporating genes from other plants. In 2014, Chinese researcher Gao Caixia filed patents on the creation of a strain of wheat that is resistant to powdery mildew. The strain lacks genes that encode proteins that repress defenses against the mildew. The researchers deleted all three copies of the genes from wheat's hexaploid genome. Gao used the TALENs and CRISPR gene editing tools without adding or changing any other genes.

[6]Ministry of Agriculture, 15th Lok Sabha Committee on Agriculture(2011- 2012),

spite of many spectacular achievements in agriculture field, the road to ensuring and maintaining food security in the years to come is full of challenges. The more worrying and daunting problem is the deceleration in the availability of food grains. As India's population is going on increasing, the food production has to be increased considerably to meet the needs of growing population. Dwindling water and land resources are the main factors of low production of crops and as a result additional food will have to be produced on existing agricultural land or marginal soils. The crop gets spoiled mainly due to insects,[7] pests,[8] disease and declining soil fertility that favours insect pests and disease vectors. These challenges lead to the growth of molecular biology and biotechnology in agriculture.

The use of biotechnology in the field of agriculture leads to:

- Increase in crop productivity,
- Lowering production costs,
- Conserving biodiversity,
- More efficient use of external inputs,
- Increasing stability of production,
- Improvement of social and economic benefits and poverty alleviation.

Biotechnology is defined in the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)[9] Report as 'any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for a specific use.' Therefore, biotechnology includes any process from fermentation technologies[10] to gene splicing.[11] It also includes traditional and local knowledge in cropping practices, selection and breeding of plants and animals by individuals and the application of tissue

"Cultivation of Genetically Modified Food crops-prospects and effects", 37th Report, p.16.

[7] Some of the insects that affect the crops are Mealybugs, Aphids, Spider Mites, Scale insects, Thrips, Springtails, Fungus Gnats, White flies, Cyclamen Mites and leaf miners.

[8]Pests include Insects, mites, rodents, animals, birds etc. The method to control the pests includes mechanical method, physical method, chemical method, cultural method, biological method and plant quarantine measures. Refer http://oer.nios.ac.in Mar 19, 2017, 17:29:47.

[9] According to IAASTD Report modern bio-technology is a term adopted by international convention to refer to biotechnological techniques for the manipulation of genetic material and the fusion of cells beyond normal breeding barriers. The most obvious example is genetic engineering to create genetically modified/genetically engineered organism (GMOs/GEOs) through 'transgenic technology' involving the insertion or deletion of genes.

[10]Fermentation is the process involving the biochemical activity of organisms, during their growth, development, reproduction, even senescence and death. Fermentation technology is the use of organisms to produce food, pharmaceuticals and alcoholic beverages on a large scale industrial basis. Refer also http://www.biologydiscussion.com Mar 19, 2017, 09:58:09.

[11]http://www.dictionary.com A term used to refer to the process by which the DNA of an organism is cut and a gene, perhaps from another organism, is inserted. (*See* genetic engineering *and* recombinant DNA.) Gene splicing is often used in industry to allow single-celled organisms to produce useful products, such as human insulin. It is also used in the production of genetically modified organisms. Refer also http://www.dictionary.com

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culture and genomic techniques etc. The revolution in plant biotechnology has opened new opportunities for plant breeders.

ADVANCES MADE IN PLANT BIOTECHNOLOGY

The plant biotechnology has made important changes in the past twenty years. Varieties of trait have been included in plant species which include:

- Herbicide resistance[12]
- Pest resistance[13]
- Viral resistance
- Slow-ripening
- Fungal and bacterial resistance
- Quality improvement (Protein and oil)
- Value addition (Vitamins, micro and macro-elements).

The first commercial GM crop was 'Flavr Savr' tomato, which was produced in 1994 engineered for slow ripening character.

List of GM food crops that have been commercialized in past fifteen years are:

- Herbicide resistance - Corn, Soybean, rice, corn, and Sugar beet
- Insect Pest resistance - Corn, rice, tomato and potato
- Viral resistance - Papaya, Squash and potato
- Slow-ripening and softening - Tomato and melon
- Improved oil quality - Canola and soybean
- Male sterility - Canola and corn

Some of the genetically modified organisms are:

The Tomato Fish:

In 1991, the company named DNA Plant Technologies genetically engineered a tomato by injecting a gene from fish named arctic flounder[14]. They wanted to create a tomato that is more resistant to frost and cold storage. Experiments revealed that the injection of the genes of the flounder to the tomato did not bring huge profits to the company and it never came into the markets. Even though this attempt was a failure, these "Tomato Fish" of "Fish Tomatoes" created fear among the public and the activists.

Tobacco:

Tobacco plants have been genetically altered in order to emit light. They are engineered in such a way by transplanting the genes from the fireflies into the genes of tobacco plants. In total darkness the glow from the leaves of the plant, stem and roots can be seen by eye.[15]

[12] Herbicide resistance can be defined as the acquired ability of a weed population to survive a herbicide application that previously was known to control the population.

[13] Pesticide Resistance is the ability of a life form to develop a tolerance to a pesticide.

[14] The Arctic flounder (*Liopsetta glacialis*) is a flatfish of the family Pleuronectidae. It is a demersal fish that lives on coastal mud bottoms in salt, brackish and fresh waters at depths of up to 90 metres (300 ft).

[15] To make the genetically engineered plants glow, they were irrigated with water that contained another substance from fireflies, luciferin, which serves as the fuel for the insects' light production. Supplied with this raw material, the genetically engineered tobacco plants glowed. The glow was dim, but could be seen with the unaided eye when the scientists stood in the dark

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Bt Cotton:
The Monsanto scientists interpolated a toxic gene from the bacterium called Bt (Bacillus thuringiensis) into cotton plants ten years ago. They are produced in order to be resistant to caterpillar. The gene of Bacillus thuringiensis is the DNA that carries the instructions for producing a toxic protein that makes the cotton resistant to caterpillars.

Bt Maize:
The Bt Maize was produced to be herbicide resistant. GM sweet corn which is insect resistant was produced by Monsanto. The genes from Bacillus thuringiensis (Bt) which produces Bt toxin which is resistant to insects is injected into corn in order to get high yield.

THE PATENT LANDSCAPE OF GENETICALLY MODIFIED CROPS
The genetically modified crops and seeds are patentable nowadays. Any farmers who purchase GM seeds have to abide by the restrictions mentioned by the companies. For example, farmers who buy soybeans that have been modified to be resistant to Roundup herbicide must sign an agreement that they will use the seeds for only one planting and they won't save the seeds for second planting. The companies argue that patents are necessary to spur innovation. But the critics are arguing that granting patent has given seed companies disproportionate market power over GM crops.

MONSANTO CANADA Inc v. SCHMEISER
The most landmark case in the patent of agricultural biotechnology is **Monsanto Canada Inc v. Schmeiser.**[16] This case is regarding patent rights for biotechnology, between a Canadian canola farmer, Percy Schmeiser and the agricultural biotechnology company Monsanto.

The facts of the case are as follows. On Feb, 23rd 1993, Monsanto Canada Inc. was granted a seventeen year patent on genetically modified canola cells that are resistant to herbicide known as Roundup (Glyphosate)[17]. The company Monsanto sold the seed as Roundup Ready canola. It was detected by Monsanto in 1998, that a farmer named Percy Schmeiser's fields were planted with the same type of seed that are resistant to the herbicide Roundup, which it perceived to be a direct infringement of the patent. Schmeiser challenged that he did not intentionally plant the Roundup ready variety of canola, but it would have been

for about 10 minutes so that their eyes became acclimatized. The emitted glow was easily detected immediately by light detection equipment and by photographic film in exposures as little as 15 minutes.

[16] [2004] 1 S.C.R. 902, 2004 SCC 34.

[17] Glyphosate (*N*-(phosphonomethyl)glycine) is a broad-spectrum systemic herbicide and crop desiccant. It is an organophosphorus compound, specifically a phosphonate. It is used to kill weeds, especially annual broad leaf weeds and grasses that compete with crops. It was discovered to be an herbicide by Monsanto chemist John E. Franz in 1970. Monsanto brought it to market in 1974 under the trade name Roundup, and Monsanto's last commercially relevant United States patent expired in 2000.

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caused by the natural pollination through the air or an accidental spillage on to his field by an area farmer's truck. Monsanto claimed that, even though the presence of seed with the patented gene of Monsanto was discovered accidentally, the seed is still the property of the company and the company deserves both the licensing fee as well as the profit from the sale of Schmeiser's crop. Schmeiser again demanded that he had the right to plant the seeds again that grew on his own land and this would override Monsanto's legal rights. Monsanto's patent covered only the genetically modified plant cells and not the genetically modified plants themselves. Therefore, the Court had the discretion to decide whether growing of genetically modified plants leads to "use" of the invention of a genetically modified plant cell.[18]

On May 21, 2004, the Supreme Court ruled in favour of Monsanto.[19] Schmeiser won a partial victory, and the court held that Schmeiser need not pay Monsanto his profits from his 1998 crop, since the presence of the gene in the crops of Schmeiser had not afforded him any advantage and he had made no profits on the crop that were determinable to the invention. The amount of profits was relatively small i.e.) C$19,832. Though Schmeiser need not pay the damages to Monsanto, he also was saved from paying the legal bills of Monsanto which is of several hundred thousand dollars.[20] The documentary ***David v. Monsanto*** moved many people.[21]

PATENT PROTECTION TO GMO CROPS AND SEEDS IN DIFFERENT COUNTRIES

U.S.A:

Patent rights are constitutionally guaranteed under Article 1, Section 8 of U.S. Constitution. Until 1930, plants and seeds were not included under patentable subject matter because they were considered as product of nature. Almost 64 GM crop varieties are approved in U.S. The patent protection is provided to genetically modified crops and seeds in the United States of America especially in case of Monsanto.

INDIA:

Strong IP protections for genetically modified seeds are partly responsible for the rapid growth and ingenuity of new seed varieties. Article 27.3(b)[22] of TRIPs agreement provides patent to biotechnological processes and products.

[18] See Canadian Patent 1,313,830.

[19] Also refer, *Monsanto Co. vs. Geertson Seed Farms*, 561 U.S. 139 (2010).

[20] Refer https://scc-csc.lexum.com/scc-csc-csc/en/item/2147/index.do. Mar 17,2017, 09:11:30.

[21] The documentary was released in 2009.

[22] Part (b) of paragraph 3 (i.e. Article 27.3(b)) allows governments to exclude some kinds of inventions from patenting, i.e. plants, animals and "essentially" biological processes (but micro-organisms, and non-biological and microbiological processes have to be eligible for patents). However, plant varieties have to be eligible for protection either through patent protection or a system created specifically for the purpose ("sui generis"), or a combination of the two. Refer also https://www.wto.org

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CRITICS VIEW ON GENETICALLY MODIFIED CROPS

Most of the critics say that the development of genetically modified crops is a bad science.[23] They say that, the more genes involved in GM plant, the more unpredictable are the results. Secondly they are of the view that they are danger to the ecosystem.[24] They fear that the Bt gene[25] may be an imprecise weapon which affects beneficial insects as well as pests. There is some evidence that the introduced genes by process of genetic engineering "jumps" into other organisms, with unpredictable and probably uncontrollable results. Thirdly, they fear that planting of more GM herbicide – resistant crop may lead to over dependence on a single herbicide. They also fear that due to genetically modified crops, the biodiversity will be damaged, they may pose risk to human health, and they are only planted for profit motive.

PATENT RIGHTS WHETHER RIGHTLY UTILIZED AGAINST FARMERS

Obtaining patent is the central issue in the development of genetically modified crops. In order to develop a genetically modified variety, the researcher must invest in research and testing. To recoup the investment and profit from the product, the researcher wants the right to commercially use the new discovery himself. So he claims for patent for a certain period before the technology enters into the public domain. Though high profits are expected from biotechnology, corporations are now claiming patents on the new processes, genetic knowledge in the development of the product and the products itself. Patents traditionally were given to new products or processes and not to discovery of things that already exist in nature.[26] Initially patent was provided for gene modification which prevents saved seeds from germinating. This technology is popularly known as 'terminator technology'.[27] Initially it is used in cotton

[23] Some critics believe that genetic engineers will not be able to deliver on their promises because the genetic structure of plants is so complicated that scientists cannot yet fully understand and modify it.

[24] Besides having doubts about genetic engineers capacity to achieve reliable results, many critics hold that the GM technologists are too focused on the specific crops they are developing, and do not pay sufficient attention to the wider environmental context in which the crops will be grown.

[25] *Bacillus thuringiensis* (Bt) is a unique bacterium in that it shares a common place with a number of chemical compounds which are used commercially to control insects important to agriculture and public health. Although other bacteria, including *B. popilliae* and *B. sphaericus*, are used as microbial insecticides, their spectrum of insecticidal activity is quite limited compared to Bt. Importantly, Bt is safe for humans and is the most widely used environmentally compatible biopesticide worldwide. Furthermore, insecticidal Bt genes have been incorporated into several major crops, rendering them insect resistant, and thus providing a model for genetic engineering in agriculture. Refer also https://www.ncbi.nlm.nih.gov › NCBI › Literature › PubMed Central (PMC)

[26] Section 2(1)(j) of the Indian Patent Act, 2005 defines "Invention".

[27] Terminator technology is the genetic modification of plants to make them produce

and tobacco, but the patent includes all cultivated seeds.

Modern hybrids already do not reproduce regularly. So that farmers who use hybrid seeds have to buy new seeds regularly. The Genetic engineering would acquaint sterility to non-hybrid crops such as wheat. It would prevent farmers from saving some of their seeds for next cultivation as they followed them traditionally. At present 80% of the crops are sown using the saved seeds from previous yield. By increasing cost of inputs, debts and dependence on the seed marketing companies, the critics fear that the farmers will be forced to purchase the hybrid seeds.

There are different objections to patent which includes:

- Dispute arises as the biotechnology industries claim that the patent protection encourages research.
- Some critics including farmers fear that patents on agricultural plant and animal materials will harm the interests of the farmers, by establishing monopolies to companies and by forcing farmers to pay more inputs to companies.
- Patents strengthen the ability of Northern industries to gain profit from Southern raw materials. Usually "Biopiracy"[28] takes place.
- The most notable cases on biopiracy are Patenting of basmati rice[29],
- Patenting of neem (**Azadirachta indica)**[30],

sterile seeds. They are also known as suicide seeds. The terminator technology is a genetically engineered suicide mechanism that can be triggered off by specific external stimuli. The preferred trigger is antibiotic tetracycline, which is applied to seeds. As a result of which the seeds of the next generation will self-destruct by auto-poisoning. The main version of the terminator includes a set of three novel genes inserted into one plant. However, there is another version, which divides two or three genes on to two plants that are later to be cross-pollinated. The ultimate outcome is a dead seed in the following generation. Many consider terminator technology a problem due to the fact that the top 10 largest seed companies globally control half the world's commercial seed market.

[28] "Biopiracy" means the appropriation of the genetic resources of a developing country by a foreign company as theft. It is claimed that companies are improperly claiming ownership, thus depriving local people of the possibility of benefiting themselves from the commercial exploitation of the substance or knowledge, and perhaps forcing the original users themselves to pay. Biopiracy operates through unfair application of patents to genetic resources and traditional knowledge. Biopiracy is the theft or usurpation of genetic materials especially plants and other biological materials by the patent process.

[29] Basmati is a long-grained, aromatic variety of rice indigenous to the Indian subcontinent. In 1997 the US Patent and Trademark Office (USPTO) granted a patent (No. 5663484) to a Texas based American company Rice Tec Inc for "Basmati rice line and grains". The patent application was based on 20 very broad claims on having "invented" the said rice. Due to people's movement against rice Tec in March 2001 the UPSTO has rejected all but three of the claims.

[30] The people of India in a variety of ways have used neem, since time immemorial. Indians have shared the knowledge of the properties of the neem with the entire world. Pirating this knowledge, the USDA and an American MNC W.R. Grace in the early 90s sought a patent (No. 0426257 B) from the European Patent Office (EPO) on the "method for controlling on plants by the aid of hydrophobic extracted neem oil." The patenting of the fungicidal properties of Neem was an example of biopiracy.

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- Patenting of turmeric,
- Patenting of rice biopiracy[31] etc.

There are also objections on patenting on grounds of sustainability.

TRIPs AND CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

Though there are many legislations relating to patent, the most important legislations that deals with patent on biotechnology are TRIPs[32] and The Convention on Biological Diversity (CBD)[33]. The CBD came into force in 1993 states some basic principles. It points out that Genetic material found within a country is owned by that country. The intellectual property regimes must be devised in such a way that it does not conflict with the CBD's goals.

The TRIPs agreement is a part of WTO. It was established in 1994. TRIPs Article 27.3(b) requires all member countries to introduce legislation allowing patenting of microorganisms, biotechnological processes and products, and patents or some type of protection (*sui generis* or unique) for plant varieties. But some critics suggest amending Article 27.3(b), because they say that the private ownership of biological resources is unethical, inequitable and contrary to the goals of CBD. Others suggest that TRIPs allows countries to exclude biological materials from patentability.

FUTURE CHALLENGES

In future, the application of intellectual property protection i.e.) granting of patent for plant and genetic material can lead to significant negative consequences. The patenting of genetic material is fundamentally problematic because it involves issues of social ethics and cultural norms that include respect for nature and the value of life.

[31] Syngenta is a biotech company that tried to grab the precious collections of 22,972 varieties of paddy, India's rice diversity, from India's rice bowl, Chattisgarh in India. Syngenta has signed a MoU with the Indira Gandhi Agricultural University (IGAU) for access to Dr. Richharia's priceless collection of rice diversity. Dr. Richharia is the ex-director of Central Rice Research Institute (CRRI), Cuttack and is known as the rice sage of India who has done pioneering work in this field.

[32] The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is an international legal agreement between all the member nations of the World Trade Organization (WTO). It sets down minimum standards for the regulation by national governments of many forms of intellectual property (IP) as applied to nationals of other WTO member nations. TRIPS was negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994 and is administered by the WTO.

[33] The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. The Convention has three main goals including: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. At the 2010 10th Conference of Parties (COP) to the Convention on Biological Diversity in October in Nagoya, Japan, the Nagoya Protocol was adopted.

Biotechnology companies seek to entitle patent over seeds and the new varieties produced from such seeds and they want to make them as company's property. Monsanto has aggressively pursued farmers who follow the traditional farming practice of saving and replanting seeds, accusing them of "infringing" its patented varieties.[34] This lead to the production of more genetically modified crops in the society. Patents can have a negative effect on society. Overprotection of high-yield seeds could critically restrict farmers from planting the most desirable crops and the capacity of farmers and seed companies to develop future generations of seeds. The Patent[35] and Trademark Amendment Act[36] requires universities to share royalties with the inventor and to use their share for research, development, and education even though they are patented.

Due to granting of patent to genetically modified organisms and plants, the patented products are removed from the public domain and it was not even available to the developing countries from where they originated. This will lead to increase in biopiracy in the future and the products of our own will be difficult to be used by us in future due to patent on the crops. The genetically modified crops are ill-suited to small and peasant farmers. The genetically modified crops will be "an antithesis of sustainable and self-reliant food production". The promoting of intellectual property rights by biotechnology companies and their governments, challenges traditional seed saving and sharing.

Due to the patent system being forced upon the farmers, they will become more dependent on seed companies and need to change their farming practices, cultivating "cash crops" to sell for export in order to buy more seed. The experts conclude that the laws should advance scientific research that helps developing countries with new technologies. These complex issues underlie the continuing controversy over granting intellectual property rights for living organisms, particularly ones that have been genetically engineered by biotechnology companies. Thus in future, the situation will be more worse than at present because granting of patent to genetically modified seeds and plants will cause a great impact on farmers which will increase the risk of farmers suicide because they will not be able to cultivate crops and earn their living instead they must depend upon the biotechnology companies which will be more difficult.

CONCLUSION

From this study I conclude by saying that, Consuming genetically modified or altered food is slowly poisoning our body. It leads to accelerated aging, organ damage, reproductive disruption,

[34] Refer Monsanto Canada Inc. V. Schmeiser, [2004] 1 S.C.R. 902, 2004 SCC 34.

[35] THE PATENTS (AMENDMENT) ACT, 2005 No. 15 OF 2005

[36] THE TRADE MARKS (AMENDMENT) ACT, 2010 NO. 40 OF 2010

immune dysfunction and insulin disorders. Many studies have proved the connection between GM foods and several major health problems. Research has authenticated that thousands of animals who consumed genetically modified food died while animals that ate a non-GM version of the same crop had a much longer life. More human beings are affected by consuming genetically modified foods. The agriculture has been seriously affected because of the introduction of GM crops and seeds. The patent protection given to the genetically modified crops and seeds lead to suicide of farmers in large numbers. The farmers are forced to purchase the hybrid seeds from the companies and hence this affects their living. They are dependent on the GM companies every year to purchase seeds which are of high rate. Hence patent of genetically modified foods have serious consequences in the human lives and also seriously affect the people who consume them.

SUGGESSTIONS:

The following are the suggestions drawn from the study:

- Biotech companies have certainly profited from GM crops, not least because seeds and genetic innovations can be patented.
- The impact of bio-colonization especially in the field of crops and seeds vehemently affected the life of human beings.
- The Patent legislations namely, the TRIPs must be amended as soon as possible because, the impact of TRIPs agreement on agriculture industry are creating negative impacts.
- In order to stop this, the patent on plants and seeds must be revoked, so that the farmers are able to reproduce the plants and seeds from previous cultivation which are Non- GM crops.
- The patent regime can at least be controlled to some extent that the farmers are not affected by granting of patent to plants and seeds which impose high cost to purchase seeds for next cultivation.
- If patent is not granted to these seeds and plants, the large companies will not be able to seize the products of country farmers and will not file infringement on the innocent farmers.
- By following all these methods, the suicide of farmers can be reduced and the health risk of persons who consume them can be reduced.
- Thus amending of the patent legislations is more important in the present situation to tackle the problems arising out of patent on the plants and seeds. The increase in the production of genetically modified plants and seeds can be controlled by having a successful legislation in India.

FINDINGS OF THE STUDY

- By studying in detail about the impact of bio-colonization, i.e.) the impact of genetically modified crops and seeds, the following have been observed:
- The patent on the genetically modified crops and seeds has created a great impact in the life of farmers.

- The genetically modified foods are like slow poison to the persons who consume them.
- The farmers are being accused by the genetically modified companies, especially Monsanto for "infringement" of the patented crops which naturally took place by cross pollination. Thus the genetic contamination of the crops affected the farmers in large.
- Due to granting of patent to genetically modified organisms and plants, the patented products are removed from the public domain and it was not even available to the developing countries from where they originated. This is called as "Agricultural Bio piracy".
- Granting of patent to genetically modified seeds and plants will cause a great impact on farmers which will increase the risk of farmers suicide because they will not be able to cultivate crops and earn their living instead they must depend upon the biotechnology companies which will be more difficult.

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