INTERNATIONAL LEGAL FRAMEWORK ON PLANT GENETIC RESOURCES AND PROTECTION OF PLANT VARIETIES

BABY, Dr. VALARMATHI R
LLM (Student), Professor,
Christ university Bengaluru.

Abstract:

Plant Genetic Resources (PGRs) ensure global food security, support sustainable agriculture and foster biodiversity conservation. This document examines the historical, legal, and commercial frameworks governing PGRs, including the evolution of intellectual property rights (IPRs) about plants and their genetic material. The discussion encompasses the role of hybrid seeds, the impact of landmark legislation such as the U.S. Plant Patent Act (1930), and seminal legal cases like Diamond v. Chakrabarty and J.E.M. Ag Supply v. Pioneer Hi-Bred International. It further explores international treaties, including the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), highlighting their interplay and implications for PGR governance. Emphasis is placed on addressing challenges such as biopiracy, the marginalization of indigenous knowledge, and the need for equitable benefit-sharing mechanisms. The document concludes by advocating for harmonized global policies to protect PGRs, ensuring a balance between innovation, biodiversity conservation, and the rights of farmers and indigenous communities.

Keywords

Plant Genetic Resources, Intellectual Property Rights, Biodiversity, Hybrid Seeds, Convention on Biological Diversity, International Treaty on Plant Genetic Resources, TRIPS Agreement, Biopiracy, Sustainable Agriculture, Indigenous Knowledge, Genetic Diversity Conservation.

Introduction:

Plant Genetic Resources (PGRs) are essential for sustainable farming practices and are the foundation for global food security. They provide the raw materials necessary for developing new plant varieties and are a vital reservoir of genetic diversity. The term "genetic resources" first emerged in 1970, and various efforts have been made to define plant genetic resources.

Generally, PGRs include all crops and certain wild relatives with valuable traits. The Convention on Biological Diversity (CBD, 1992) [1] defines plant genetic resources as any living material with current or

[1] Article 2.1 (a) of the FAO International Undertaking on Plant Genetic Resources (1983) defines the term as the reproductive or vegetative propagating material of the following categories of plants: i) cultivated varieties (cultivars) in current use and newly developed varieties; ii) obsolete cultivars; iii) primitive cultivars (land races); iv) wild and weed species, near relatives of cultivated varieties; and v) special genetic stocks (including elite and Article 2.1 (a) of the FAO International Undertaking on Plant Genetic

potential value to humans. Similarly, the revised International Undertaking of the FAO (1983) describes PGRs as all generative and vegetative reproductive material of species with economic and social importance, particularly for present and future agricultural needs, focusing on nutritional plants.

Under this framework, PGRs encompass the economic, scientific, and societal value of heritable materials within and among species. This includes materials used in research fields like cytogenetics, evolutionary biology, physiology, biochemistry, pathology, ecology, and accessions assessed for their agronomic or breeding potential.

A. Protection of Hybrid Seeds

The historical origins of conventional intellectual property, particularly patents, can be traced back to the fourteenth century in the West. At that time, the focus was primarily on technical or industrial inventions rather than on living materials such as seeds, plants, or plant varieties. Although plant genetic resources (PGRs) could not be commodified, they were consistently viewed as a valuable resource and considered the common heritage of humankind. This meant anyone could obtain seeds and cultivate them as they saw fit.

Over time, seed producers began developing plant varieties through a controlled cross between two parent plants, commonly called "hybrid seeds" in seed catalogs.[2] Commercial breeders initiated hybridization, a scientific process of combining and breeding seeds to enhance desirable traits in the resulting plants, such as higher yields, uniformity, improved color, disease resistance, and more. These improved seeds were made available to farmers for purchase, enabling better crop production.[3] The first generation of hybrid seeds was particularly advantageous, as they consistently produced plants with the desired qualities. However, subsequent generations failed to replicate the first performance, requiring farmers to buy new hybrid seeds each planting season to maintain hybrid vigor.[4] This development marked the beginning of seed companies exerting control over the replanting of grain as seed through hybridization and scientific breeding techniques.

Hybridization, or the scientific breeding of seeds, became the first method by which companies gained control over replanting grain as seed. Recognizing the growing business opportunities and increasing competition in the seed industry, private seed producers sought to protect parent-inbred lines[5] as trade secrets while releasing

Resources (1983) defines the term as ―the reproductive or vegetative propagating material of the following categories of plants: i) cultivated varieties (cultivars) in current use and newly developed varieties; ii) obsolete cultivars; iii) primitive cultivars (land races); iv) wild and weed species, near relatives of cultivated varieties; and v) special genetic stocks.

[2] Over time, seed producers began developing plant varieties through a controlled cross between two parent plants, commonly referred to as "hybrid seeds" in seed catalogs. Commercial breeders initiated hybridization a scientific process of combining and breeding seeds to enhance desirable traits in the resulting plants, such as higher yields, uniformity, improved color, disease resistance, and more. These improved seeds were made available to farmers for purchase, enabling better crop production. The first generation of hybrid seeds was particularly advantageous, as they consistently produced plants with the desired qualities. However, subsequent generations failed to replicate the performance of the first, requiring farmers to buy new hybrid seeds each planting season to maintain hybrid vigor. This development marked the beginning of seed companies exerting control over the replanting of grain as seed through hybridization and scientific breeding techniques.

[3] The process of seed hybridization developed in 1908 and in the US, the commercial market was launched in the 1920s, with the first hybrid maize.

[4] Haley Stein, -Intellectual Property and Genetically Modified Seeds: The United States, Trade, and the Developing World 3(2) Nw. J. Tech. &. Intell. Prop.

[5] Inbred lines are lines of germplasm so nearly homozygous, or genetically stable, that when the plant is allowed to self fertilise, the resulting progeny seed will grow a plant that is the same as the parent plant. See, Debra L. Blair, Intellectual Property

hybrid seeds to the market. The first hybrid seed corn was introduced in 1926 by Hi-Bred Corn Co. (now Pioneer Hi-Bred International, Inc.), and farmers began widely adopting hybrid corn by 1930.[6]

B. Protection of Asexually Reproduced Plants

Traditionally, living organisms were not eligible for patent protection, as plants and animals were regarded as natural products that could not be patented. This perspective shifted with introducing the Plant Patent Act of 1930 (PPA) in the United States. The Act aimed to protect inventors and discoverers of distinct and new plant varieties reproduced asexually. As Keith Aoki noted, patent and para-patent laws relating to plants took shape during the early 20th century, culminating in the U.S. Plant Patent Act of 1930. This legislation was the first in the world to provide intellectual property protection for plants, establishing a new category of plant patents. The PPA granted patent-like protections to breeders of new asexually propagated plant varieties, offering incentives and safeguards similar to those afforded to innovations in mechanical and scientific fields.[7]

The agricultural sector leverages patents and other types of IP protection to establish market exclusivity, fund research, maintain control over key genetic assets, and command significant price premiums for its proprietary products. In this respect, the United States is one of the most ag-friendly jurisdictions, providing more government-sanctioned legal options for protecting plant-related inventions than any other country. IP owners may seek formal patent and patent-like protection for their inventions in the United States by applying for a utility patent, a plant patent, and a plant variety protection certificate. Each of these forms of IP registration provides a different scope of protection and includes unique application requirements. At the same time, all three may be used in parallel to protect the same variety.[8]

A plant patent is a widely recognized protection for plant inventions, particularly in the United States. Introduced under the U.S. Plant Patent Act of 1930, it was designed to safeguard asexually propagated plants for plant breeders. Plant patents were especially advantageous because they protected sports (spontaneous mutations) and other discovered or developed plants without requiring every trait to remain stable (or fixed) across generations. Compared to traditional utility patents, plant patents offered a more straightforward path to protection, requiring only a detailed phenotypic description of the plant variety in exchange for 20 years of exclusivity without the need to make a biological deposit of the plant. This simplicity also contrasted with plant variety protection (PVP), which, until recently, necessitated applicants to deposit stable and uniform seeds for each protected variety, a technically demanding requirement for many asexually propagated species.

The *Imazio* decision, which limited the scope of plant patents, placed vegetatively propagated plant inventions at a significant disadvantage compared to their sexually propagated counterparts. Inventors of new sexually

Protection and Its Impact on the U.S. Seed Industry 4 Drake J. Agric. L. 305 (1999). In plant breeding, inbred lines are used as stocks for the creation of hybrid lines to make use of the effects of heterosis. Inbreeding in plants also occurs naturally in the form of self-pollination. See, https://en.wikipedia.org /Inbreeding .

[6] Debra L. Blair, Intellectual Property Protection and Its Impact on the U.S. Seed Industry 4 Drake J. Agri. L. 304 (Spring, 1999).

[7] 35 USC Sec.163

[8] IP Protection for Vegetatively Reproduced Plants: New Paths Forward - Marcelo Pomeranz,

propagated plant varieties could protect their innovations through a Plant Variety Protection (PVP) certificate or a utility patent. A PVP certificate offered broad protection, covering not only the specific plant described in the application but also any "essentially derived variety"plants predominantly derived from the original array that retained the essential characteristics of its genotype or combination of genotypes.

C. Protection for Genetically Modified Seeds and Plants

Despite the protections offered for plant varieties through trade secrets, contracts, the Plant Patent Act (PPA), and the Plant Variety Protection Act (PVPA), the seed industry remained dissatisfied. It advocated for a federal intellectual property framework, such as utility patents, to prevent independent breeders or seed companies from profiting off another entity's research, development, and investment. This push gained momentum with landmark rulings in *Diamond v. Chakrabarty* and Ex Parte Hibberd, which opened the door for broad patents in genetic engineering and established that plant varieties could be patented.

In *Diamond v. Chakrabarty*[9], the U.S. Supreme Court ruled that the patentability of an invention was not influenced by whether it was animate or inanimate. The Court held that as long as an invention meets the criteria of novelty, utility, and non-obviousness and is a product of human manufacture rather than a natural occurrence, it is eligible for patent protection. This decision set a critical precedent for recognizing the patentability of living organisms.

The landmark case *Diamond v. Chakrabarty* allowed for the patentability of a genetically engineered microorganism, a bacterium capable of breaking down components of crude oil, offering potential utility in addressing oil spills. The bacterium exhibited characteristics absent in naturally occurring bacteria and was the subject of a patent application for "microorganisms having multiple compatible degradative energy-generating plasmids and preparation thereof."

The patent examiner initially rejected the application, asserting that microorganisms were "products of nature" and, as living entities, were not patentable under 35 U.S.C. The Supreme Court, however, ruled that the bacterium was patentable because it was a product of human ingenuity with characteristics "markedly different" from those found in nature and demonstrated significant utility. The Court clarified that the relevant distinction for patentability is not between animate and inanimate objects but whether the invention is human-made. It stated that "anything under the sun that man makes" could be patentable if it met the criteria of novelty, inventiveness, and industrial application. The Court further determined that the terms "manufacture" or "composition of matter" in patent law do not exclude living organisms.

The *Ex Parte Hibberd* decision of 1985 further solidified this framework. In this case, a utility patent application for a maize plant with high amino acid levels was initially rejected by a Patent and Trademark Office (PTO) examiner, who argued that plants were subject to the Plant Variety Protection Act (PVPA) of

[9] 447 US 303 (1980).

1970 or the Plant Patent Act (PPA) of 1930, rather than utility patents. The U.S. Board of Patent Appeals and Interferences overturned the rejection, holding that the enactment of the PVPA did not preclude granting utility patents for plant matter. The Board reasoned that when human ingenuity transforms a product of nature, it becomes eligible for patent protection under the principles outlined in *Diamond v. Chakrabarty*.[10] The Board subsequently granted utility patents covering the tissue culture, seed, and entire plant of the corn line derived from tissue culture.

In 2001, the U.S. Supreme Court extended utility patent protections to both sexually and asexually reproduced plants in *J.E.M. Ag Supply v. Pioneer Hi-Bred International*[11]. The Court ruled that newly developed plant breeds could be protected under utility patents, with neither the PPA nor the PVPA limiting the scope of such patents. It held that 35 U.S.C. § 101 includes plant life within its scope and that Congress did not exclude plants from utility patent eligibility when enacting the PPA and PVPA. The decision reinforced the complementary nature of the three systems of plant protection—utility patents, the PPA, and the PVPA.

Contrastingly, in 2002, the Canadian Supreme Court took a different stance in *Harvard College v. Canada (Commissioner of Patents)*[12], ruling that higher life forms, including plants, were not patentable as they did not fall under the definitions of "manufacture" or "composition of matter" in the Canadian Patent Act. However, in *Monsanto Canada Inc. v. Schmeiser*[13], the Court acknowledged that genetic elements such as plant genes and cells could be patentable, distinguishing them from entire higher life forms.

D. International Undertaking on Plant Genetic Resources

The International Undertaking on Plant Genetic Resources (IUPGR), adopted by the Food and Agriculture Organization (FAO) Conference in 1983, was the first international agreement to address issues related to access and proprietary claims over plant genetic resources (PGRs) for food and agriculture. The undertaking aims to ensure that PGRs of economic and social significance, mainly those essential for agriculture, are explored, preserved, evaluated, and made accessible for plant breeding and scientific research. It upholds the principle that all PGRs, including naturally occurring plants, germplasm in seed banks, and cultivated plant varieties, are the common heritage of humanity and should be freely available without restrictions. "The undertaking seeks to ensure that plant genetic resources of economic and social interest, particularly for agriculture, will be explored, preserved, evaluated, and made available for plant breeding and scientific purposes."[14] These rights extend to traditional cultivars, wild species, and varieties developed by laboratory scientists. However, the rules and standards established under the IUPGR for exchanging seeds and plant materials sparked considerable controversy.

[10] Ibid 16,
[11] 534 US 124 (2001).
[12] [2002] 4 SCR 45 (Can.).
[13] (2004) 1 S.C.R. 902 (Can.)
[14] Article 1 of the International Undertaking, 1983.

The decade following the adoption of the International Undertaking on Plant Genetic Resources saw growing interest and awareness regarding biological diversity and the necessity of its conservation, sustainable use, and equitable sharing. This culminated in the signing of the Convention on Biological Diversity (CBD) by 154 nations during the United Nations Conference on Environment and Development (UNCED) in June 1992. Advances in biotechnology and intellectual property rights developments have added urgency and complexity to the need for further international legal frameworks governing the management of plant genetic resources. Nations are now revisiting the International Undertaking, exploring its potential as a mechanism to address these emerging challenges. Proposals have been made to revise the Undertaking to meet evolving needs and to transform it into a legally binding instrument, potentially under the framework of the CBD.

The International Undertaking on Plant Genetic Resources (IUPGR) established the "common heritage" principle. It adopted a broad definition of plant genetic resources (PGRs), making commercial plant varieties accessible to farmers and breeders worldwide. However, the Undertaking did not distinguish between “raw” and “worked” plant germplasm. This principle provided the framework for countries and international gene banks to collect vast amounts of plant genetic material without the consent or compensation of the countries of origin.

As a result, “gene-poor” nations, such as the United States, developed extensive seed collections under the “common heritage” regime, becoming net exporters of seed germplasm to “gene-rich” developing countries. Despite being the source of much of the seed now stored in gene banks, these developing countries depended on access to those very seed banks. Professor Brush noted that this dependence means that a slowdown in the exchange of crop germplasm is likely to impact poorer countries more severely than wealthier industrial nations. This is because industrialized countries have established effective crop collections that support their national breeding programs and those of other nations, leaving the poorest countries reliant on borrowing germplasm from countries like the United States.

Alternative formulations were sought to address these challenges, leading to interpretive resolutions in 1989 and 1991. These resolutions reaffirmed the principle of "common heritage" while seeking to balance the rights of formal innovators, such as commercial plant breeders, with those of informal innovators, such as farmers cultivating traditional varieties. Resolution No. 5/89 introduced the concept of “farmer’s rights,” recognizing the contributions of farmers past, present, and future in conserving, improving, and sharing PGRs, particularly in centers of origin or diversity. These rights were entrusted to the international community as trustees for current and future generations to ensure farmers' benefits and support the continuation of their critical contributions.

It was acknowledged that farmers should receive compensation for using germplasm, which is the product of thousands of years of selection and cultivation by farmers in the developing world. Recognizing the vital contributions of farmers to plant genetic resources (PGRs) and global food security, particularly in developing countries, the IUPGR affirmed their rights to:

1. Ensure global recognition of the need for conservation and secure adequate funding to support these efforts.
2. Support farmers and farming communities worldwide, especially in regions that are centers of origin or diversity of PGRs, in their efforts to protect and conserve plant genetic resources and their natural ecosystems.
3. Enable farmers, their communities, and nations across all regions to fully benefit both now and in the future from the enhanced utilization of PGRs through plant breeding and other scientific advancements.

In 1991, the FAO Conference proposed the establishment of an international fund for plant genetic resources (PGRs) to promote the implementation of farmers' rights and support the conservation and utilization of PGRs, particularly in developing countries. However, the realization of funds and farmers' rights was delayed until 1989 due to the voluntary nature of contributions. Despite this, the International Undertaking continued to advocate globally for the importance of PGR conservation and financing, focusing on benefiting farmers in indigenous and local communities. However, its non-binding status limited its influence.

In 1992, Agenda 21 called for strengthening the FAO Global System on Plant Genetic Resources and aligning it with the Convention on Biological Diversity (CBD) outcomes. Resolution 3 of the CBD's Final Act emphasized that issues related to access to ex-situ collections and farmer's rights should be addressed under the FAO Global System on Plant Genetic Resources. This led to extensive negotiations to revise the International Undertaking in harmony with the CBD. These negotiations began in November 1994 and culminated in November 2001, adopting a binding agreement, the International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA Treaty).

1995 FAO's Commission on Genetic Resources for Food and Agriculture (CGRFA) initiated revisions to the International Undertaking on Plant Genetic Resources (IUPGR), mainly in response to vigorous protests by developing countries, including India, during CBD negotiations. By July 2001, over 100 countries had agreed to a revised version of the IUPGR. Key provisions of the revised IUPGR include:

1. A designated list of 35 crops and 29 for age species is subject to agreed rules for access and benefit-sharing. The multilateral system applies to these crops, managed and controlled by the parties, are in the public domain, or are part of the ex-situ collections held by the International Agricultural Research Centers of the Consultative Group on International Agricultural Research (CGIAR).
2. Regarding intellectual property rights (IPRs), countries agreed, after extensive debate, that recipients of germplasm "shall not claim any IPRs or other rights that limit facilitated access to plant genetic resources for food and agriculture or their genetic parts and components in the form received from the multilateral system."
3. A financial mechanism requires those commercializing these resources to share benefits with farmers.
4. The responsibility of recognizing and implementing farmers' rights rests with national governments.

The revised IUPGR also advanced the concept of farmer's rights. Resolution 5/89 defined these as rights derived from the contributions of farmers past, present, and future in conserving, improving, and making PGRs available, particularly in centers of origin and diversity. These rights are held by the international community, acting as trustees for present and future generations, to ensure farmers benefit fully and continue their essential contributions.

E. Convention on Biological Diversity (CBD)

In a world of increasing globalization and environmental degradation, biological diversity is one of the issues that humankind must address to survive. It is of common concern to all of us. Therefore, it is not surprising that biological diversity, along with climate change, is addressed by the international community in political and legal terms. The Convention on Biological Diversity (CBD)' is an international treaty with near universal membership. It entered into force nearly 4 years ago and now has established most of the elements required to be operational. Attention within the process is now moving towards implementation, with the impending review of the operations of the Convention at the fourth meeting of the Conference of the Parties (COP) in May 1998 marking a significant development in this transition. By way of context and to understand the issues at stake in this move towards implementation, this article will briefly describe the importance of biodiversity and the history of the Convention. It will then elaborate on the provisions of the Convention, its institutional structure, and the processes of substantive elements which the Parties have initiated to develop the substantive provisions of the Convention. This article's last and most extensive section will detail this transition from establishment to implementation within the Convention process. In particular, this article will consider three of the essential elements in this dynamic: the review of the institutional structure of the Convention, what has come to be known as the modus operandi of the Convention; the development of the responsibilities of the Parties; and the ecosystem approach, which forms the underlying philosophy of the Convention.[15]

According to Philippe Cullet, several key policy developments in the 1980s shaped the context in which the Convention on Biological Diversity (CBD) emerged. These included the rapid advancement of genetic engineering, which highlighted the economic value of biological resources and their potential to generate revenue for countries of origin; the growing acceptance and integration of the concept of sustainable development; and the international push to regulate biodiversity in response to its alarming loss.

It was evident, however, that significant inequalities existed between developing and developed countries regarding access to genetic resources and the technology needed to utilize them, creating barriers to fully realizing the economic potential of biological resources. The Convention can be seen as the result of negotiations between countries that controlled these resources and saw no compelling obligation to cooperate globally and those that were motivated by both concerns over biodiversity loss and the need to ensure access to biological resources.

[15] "The Convention on Biological Diversity"- The Next Phase Sam Johnston

F. International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) 2004

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA or the Treaty) is the first legally binding international agreement explicitly dedicated to the conservation and sustainable use of plant genetic resources for food and agriculture (PGRFA). Its primary goal is to ensure the conservation, accessibility, and sustainable utilization of PGRFA. The Treaty was adopted during the Food and Agriculture Organization (FAO) Conference in November 2001, following seven years of extensive negotiations. It came into force on June 29, 2004, after receiving its fortieth ratification.

The ITPGRFA forms part of a broader framework called the "regime complex for plant genetic resources" (Raustiala & Victor, 2004). This regime includes other significant agreements such as the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), the Union for the Protection of New Varieties of Plants (UPOV), and the Convention on Biological Diversity (CBD). The effectiveness of the ITPGRFA depends not only on the commitment of participating countries to implement its provisions but also on its interplay with these other agreements. Overlaps between multiple legally binding treaties addressing similar issues can create conflicts, which may constrain the ability of countries' parties to multiple treaties to implement each effectively, potentially limiting the treaties' overall impact.

This context provides the foundation for analyzing the legal relationships between the ITPGRFA, TRIPS, UPOV, and the CBD. The article begins by outlining the conflicts that can arise in public international law and the interpretative rules available for resolving them. It then introduces the ITPGRFA and its relevant provisions. The relationships between the ITPGRFA and each of TRIPS, UPOV, and the CBD are subsequently examined, followed by a discussion of future perspectives, particularly about the ongoing negotiations under the CBD framework for an international regime on access and benefit-sharing.

G. Proprietary Claims over Plant Genetic Resources

The article *"Bio-Piracy: Creating Proprietary Rights in Plant Genetic Resources"* by James O. Odek examines the historical exploitation and modern-day challenges surrounding the ownership and control of plant genetic resources. It highlights how colonial powers and, later, multinational corporations appropriated genetic materials from developing countries without compensation, a practice now termed " bio-piracy." These resources, critical for agriculture, medicine, and biotechnology advancements, have been commoditized and patented by developed countries, often denying fair benefit-sharing to their countries of origin. The article critiques the "common heritage of mankind" concept, which facilitates free access to genetic resources from developing countries while allowing developed nations to patent derived products. It emphasizes these resources' economic, scientific, and environmental importance and underscores international law inequities favoring developed nations. While international agreements like the Convention on Biological Diversity (CBD) and Agenda 21 recognize state sovereignty over genetic resources and promote equitable sharing of benefits, their implementation is limited, especially for ex-situ collections held in gene banks. The article calls

for rediscovering global legal frameworks to ensure fair compensation, recognition of farmer's contributions, and a balance between sovereignty and international cooperation.[16]

H. Intellectual Property Protection for Plant Varieties: Analysis of the International Legal System

In 1961, predominantly industrialized nations established a multilateral framework to advance private ownership of plant genetic resources (PGRs) through the Geneva-based International Union for the Protection of New Varieties of Plants (UPOV). Laurence R. Helfer described the UPOV treaties as a sui generis system explicitly tailored to meet the needs of commercial plant breeders. The UPOV introduced a dedicated mechanism to regulate proprietary control over varietal innovations. According to Dutfield, UPOV is an "international regime designed specifically to protect plant varieties whose seeds could otherwise be easily saved, replanted, and sold" by farmers. The organization's mission is "to provide and promote an effective system of plant variety protection, to encourage the development of new plant varieties for the benefit of society." Given the Convention's significance, member states must adopt necessary measures to ensure its implementation.

The first two revisions of the UPOV Convention in 1972. Furthermore, 1978 did not substantially change the plant variety protection system. However, the 1991 revision embraced significant changes compared to the earlier versions of UPOV. It expanded and strengthened the protections available to the plant breeders while limiting the rights of farmers to save, use, and exchange seeds. The definition of breeder' has been expanded to include both those who bred a variety and those who discovered and developed the array.

I. International Union for the Protection of New Varieties of Plants (UPOV)

The definition of variety does not appear in UPOV 1961, and the state parties exercised broad discretion in defining the characteristics of plant groupings that qualify for protection. UPOV 1991 presents the legal definition of plant variety, which is more adapted to this field's scientific progress and techniques. It defines a plant variety as a plant grouping within a single botanical taxon of the lowest known rank that can be determined by the expression of the characteristics resulting from a given genotype or combination of genotypes; distinguished from any other plant grouping by the expression of at least one of the said characteristics; and considered as a unit about its suitability for being propagated unchanged.

This definition explicitly acknowledges the existence of plant groupings, sometimes referred to simply as germplasm '. These are treated as plant varieties despite being less uniform than required to fulfill the uniformity requirement. The expression' botanical taxon of the lowest known rank 'does not refer to any scientifically agreed ranking system, as the term' variety used in this definition is not identical with the botanical varieties. The Convention requires an array designated by a denomination, which will be its genetic designation, enabling the variety to be identified. The authority shall register the denomination as the breeder

[16] Bio-piracy: creating proprietary rights in plant genetic resources - james 0. Odek

submits while granting the breeders' rights. When a variety is offered for sale or marketed, it shall be permitted to associate a trademark, trade name, or other similar indication with a registered variety denomination.

J. Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)

The Agreement on Trade-Related Intellectual Property Rights (TRIPS), adopted in 1994 as a treaty administered by the WTO, is the first and only IPR treaty that seeks to establish universal and specific substantive standards for the intellectual property laws of the WTO members. It introduces many new obligations, including those related to patents and trade secrets, and also provides arbitration to settle trade disputes between member nations. While emphasizing IPRs as private rights, the preamble of the TRIPS Agreement recognized that intellectual property seeks to foster public policy goals, including developmental and technological objectives. It allows a State to interpret the provisions of the TRIPS Agreement so that the protection and enforcement of IPRs does not run counter to the social and economic welfare of the State as a whole.

In formulating or amending national laws, the States must prioritize promoting the public interest in sectors of vital importance to their socio-economic and technological development and protect public health and nutrition.[17] The national IPR regime need not be modeled on those of the developed courtiers, and it may be flexible and country-specific so long as it complies with the minimum standards set out in Parts II and III of the TRIPS Agreement.

K. Legal Obligations under the TRIPS Agreement

The TRIPS Agreement provides that patents shall, subject to certain conditions, be available for any inventions, whether a product or process, in all fields of technology, provided that they are new, involve an inventive step, and are capable of industrial application. It requires the WTO Member States to provide minimum standards of intellectual property protection for all fields of technology, such as inter-alia, pharmaceuticals, and biotechnology, without any discrimination. States are not allowed to take measures to limit the grant of patent protection because the disclosed invention belongs to a particular technological domain, including plant varieties.[18]

The State's obligation to grant patent protection has two exceptions: firstly, members may exclude inventions from patentability where it is necessary to protect order, public, or morality, including to protect human, animal, or plant life or health or to avoid serious prejudice to the environment; secondly, the Members States are not obliged to grant patents on plants or animals. However, as to the protection of microorganisms and micro-biological or non-biological processes, Article 27.3. (b) without setting substantive standards for such

[17] Article 8(1) of the TRIPS Agreement states Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement.

[18] Critical Analysis of Human Gene Patenting- *Moulya Nagraj*

protection, the TRIPS Agreement states: Members shall provide for the protection of plant varieties either by patents, an effective sui generis system, or any combination thereof.[19]

It can be logically interpreted that while WTO members may deny the grant of patents for plants, such as a genetically modified plant, they must provide patents or other IPRs about a plant variety. It requires the States to provide any of the three broad forms of protection outlined in Article 27.3. (b) of the TRIPS Agreement. The protection need not be of international standard or comparable to the patents granted under the TRIPS Agreement as long as the individual country adopted an effective intellectual property mechanism to protect plant varieties. In the context of PGRs, it must be clarified that when plants have been subject to technical or technological interventions for producing new plant varieties, they are subject to a different regime and, therefore, not covered by the patentability exception. The TRIPS Agreement's different treatment of plant varieties reflected the need for more consensus among negotiating countries, mainly between the US and Europe, although their standards are becoming closer. The abovementioned grounds for exclusions from patent protection have profound implications for biotech patents, including patents over microorganisms.

L. Patentability of Plant Genetic Innovations: Sui Generis Systems

Whether plant genetic material may constitute the subject of an invention remains a debatable issue among the WTO members, and divergence of opinion exists as to the proprietary claims upon seed and plant. The TRIPS Agreement is based on the assumption that there may be at least plant-related inventions. It recognizes that living things may be patented, and the developers of plant varieties must receive intellectual property protection for their invention.[20]

A plant variety may be described as a modification of a natural plant that belongs to the plant kingdom. The Agreement requires members to protect a plant variety, not the plant itself. However, it is argued that preserving the altered genetic material of genetically modified organisms at the cellular level equals protecting the whole genetically modified plant. For example, if a gene within a GM crop plant is patented, then using the plant containing that gene can constitute infringement as if the patent was claimed on the plant itself. However, several industrialized countries, including the United States, Japan, Australia, New Zealand, Sweden, and the United Kingdom, have permitted plant breeders to obtain patent protection in new varieties provided the eligibility requirements have been fulfilled.

Countries with advanced biotechnology capacity have routinely granted patents for gene-based inventions and isolated and purified natural substances, including deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Without any prescribed definition of the term invention, it is generally agreed that for patent law, innovation needs to be practical and technical, in addition to the specific patent requirements, i.e., novelty, inventiveness, and industrial applicability, as prescribed in the Agreement. However, these requirements present serious impediments to patenting innovations composed of, used, or applied to plant genetic material.

[19] GMO Trade in the Context of TRIPS: From the Perspective of an Autopoietic System Analysis - KAWAMURA, Satoko
[20] Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System - Dan Leskien and Michael Flitner

Intricacy in fulfilling technical requirements, apart from moral, ethical, or bio-safety issues, becomes a significant obstacle in granting intellectual property protection for plant-related innovations. It is argued that the patent system is inappropriate as the plant-related innovations cannot meet the requirements of novelty, inventive step, and disclosure.[21]

TRIPS Agreement uses the adjective effective 'as opposed to the effective 'to signify an enhanced efficiency requirement in conjunction with establishing rules and procedures for IPRs. This provision has given rise to significant debate and confusion about the meaning of the term effective sui generis system. 'Since no explanation is given regarding the system, it is interpreted as implying that all countries either have to introduce patents or plant breeders rights (PBRs). After careful analysis of the treaty's objectives and purpose, it has been argued that national plant variety protection laws must include four core elements to qualify as effective sui-generis within the meaning of Article 27.3(b). Such rules must apply to

1. plant varieties in all species and botanical genera;
2. Grant plant breeders either an exclusive right to control particular acts concerning those varieties or, at a minimum, grant a right to remuneration when third parties engage in those acts;
3. provide national and most favored nation treatment to breeders in other WTO member states and
4. establish procedures that enable breeders to enforce the rights granted to them by such laws.

Once A patent is awarded, the owner enjoys exclusive rights to prevent third parties from using, selling, or importing that product or process and to assign, transfer, or make licensing contracts for twenty years. The fundamental right conferred on the plant breeders by the UPOV convention in its 1978 version was exclusive commercial right, i.e., exclusive right for producing commercial marketing of propagating material of the new variety. The 1991 version of the UPOV has shifted the exclusive right 'from commercial right to exploitation correct, i.e., more akin to patent rights.[22]

The PBR is a milder form of IPR in which minimum support is given to breeders of new plant varieties. The UPOV Convention has some features in common with the patent system, including some essential differences of fundamental nature. Protection under the patent system targets an invention, whereas plant variety protection relates to the product as such; namely, no enabling disclosure is necessary. Moreover, plant varieties of natural origin – discoveries - are eligible for plant variety protection.

The 1978 version of UPOV, known as the effective sui generis system, is supposed to be applied to the PBRs system required under the TRIPS agreement; however, the sui generis option is not limited to PBRs and can be construed differently. The TRIPS Agreement allows the member countries to devise a plant variety protection regime that fits their needs and situation per their national interest. This paragraph is generally believed to be a gateway to avoid essential obligations under the TRIPS Agreement. However, it is not so because Article 8(2) of the Agreement states as follows: Appropriate measures provided that they are consistent with the provisions of this Agreement, may be needed to prevent the abuse of intellectual property

[21] Rimmer, M. (2002). Submission to the Advisory Council on Intellectual Property Inquiry Into The Innovation Patent - Exclusion Of Plant And Animal Subject Matter. https://core.ac.uk/download/85125705. pdf

[22] Foster, S. (2008). Prelude to Compatibility between Human Rights and Intellectual Property. Chicago Journal of International Law, 9(1), 171-211.

rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology.

Though it has been described as one of the most controversial Agreements, from the above, TRIPS provides a choice for protecting plant varieties, and the member countries may choose from patents, a sui generis system, or a combination of the two. Although the UPOV system of PBRs is generally accepted as an effective sui generis system, TRIPS does not specify what kind of breeders' rights meant and does not say what else a member state can include in its law, apart from breeders' rights. Thus, the TRIPS Agreement provides a flexible system, which leaves a lot to members' discretion.

Conclusion

The intricate interplay between international legal frameworks and the governance of plant genetic resources (PGRs). These resources, vital for global food security and agricultural sustainability, are subject to evolving intellectual property rights (IPRs) influenced by technological advances and commercial interests. The chapter highlights the tension between farmers' traditional rights and breeders' privileges, revealing a dynamic landscape shaped by agreements like UPOV, TRIPS, and CBD. While these frameworks strive to balance innovation, biodiversity conservation, and equitable benefit-sharing, challenges such as biopiracy and the marginalization of indigenous knowledge remain significant. Ultimately, the chapter calls for harmonized international policies that protect PGRs and ensure justice for all stakeholders, particularly farmers and Indigenous communities, who a200414_IJRTI2501081_662_675re central to the stewardship of genetic diversity.