Journal of Technology Law & Policy

Volume 3 | Issue 1 Article 2

September 1997

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Journal of Technology Law & Policy
Volume 3 Fall 1997 Issue 1
Published by Students at the University of Florida College of Law

Return to Table of Contents | Comment on this Article

By Policy or Law? The Challenge of Determining the Status and Future of Agro-Biodiversity

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Cite as: Cary Fowler, Ph.D., *By Policy or Law? The Challenge of Determining the Status and Future of Agro-Biodiversity*, 3.1 J. TECH. L. & POL'Y 1,<http://journal.law.ufl.edu/~techlaw/3-1/fowler.html>(1997).

I. Introduction

{1} Intellectual property rights, like other categories of rights or law, are historically situated. [1] They are conceived, constructed and interpreted "in context." Their emergence - as applied to a particular type of innovative activity - is related to economic, technological and political factors - and cannot be seen simply as the unfolding of disembodied legal logic. [2]

{2} Today, one of the most vibrant and volatile areas in the field of intellectual property rights concerns the status of plant genetic resources associated with food and agriculture. These resources come in a variety of forms from gene and gene complex to a finished crop variety; from a peasant-selected and maintained "landrace" to the inbred line used in a private sector plant breeding program. Arguably, both the farmer-variety and the modern, scientist-produced cultivar contain a measure of creative, intellectual

input. Beyond debate is the fact that plant genetic resources constitute the biological foundation of agriculture. As the raw material for the evolution and development of the world's food crops, they are clearly among the most valuable of all resources. [3]

{3} Political factors and rapid advances in technology can combine to alter market conditions and change the value and utility of these biological materials for agricultural and pharmaceutical purposes. The development of policy and law concerning t he ownership and control of plant genetic resources is being driven by such factors and is being played out both in intergovernmental fora and national legislatures. But, the peculiar nature of the resources adds complexity to the formulation of policy an d law. Determining ownership and assigning rights and benefits is not always straightforward when the subject matter is a biological resource which constantly evolves and which has been spreading around the world since the Neolithic Age. Unfortunately, the task is more complicated still - how will this be done while ensuring that biological diversity is also conserved, as required under the Convention on Biological Resources? The questions of ownership, control and benefit sharing are inextricably linked with the more practical questions of access to, and development and use of these resources. A mixture of policies and laws can be employed to address such issues. Failure in one area, however, may prompt action - even inappropriate action - in the other. Such is part of the context in which actors are developing new policies and laws governing agro-biodiversity.

II. Intellectual Property Rights Applied to Plants

{4} The first intellectual property rights law in the United States to cover biological materials explicitly was the Plant Patent Act of 1930. [4] This act provided patent protection for asexually reproduced varieties of domesticated plants (e.g. apple, pear, rose, etc.). [5] Since that time, patent or patent-like protection has been expanded through legislation and court decisions to include: sexually reproduced plant varieties, [6] micro-organisms, [7] genes and gene complexes, [8] characteristics [9] and products. [10] Trade secrets, contracts, and use of the tort theory of conversion have also been used for the protection of plant germplasm. [11]

{5} Historically, ownership and control over particularly valuable plant varieties or characteristics had to be asserted and sought in different ways - typically through isolation of the plant (such as confining its production to an island, as in the case of indigo during French colonial times) combined with physical force. [12] As early as 1556, Spain's Council of the Indies, convened in Madrid, passed legislation making it illegal for foreigners to explore for plants in Spain's New World possessions. [13] Such claims proved difficult to enforce. The wide geographic spread of seeds and planting materials since the earliest days of agriculture itself some 12,000 years ago, and the ease with which seeds could be obtained and moved about, rendered exclusive ownership and control almost impossible at the species or genotype level.

{6} Marketing measures were also employed to gain a degree of control over the reproduction and sale of particularly valuable plant varieties. Stark Brothers Nurseries, for example, was particularly active in the early part of the century in promoting new varieties of fruits through mail order catalogs, and was the first to market the popular Red and Golden Delicious apple varieties. [14] Once sold, an apple variety could be - and frequently was - grafted to produce genetically identical copies of the original, with no economic return or royalty to Stark Brothers. A company such as Stark Brothers had no legal recourse when others reproduced "their" varieties and offered them for sale. There was no intellectual property right associated with the variety. Stark owned trees; it did not own the variety itself. Stark attempted to solve its problem through contracts made with its customers. Buyers of varieties entered into an agreement not to multiply or sell the variety obtained from Stark. But this effort, like others

before it, failed.

{7} The economic impetus behind the promulgation of intellectual property rights for biological materials came with the rise of the American seed industry and, later, with the establishment of commercial plant breeding programs. The latter were made possible by the practical application of scientific principles of heredity discovered by Mendel in the 19th century and rediscovered and published in 1900. [15] Decades elapsed, however, before these principles were completely accepted as governing heredity in general, as opposed to just in peas and other select species. By 1930, little if any breeding work was underway in the very fruits and flowers covered by the Plant Patent Act. [16] Stark Brothers, which hired the private lawyer who drafted the Plant Patent Act, was not at the time engaged in any plant breeding activities. The passage of the bill, furthermore, did nothing to encourage breeding at Stark's. More than sixty years after passage of the Act, they still were without a plant breeding on staff. The Act did not so much serve to promote or reward invention (for there was none) as it did to reward discovery through the securing of a market for the owner of a new, patented variety.

{8} Interestingly, there was a great deal of experimentation and crop breeding work being undertaken by farmers in the U.S. from the 18th century onwards, based on huge quantities of genetic materials - seeds - imported and distributed first by the U.S. Patent Office and later by the U.S. Department of Agriculture. [17] The fruits of these efforts (which were never considered to be the proper subject of patent protection) account for the spread and wide scale adaptation of non-indigenous crops to the myriad environments found in the U.S. Individual farmer-breeders, however, had little economic incentive or need for patent protection for such biological inventions during this period.

{9} As breeding programs and commercial seed activities came to encompass more and more crops in the middle decades of this century, the need for intellectual property rights protection for a broader range of crops (grains, vegetables, etc.) was felt by emerging commercial interests. After several unsuccessful attempts in the 1960s, the seed industry persuaded Congress to pass such legislation, the Plant Variety Protection Act, in 1970. [18] This act requires that an applicant demonstrate that the protected variety is distinct, uniform (genetically), and stable. It does not require disclosure of an inventive step.

{10} Holders of certificates granted under the Plant Variety Protection Act are provided with reciprocal rights in the more than thirty countries which are members of the International Union for the Protection of New Varieties of Plants (UPOV). This intergovernmental organization is based on the International Convention for the Protection of New Varieties of Plants signed in Paris in 1961.

{11} Developing countries have been slow to join UPOV and institute variety protection schemes. [19] The stage of market development and plant breeding activity found in most developing countries has not been conducive to producing political pressure for such legislation.

{12} Both the U.S. Plant Patent Act and the Plant Variety Protection Act, as well as similar plant breeder's rights laws in other countries, provide protection for varieties of plants, i.e., for certain unique combinations of genes. They do not offer protection for the genes themselves or for any novel characteristic.

{13} Until recently it was the variety itself which was the primary unit of economic value. With the advent of the new biotechnologies, the locus of value began to expand and shift to genes. Once unthinkable, genes can now be transferred across species "boundaries." The expression of firefly genes transferred to tobacco plants is one particularly evocative example of the power of recent scientific

advances. Less dramatic transfers are becoming commonplace. The application of new biotechnologies to plant breeding has brought new economic opportunities and fresh challenges to existing intellectual property rights regimes.

{14} Plant breeding involves the rearrangement and manipulation of genes. The genes do not drop out of the sky. Some 6 million samples of agricultural crops (typically in the form of seed) are conserved in cold storage in more than 1300 "genebanks" around the world. [20] Genebank collections contain much of the intra-species genetic diversity of the world's agricultural crops - most of it coming from developing countries where virtually all major crops were domesticated and initially developed. [21] These genetic resources - the legacy of 12,000 years of agriculture and eons of plant evolution before that - are the raw material used in plant breeding programs. Without it, plant breeders would not be able to fashion new varieties resistant to pest and diseases, or adapted to new farming or climatic conditions.

{15} Because they constitute the very foundation of agriculture, plant genetic resources are arguably the most valuable raw materials on earth. Major efforts are underway to catalog and document these resources and to construct maps of the genomes of a number of crops. Such work will allow for more efficient deployment and use of specific genes and gene complexes. Moreover, as genes and their functions are identified, the prospect of inserting a particular characteristic in one species by using genes from another becomes more and more feasible, and common. [22]

{16} The desire to gain legal ownership and control over genes has led to numerous and widely-publicized court cases, and to the effective expansion of coverage of patent statutes. It has also led to the intensification of conflict over ownership and benefit-sharing associated with biological diversity in general, and more specifically with the thousands of distinct varieties of domesticated crops and the genes they contain which are conserved ex situ or still found in the fields and gardens of traditional farmers, particularly in developing countries.

III. The Convention on Biological Diversity

{17} The Convention on Biological Diversity, which opened for signature at the "Earth Summit" and came into force legally in 1993, is the most obvious example of the continuation of the centuries-long struggle over ownership and control of biological materials. The Convention "reaffirms" that "States have sovereign rights over their own biological resources." [23] Under terms of the Convention, access to these resources is granted by the "country of origin" on the basis of mutually agreed terms. Article 2 states that the country of origin of genetic resources "means the country which possesses those genetic resources in in-situ conditions." And in-situ conditions "means conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties."

{18} The Convention, however, recognizes the need to find solutions to certain outstanding matters, including: a) Access to ex-situ collections not acquired in accordance with this Convention (i.e., the 6 million samples in genebanks); and b) The question of farmers' rights. [24]

{19} These matters are now being negotiated in the intergovernmental Commission on Genetic Resources at the Food and Agriculture Organization of the UN (FAO) in Rome. Of particular interest to this discussion is the matter of "Farmers' Rights."

IV. Farmers' Rights: Intellectual Property Rights in the Making?

{20} The concept of "Farmers' Rights" has been the subject of intense debate at FAO for a decade. In the (legally non-binding) International Undertaking on Plant Genetic Resources, first adopted by the 1983 FAO Conference as Resolution 8/83 and currently adhered to by 110 countries, "Farmers' Rights" have been defined as "rights arising from the past, present and future contributions of farmers in conserving, improving and making available plant genetic resources, particularly those in the centres of origin/diversity." [25] The definition highlights a crucial distinction between these and other resources, or raw materials.

{21} Plant genetic resources as represented in traditional "farmer-varieties" of agricultural crops are an already-improved raw material. There is an "intellectual" component to the resource. The resource consists of thousands of genetically distinct varieties of wheat, rice, tomatoes, etc., which exist owe their existence in large part to the people who have fashioned them through mass selection and breeding over the years. In many instances this selection has been conscious and knowing, with goals in mind and with effective techniques at hand. [26] Farmers have selected for and created varieties of maize particularly suited for eating fresh off the cob, for roasting, for grinding into flour, for making beer, for popping, and for medicinal and other purposes. Less noticeable perhaps, farmers have created "varieties" adapted to their particular ecological situation - to the myriad pests, diseases, soil conditions and climates in the world's agricultural fields and gardens. It is this genetic diversity which is now being captured and used in modern plant breeding programs.

{22} Due to a number of historical factors, not the least of which was the Ice Age, most genetic diversity in modern agricultural crops, as noted above, originated and is to be found in developing countries. The uneven distribution of this valuable agricultural resource has brought a distinct "North-South" flavor to the international political debate. Developing countries have been seen as donors, and developed countries as recipients and beneficiaries of the flow of germplasm. The value of this transfer of genetic wealth should not be underestimated. In a letter to the U.S. Senate urging ratification of the Convention on Biological Diversity, U.S. Secretary of State Warren Christopher estimated that the annual value of developing country germplasm to just two leading U.S. crops was $10.2 billion. [27] Extracting some of that value for the donors, however, is a different matter.

{23} As impressive and useful as they might be, traditional farmer-varieties cannot typically meet the UPOV criteria of distinctness, uniformity and stability. In particular, they are rarely uniform. [28] A peasant farmer depends on the stability and dependability of production offered by genetic heterogeneity. Uniformity in the field all too frequently means vulnerability to pest and disease attacks. [29]; Thus, while the intellectual property of modern plant breeders might be protected legally, the breeding work of farmers is not and cannot be through the same statutes or similar approaches.

{24} Furthermore, it is not evident that any substantial commercial market exists for this genetic material despite its obvious utility. Buyers of genes, or farmer-varieties, must be assured that they are purchasing unique and useful resources for which there are few practical alternatives. Given the enormity of crop genetic diversity and the fact that more than 3000 genebanks around the world maintain collections, the creation of a market would appear to be difficult. Some genetic materials may be redundant, having characteristics found in multiple varieties or species. Others may be so rare as to make the cost of their identification prohibitively high and their sales price correspondingly low. [30] Indeed, few examples exist of countries successfully selling crop genetic resources.

{25} The perceived imbalance in this situation led to political controversy [31] and finally to the agreement on "Farmers' Rights" at FAO, as noted above. The definition for these rights ("rights arising from the past, present and future contributions of farmers in conserving, improving and making

available plant genetic resources, particularly those in the centres of origin/diversity"), however, falls short of something that can be operationalized or enforced. Positing the origin of the rights and the reason for their existence is not the same as specifying the content of the rights.

{26} "Farmers' Rights" could be seen, or constructed, as a form of intellectual property rights, which might be extended either to individuals or to communities. [32] A number of countries are considering such legislation. Superficially, it would seem that intellectual property protection accessible to and appropriate for farmers is warranted given growing evidence of their innovative activities. [33]

{27} Rights arise and are defined, however, in a social, political, economic and technological context. Such an enabling context would not seem to exist in this case. Moreover, implementation of intellectual property rights for farmer-varieties would appear difficult, if not impossible. Tracing the origin of a trait or gene and ascertaining its uniqueness would not be easy given the amount of genetic diversity and the number of farmers involved. [34] Much of the diversity produced by farmers has been developed over generations and is the product not so much of a single farmer as of a community of farmers. Assigning ownership to an individual or even to a community would be problematic at best.

{28} Determining the value of the contribution of particular germplasm to a complex, multi-year breeding program would also be difficult. Consider the pedigree of the VEERY line of wheat produced at the International Maize and Wheat Improvement Cent re (CIMMYT) in Mexico. This wheat was the product of 3170 different crosses involving 51 parents from 26 countries. The pedigree is yards long - in small type. The VEERY line has been used in the breeding of a number of varieties. [35] How do we determine the value of each of the components used in developing VEERY? How do we determine the value of these components when the line is crossed with other lines in another breeding programme? Such questions cannot easily be answered. No accepted quantitative or qualitative criteria or measures exist.

{29} In the most recent negotiations at FAO, a number of countries have sought to define "Farmers' Rights" in terms of a collection of "entitlements," inter alia:

* support for research, training and institutional capacity building
* facilitation and support for "farmer-based knowledge systems"
* review of credit facilities and market provisions and the removal of financial and market barriers against farmer-based knowledge systems
* transfer of technology
* modification of land tenure and seed laws
* financial support of farmer conservation and development of plant genetic resources
* establishment of systems to ensure the "fair and equitable sharing of benefits arising out of the utilization of plant genetic resources for food and agriculture" [36]

{30} In addition, some countries have proposed that "Farmers' Rights" include "collective rights regimes" (intellectual property rights) and the right to save and re-use seed of varieties protected under legislation such as the Plant Variety Protect ion Act. The diversity of demands raises questions as to the nature and purposes of the rewards and incentives being proposed, as well as their relevance to and connection with the concept of "Farmers' Rights" as originally agreed at FAO.

{31} How the scale of benefits or entitlements would be determined and how these benefits would be apportioned among countries and/or farming communities remains to be seen. No specific proposals addressing these issues have been made during the course of negotiations at FAO.

{32} In summary, "Farmers' Rights" has been used as a political slogan which at times has 1. sought to obtain support for conservation and development programs for plant genetic resources, 2. contained a demand for certain entitlements not directly related to the biological resources; and 3. been a proposal for a new form of individual or collective intellectual property rights.

{33} In a separate but related negotiating process at FAO, 150 countries adopted a Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, at the Fourth International Technical Conference on Plant Genetic Resources held in Leipzig, Germany, in June 1996. This Global Plan outlines twenty specific initiatives in four broad categories: in-situ conservation and development; ex situ conservation; utilization of plant genetic resources; and institutions and capacity building. The Plan has been endorsed by the heads of state and government at the World Food Summit (1996) and by the Conference of Parties to the Convention on Biological Diversity.

{34} Funding and implementation of the Global Plan of Action could be a tangible expression of support for farmers in recognition, as the definition of "Farmers' Rights" describes it, of the "past, present and future contribution of farmers in conserving, improving and making available plant genetic resources...." Indeed, Resolution 3/91 of the FAO Commission on Plant Genetic Resources states that "Farmers' Rights will be implemented through an international fund on plant genetic resources which will support plant genetic conservation and utilization programmes, particularly, but not exclusively, in the developing countries." The development of a Global Plan of Action was set in motion by the intergovernmental FAO Commission on Genetic Resources because of the need to determine what the International Fund would support and how much money was needed. The de-linking of "Farmers' Rights" and the Fund occurred in large part with the signing of the Convention on Biological Diversity, which encouraged a bilateral approach to benefit-sharing by reaffirming national sovereignty and prompting countries to think of their status as "countries of origin" of valuable biodiversity. As discussed earlier, however, markets have not emerged and countries of origin have not realized significant income from selling their agricultural biodiversity.

{35} Linking the realization of "Farmers' Rights," as defined in the FAO Commission Resolution 8/83, with implementation of the Global Plan of Action would effectively tie benefits to associated actions. Significantly it would also bypass the difficult problems associated with determining ownership and associated rights over, and the monetary value of, biological materials that will surely arise if countries apply the Convention on Biological Diversity's approach regarding "country of origin." Agricultural genetic resources are, in economists' terms, a classic "public good." Such a public good produces common responsibilities as well as benefits. The clear task of the current round of international negotiations is to define and operationalize both. Fortunately, a "win-win" situation is conceivable, as conservation and improvement of this important biological resource produces immense benefits which can be enjoyed by all.

V. Trade-Related Aspects of Intellectual Property Rights (TRIPS)

{36} In politics as in patent law, timing is important. In 1999, the World Trade Organization will review implementation of agreements related to trade-related aspects of intellectual property rights (TRIPS). Article 27 guarantees "The protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof." It is widely believed that the UPOV regime would be considered an effective sui generis system. In fact, UPOV falls somewhat short. To meet the TRIPS standard, all species would have to be eligible for protection, and the rights guaranteed under law in one nation would have to extend not just to other members of UPOV, but to all countries under the World Trade

Organization.

{37} The general UPOV approach, nevertheless, is certainly what parties to the TRIPS agreement had in mind for an acceptable sui generis alternative to patents. However, UPOV does not provide for protection of traditional farmer-varieties of crops, and thus cannot substantially help meet the goals of the Convention on Biological Diversity to ensure the conservation, sustainable utilization and fair and equitable sharing of benefits arising from the use of biological diversity. Moreover, negotiations at FAO (aimed at resolving the "outstanding matters" left with the Convention on Biological Diversity) have not yet yielded a benefit-sharing mechanism or formula to protect or reward farmers for their practical and intellectual contributions to plant genetic resources.

{38} If the question of "Farmers' Rights" is not resolved expeditiously at FAO, developing countries (mindful of the upcoming TRIPS review as well as the mandate of the Convention on Biological Diversity that access to biodiversity be granted on mutually agreed terms by countries of origin) will be left with two alternatives to pursue in extracting benefits from the biological diversity in their possession:

{39} 1. They could provide access to plant genetic resources on a case-by-case basis through individual bilateral arrangements. However, access to the full range of genetic resources now available would require tens of thousands of bilateral agreements. And, as the monetary value of any specific genetic resource to a plant breeding program is difficult to determine (and rarely known in advance of the breeding work itself), benefit sharing terms will be difficult to resolve. Moreover, farmers may not be the beneficiaries of bilateral agreements concluded between governments and/or governments and the private sector.

{40} 2. They could fashion sui generis intellectual property rights regimes covering both the product of modern plant breeding programs as well as material produced or conserved by farmers. The advantage would be that rights would be recognized almost universally. Countries not recognizing them would be subject to trade sanctions under the provisions of the World Trade Organization. The disadvantage is that the bona fide recipients of such legal protection would be extremely difficult to determine, and it is unlikely that farmers could easily document and establish claims of ownership. In the absence of information on the genetic properties of a farmer-variety, the holder of intellectual property rights might find that he/she has no market, no way to exercise the right or benefit from it effectively.

VI. Conclusion

{41} Questions of access to, ownership of, and benefit-sharing from biological resources are currently under debate and negotiation both at the national level, and at the international level in multiple fora. These debates are related to and will have an impact on the evolution of intellectual property rights associated with biological materials, and particularly with new agricultural plant varieties as well as with genes and characteristics.

{42} Historically, farmers have made major contributions to the development and conservation of plant genetic resources for food and agriculture. These contributions, which are on-going, are not easily recognized or rewarded through existing intellectual property rights regimes. They could be rewarded, and farmers could receive benefits as a class, through multilateral agreements whereby conservation, development and utilization of plant genetic resources would be supported. The FAO Global Plan of Action could be the means through which such support is provided.

{43} If multilateral benefit-sharing agreements cannot be finalized, it is likely that countries will begin to restrict access to their genetic resources, use contracts and bilateral agreements, and experiment with intellectual property rights regimes designed to protect genetically diverse farmer-varieties. The TRIPS section of GATT, which mandates the establishment of a patent or effective sui generis system for the protection of plant varieties will encourage countries to make "Farmers' Rights" an intellectual property right, if other forms of protection and benefit sharing, such as those described above, are not agreed upon. Moreover, restrictions on the access and use of agricultural genetic resources such as most IPR regimes would impose, may only serve to encourage technological developments (e.g., transfer of genes across species barriers) which would further undermine the bargaining position of "countries of origin" and deal another blow to conservation and development efforts.

{44} Failure to adopt appropriate policies at the international level may, therefore, lead to the establishment of new forms of intellectual property rights at the national level. Such legal responses to fundamentally political and scientific problems are not likely to produce real or lasting solutions.

ENDNOTES

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[1] Granovetter, M., *Economic Action and Social Structure*, 50 Am. J. of Soc. (1985).

[2] Fowler, Cary, Unnatural Selection: Technology, Politics and Plant Evolution (1994).

[3] Harlan, Jack, Crops and Man (1992).

[4] Townsend-Parnell Plant Patent Act, 46 Stat. 376 (May 23, 1930, ch. 312, §1).

[5] These are species which are multiplied asexually for the commercial market, by grafting or other "cloning" techniques. The Act, however, excludes potato and such tuber crops.

[6] 7 U.S.C. §2321 et seq. (Plant Variety Protection Act of 1970, 84 Stat. 1542), as well as through *Ex Parte Hibberd.*

[7] *Diamond v. Chakrabarty*, 447 U.S. 303, 308-9 (1980).

[8] *(Ex parte Hibberd)*, 227 U.S.P.Q. (BNA) 443 (Bd. Pat. App. & Interferences 1985)

[9] *Imazio Nursery v. Dania Greenhouses*, 69 F.3d 1560 (D.C. Cir. 1995) limited the rights of holders of plant patents under the 1930 law to excluding only those who have derived their material directly from the patent holder's stock. Independent creation is thus an ample defense in an infringement action. Breeders fashioning a new variety with a unique trait - in this case a heather variety which bloomed in different months than other varieties - must now seek protection under utility patent statutes for such a characteristic. *See* Richard Kjeldgaard and David Marsh, *Recent United States Developments i n Plant*

Patents, 2 Molecular Breeding (1996).

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[14] Terry, Dickson, The Stark Story: Stark Nurseries 150th Anniversary (1966).

[15] Mayr, Ernst, *The Growth of Biological Thought: Diversity, Evolution and Inheritance*, Cambridge: Belknap-Harvard University Press, 1982.

[16] Folger, J.C. and S.M. Thomson, The Commercial Apple Industry of North America (1921). Folger and Thomson state: "Seed selection and hybridization have been responsible for the improvement of many cultivated plants and for the discovery of many new varieties, but not so for the cultivated fruits. Practically all varieties of fruit are the result of chance discovery of seedlings."

[17] Pieters, A.J., *Seed Selling, Seed Growing and Seed Testing, in* Yearbook of Agriculture for 1899, U.S. Department of Agriculture (1900). *See also,* the various yearly reports of the Commissioner of Patents from this period.

[18] Fowler, *supra.*

[19] To date, only Argentina, Chile, Colombia, Paraguay, and South Africa are signatories.

[20] The State of the World's Plant Genetic Resources, U.N. Food & Agric. Org. (1997) (forthcoming).

[21] Zeven, A.C., and P.M. Zhukovsky, Dictionary of Cultivated Plants and their Centres of Diversity (1975).

[22] A number of crops now contain genes from the bacterium, *Bacillus thuringiensis* (Bt), for example.

[23] Preamble to the Convention on Biological Diversity, U.N. Env't. Programme (1992).

[24] Nairobi Final Act of the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity, Resolution 3, U.N. Env't. Programme (1989).

[25] Conference Resolution 5/89, U.N. Food & Agric. Org. (1989).

[26] Berg, Trygve, et al., Technology Options and the Gene Struggle (1991).

[27] 16 August 1994.

[28] Considered - and compared - not as individual plants but as a "population," a farmer-variety might be considered as distinct, and it is not inconceivable that criteria could be formulated which would allow

for the designation and protection of such populations. *See* Dan Leskien and Michael Flitner, *Intellectual Property Rights and Plant Genetic Resources in*, Issues in Genetic Resources, No. 6. (1997).

[29] National Academy of Sciences, Genetic Vulnerability of Major Crops (1972).

[30] Simpson, R. David, *Biodiversity Prospecting: Shopping the Wilds is Not the Key to Conservation in*, Resources for the Future, No. 126, 1997.

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[32] Agrobiodiversity and Farmers' Rights: Proceedings of a Technical Consultation on an Implementation Framework for Farmers' Rights. (Swaminathan, M.S., ed., 1996).< BR> "Model Provisions for National Laws on the Protection of Expressions of Folklore Against Illicit Exploitation and Other Prejudicial Actions," prepared by the United Nations Educational, Scientific and Cultural Organization (UNES CO) and the World Intellectual Property Organization (WIPO) may also provide a starting point for construction of new intellectual property rights.

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[35] *Ibid.*

[36] Report of the Commission on Genetic Resources for Food and Agriculture, Seventh Session, U.N. Food & Agric. Org. (1997).
