JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Protection of Genetic Resources for Agriculture in India

Manjunatha .N. G[1]

Introduction: The Introduction of genetically modified seeds into the environment has been increasingly controversial as illustrated by the ongoing debates concerning the commercialisation of *Bt*cotton[2] in an increasing number of states in India over the past few years in other countries too in particular in the European region the development of agricultural genetic engineering and the commercialisation of transgenic food products has been met with significant resistance[3].

The importance of the agricultural sector in developing countries as a source of food, incomes, employment and often foreign exchange cannot be overstated. As much as good health, a productive and sustainable agricultural sector is critical to achieving economic growth and poverty reduction about three quarters of the world's poor people live and work in rural areas[4]

Debates around genetic engineering span a wide number of areas and concerns these include trade facilitating measures intellectual property rights, as well as impacts on the environment, human health, food security and livelihoods. In general concerns are related to the contribution of agricultural genetic engineering to a broader process of sustainable and equitable development if is this contribution to the broader process of development and to the narrow notion of economic development which is considered here.

Sustainable agriculture is possible only with the existence of genetic diversity and protection of the same is significant in an agricultural system which is eco-friendly of over 100 crop species of major economic importance in the world only 16 originated in USA, Canada and northern Europe. The majority of the world's most widely used crops (including cereals fruits, vegetables, pulses, species and others) have originated in tropical countries. The genetic material derived from these countries. The genetic material derived from these countries contributes nearly 92% of global production of food crop.

India though called as the centre of origin of so many importantcrops, agriculture is heavily dependent on genetic material from the west. The drastic change in the crop pattern of several countries is due to take over by

[1] M.A.,LL.M.,M.phil.,(Ph.D),NET-JRF(Law),KSET-LAW,KSET-POL.SC.,& Research scholar in law, Gulbarga University,Kalaburagi & Asst.Professor in law, Vidyodaya law college(Aided) B H Road, Tumakuru-572102, Karnataka
[2]GRAIN, Bt cotton: The facts behind the hype, http://www.grain.org/seedling/id=457 Seedling(2007)
[3]P.K Gupta , ' Transgenic plants some current issues, current science vol 70, No 7 April 10 (1996)
[4]IPAD(2001) 'Rural poverty report 2001-the challenge of ending rural poverty' IFAD, Rome, pp14-15, source:http://www:ifad.org/poverty.

multinational corporations and introduction of breeders rights in favour of them. This has a very adverse impact on the environment genetic diversity which has been developed natural by the people for countries.Genetic resources mean any material of plant, animal microbial or other origin containing functional units of heredity. These genetic resources are very important to natural eco-system the natural and original genes of plant and animals to be protected because by using these genes only modern BT process can be carried out. Sustainable agriculture is possible only with the existence of genetic diversity and protection of the same is significant in an agricultural system which is eco-friendly. Agriculture is rightly called as the backbone of Indian economy 2/3rd of the population constitutes workforce dependent on agriculture and allied activities. It is the single largest contributor (33%)[5].

Impact of Modern agriculture systems:

Traditional agricultural practices are mainly nature oriented and suited to different climatic and environmental conditions. It is the modern agricultural system that brought a drastic change in the farming practices. It includes in itself mechanized and chemical based framing, commercial farming contract farming and genetic farming.

Mechanised and chemical farming: Where animal power, manure and traditional methods of pest control are replaced by mechanization and chemicals characterised by high water utilization.

Commercial farming: The aim of modern agricultural system was to enhance the production of food crops but most of the farmers shifted to commercial crops as this system needs higher water utilization here mono cropping is the norm characterised by the utilization of fertilizers and pesticides.

Contract Farming: The propagation of plants in this kind of farming takes place in laboratories. All control is in the hands of corporations or scientists thus farmers are defendant on external agencies for seed growing technology, markets etc and this system took over the traditional systems for want of higher yield. Higher income at the cost of genetic diversity and environment.

Green Revolution (1966-68): Achieving the food security was the permanent item on the agenda of new independent India prior to green revolution, the emphasise was on the expansion of lands under cultivation but increase in death rate due to starvation and imbalanced growth of population depended swift action on the part of the state and green revolution is the consequents of it green revolution brought with it HYV-High yielding varieties, which was the first step towards genetic farming.

There are three important features of green revolution:

a. Continued expansion of farming areas.
b. Double cropping of existing farm land.

[5]GrahamDutfield, 'The Andean pact common system on Access to genetic resources : a commentary' http:www.redbio.org/portal/encuentros/enc 2001 /minicurses/pdf /mc15/16 comments%20 and pact.pdf Ag2/1997

c. Using of genetically improved seeds.

Agriculture and genetic diversity impact of green revolution: Though green revolution yielded the desired result of increase in food production. In the long run it led an anticipated and undesired results. Green revolution displaced genetic diversity in two ways.

A it brought in monocultures like wheat, rice which replaced the then existing mixed cropping and rotation crops like wheat, maize millets, pulses, oil seed etc.

B. It encourages growing single varieties derived from exotic dairy varieties (in rice and wheat) to mano cropping[6].

Maximise grain production at the cost of diverse indigenous notive varieties of rice and wheat that are suited to different soil, water and climate conditions apart from these. The use of pesticides used to kill some pests also affected the population of nontargeted organisms like snakes, birds, frogs which act as natural pest control mechanisms.

Application of high chemical fertilizers led to loss of several micro-organisms and earth worms agencies of restoration of the fertility of soil. For ex- the cropping pattern in Punjab has witnessed a major shift towards wheat (in the rabi season) and rice (in the kharif season) wheat had spread at the cost of gram, barley, rap reed and mustard which were usually shown as mixed crops along with traditional wheat verities.

Similarly the area under rice increased at the cost of maize, kharif pulses and masoor, groundnut, green fodders and cotton. This proactive deprived rice crop- nitrogen capabilities of displaced leguminous crops and demanded artificial fertiliser inputs for cultivated paddy, in addition to the aforesaid it narrows the availability of different food crops with nutritional benefits.

Value of Genetic Diversity: Generally crop verities are derived into 2 varieties

1. Farmer Varieties: Modern varieties are the products of plant breeding by professional plant breeders in private companies and publicity funded resear5ch institutes. These rasieties are some time called HYV (High yield varieties) they typically have a high degree of uniformity. Farmersrasientieson the other hand are products of breeding or selection carried out by farmers over many generations farmers varieties tend to be non-uniform and contain high level of genetic diversity.

[6]Monocropping is the agricultural practice of growing a single crop year after year on the same land, in the absence of rotation through other crops or growing multiple crops on the same land (polyculture). Corn, soybeans, and wheat are three common crops often grown using monocropping techniques. Monocropping allows for farmers to have consistent crops throughout their entire farm. They can use the same seed, pest control, machinery and growing method on their entire farm giving them a larger yield for a significantly lower cost.

For instance in India which rice originated and spread throughout Asia alone according to richatis well known rice scientist. 400000 varieties of rice existed during Vedic period even today 200000 varieties exist in India which would be grown in different climate conditions.

Genetic diversity provides stability to farming system and enables farmers to adopt crops suited to their own ecological needs culture and tradition. It also provides self sufficiently and security losses due to a particular crop are compensated by the yield of other crops and varieties.

Wild ecosystems and agriculture: Genetic diversity represents a treasure chest of potentially valuable but as yet unknown resources this is the reason for maintaining both wild ecosystem and traditional farming as plants in these habitats are likely to contain and develop new and valuable genetic characteristics for ex- in India. Cassara yields save in creased up to 18 times with the disease resistance provided by genes from wild brazilliancanava.

Genetically modified or engineered organisms and Agriculture:

Most of the modern varieties are genetically modified crops either is high yielding a pest resistant. This could be a boon to Indian agriculture but when we visualise. Their negative effects on health and environment they are most dangerous. Reports from Cornell University have shown that butterflies ted on pollen of GM corn. Shown retarded growth and high mortality rate.Swiss scientists have also shown the insects which help in bio-control of pests were damaged seriously by GM corn, the culprit in both cases in BT corn a genetically engineered variety of corn using the same system of resistance as used in notorious *BT*. Cotton planed by Monsanto.

Sustainable Agriculture:

Farmers varieties over modern varieties traditional v/s modern agricultural system agriculture is said to be sustainable only when it in ecologically sound. Economically viable socially just culturally appropriate and based on holistic approach.

According to kalyanikandeela sustainable agriculture implies-

a. In corporation of natural processes such as nutrient cycling, nitrogen fiction and pest predatorrelishes
b. Minimisation of the use of external and non-renewable inputs that damage the environment or harm the health of farmers and consumers.
c. Participation of farmers and rural people in all the processed of problem analysis technology development adoption and extension and monitoring evolution.
d. More equitable ocean to productive resources and opportunities.
e. Greater productive use of local traditional knowledge, practices and resources.
f. In corporation of diversity of natural resources and enterprises within farms
g. Increase itself reliance amongst farmers and rural communities and
h. Economic viability of form operations.

By taking into account the merits of traditional system we can say that it is more eco-friendly and sustainable recognition the importance and significance of traditional varieties many farmer have shifted to

organic farming growing traditional varieties which not only restores environment but also indigenous crop varieties.

A good example for this is the *'BreejBachaoAndholan'*[7] initiated in a small Himalayan village jaradhgan which not only aims at conserving environment genetic diversity by traditional farming but also restoration and collection of traditional varieties. It has collected over 250 varieties of rice and 170 kidney beans.

Many traditional system of farming could be seen in India which are not only eco-friendly but also characterised by multiple cropping one of them is 'Baronet' meaning 12 crops. In this system 12 crops are simultaneously grown a combination of cereals, lentils, vegetables creepers and root vegetable involves low risk in case of failure of a particular crop and also helps in nutrient retention in the soil.

Regime on plant varieties:

The first convention which dealt with plant varieties was the convention on the protection of new varieties of plants (UPOV)[8] signed in 1961 and union for protection of plant varieties was also formed. According to which the member states are required to grant commercial breeders ownership rights over modified varieties. The UPOV was revised in 1971 and 1992, these provisions have progressively strengthened the commercial breeder's rights.

In 1991 revision allows for patents to be give in addition to plant breeder's rights. These revisions extends the scope to-

a. The who propagating material (not just the reproductive or vegetative part) and
b. Reproduction conditioning for the purpose of or stocking of any of these varieties parts.

Rights of the Farmers to save and exchange seeds are severally impaired:

Exchange needs are reversely impaired as it recognises the ownership over essentially derived varieties also i.e. unless a major modification is done the derived variety belongs to the owner of the protected variety from which it has been derived.

International legal Regime:

a) TRIPS: Agreement on trade related aspects of intellectual property rights under WTO obliges all its members to provide protection for plant varieties either by patents or be effective significant that it should be up to the standard set by TRIPS.
b) UNCBD- (United nations Conventions on Biological Diversity 1992): Is the only convention that somewhat recognises traditional knowledge and sovereign right of a nation over its biological resources.

[7]The 'BeejBachaoAndolan' [BBA], begun in the late 1980s, is twenty five year old, led by farmer and social activist Vijay Jardhari. The Andolan started in the village Jardhargaon of district Tehri, Uttarkhand, famous for its unique movement to save the traditional seeds of the hills.

[8]PrabhashRanjan, " Recent Developments in India's plant variety protection, seed regulation and linkages with UPOVs proposed membership" Journal of world Intellectual property Vol 12, No (3) (WBNUJS) Kolkata India 2009

It was the first international instrument to call upon nations to respect, maintain and protect indigenous knowledge.

Case- Monsanto Canada Inc v/s Schmeiser[9]- Though the decision In this case has no direct relevance in the countries other than Canada it has the potential of influencing the policy making with regard to breeders rights and patents.

Facts of the case: Monsanto a U.S based multinational company developed a genetically modified(GM) variety of Canada it is used by many farmers in Saskatchewan in Canada. Schemister a former from the same area though didn't use these GM variety he was found in possession of it (he did not pure hazed it from the company). Canadian Supreme Court held that the patent had been violated. The significant part of the decision was on the matter. Whether Monsanto's patent on GM cells extends to plants also. It was enunciated in the decision that plant it is not possible to disassociate the two. Thus it was extended to plants also this influence or significant where plants are not patentable. Thus there should be a strict distinction between genes and plants. The decision was felt as prejudicial because the contamination of fields by GM seeds by pollination was no taken into account.

Indian Scenario:

1. The protection of plant varieties and farmers rights Act 2001[10]- was enacted as an obligation under TRIPS. The main lacuna of this Act which itself is against farmers interests are follows-
   a. This Act provides only a lip service to the idea of royalty payment when their varieties are used by MNCs(Sec 26, 56)
   b. It does not provide any strong protection to farmers in case of crop failure of registered varieties. *BT* cottons failure is a very good example where aggrieved farmers are yet to get the compensation. Sec 39.2 says that if such propagating material fails, the farmer may claim compensation in the prescribed manner before the authority. Loss of crops which leads to farmers suicides demands severe punishment which should act as deference against earning companies.
2. Bio-Diversity Act 2002: the preamble itself calls for fair and equitable sharing of benefits arising out of the use of traditional knowledge.

[9] 2004 1 S.C.R. 902, 2004 SCC 34 is a leading Supreme Court of Canada case on patent rights for biotechnology, between a Canadian canola farmer, Percy Schmeiser, and the agricultural biotechnology company Monsanto. The court heard the question of whether Schmeiser's intentionally growing genetically modified plants constituted "use" of Monsanto's patented genetically modified plant cells. By a 5-4 majority, the court ruled that it did. The case drew worldwide attention and is widely misunderstood to concern what happens when farmers' fields are accidentally contaminated with patented seed. However, by the time the case went to trial, all claims of accidental contamination had been dropped; the court only considered the GM canola in Schmeiser's fields, which Schmeiser had intentionally concentrated and planted. Schmeiser did not put forward any defence of accidental contamination.

[10]SumanSahai, " Farmers Rights and Agricultural security: India's Plant variety protection and Farmers Rights Act 2001: http://www.genecampaign.org

3. Insecticides Act 1968- This is the most important enactment in controlling use of pests in agriculture but it observes silence on the environment effects associated with residual insecticides uptake of chemical by plants.

   Tiwaricommitte- This committe has been appointed to suggest changes in environmental legislation this committe pointed out that the legislators in India are useless they fail to control the use of oregano chlorine pesticides which was prohibited are over the worlds it is proved that it effect the natural resources.
4. Geographical Indication of goods (registration and protection) Act 1999[11]- This Act is to establish the geographical origin of agriculture, natural and traditional goods. This Act recognise the geographical origin of particular crop which helps to get patent right.
5. The International treaty on plant genetic resource for food and agriculture 2001- The objective of the treaty is to conserve and sustainable use of plant genetic resource for food and agriculture and the fair and equitable sharing of benefits arising out of their use in harmony with biodiversity. The treaty recognises 3 rights of farmers.
   a. Protection of traditional knowledge
   b. Rights of farmers to participate in equitable sharing of benefit.
   c. Farmers have a right to participate in decision making at national level.
6. Regarding protection of seeds: From first 5 year plan onwards in India there has been emphasis on seed production and distribution in the second 5 year plan periods when the community development programme was in sharp focus the approach to seed production was highly decentralised one govt has established block level seed forms and national seed corporation was established in 1963.

The progress in the world of plant breeding and seen development until know has largely due to restricted exchange of genetic stock among breeders. Seeds provide the most effective safety net for poor farmers. The modern genetic seeds are created from genetic materials taken from traditional varieties and wild relative & crops. Government of India also enacted major enacts like the seeds Act 1966, the seed policy 2005, and seeds bill 2004.

7. **Cartagena Protocol on Bio-safety 2000-**under these living modified organisms means any living organisms that posse's combination of genetic materials obtained through the use of modern technology. The Cartagena protocol concerned with safe handling use and transfer of technology genetically modified seeds and crops will create heritage resistance seeds. Example –Monarch butterfly in case of *BT* crops the coming of bio-safety protocol will chart a new direction in growth and development of modern BT this protocol deals with in interacted transfer of genetically modified crops. Art 16 of the protocol makes parties to establish appropriate domestic mechanism to regulate manage and control risks associated with LMOs which means legislations. Art 23- of the protocol calls upon the parties to promote and facilitate awareness education and participation of publics reporting safe transfer handle and use of LMOs with regard to bio safety.

[11]William Caenegem, " Registered Geographical Indications: Between intellectual property and rural policy-part I, Journal of world intellectual property volume 6, issue 5 sep (2003)

Genetic resources for food and Agriculture and Intellectual Property Issues-2001:

These biological resources for food and agricultural are the basis for life on earth, food and livelihood security and agro-ecosystem interesting and also they form the main resource for the bio technology and plant breeding industries they are being manipulated utilised and traded in was hitherto unforeseen and it is therefore important for human survival that care is taken in providing a technical, regulatory and legal framework for their conservation and sustainable use that is competent to deal with these new pressures, countries need to be able to exercise their rights in many intergovernmental forums to ensure this happens.

WTO Agreement on Agriculture[12]: The implementation of the agreement on agriculture stated with effect from Jan 1995 as per the provisions of the agreement the developed countries would complete their reduction commitments within 6 years. The products which are included within the purview of this agreement are what are normally considered as part of agriculture except that it includes fishery and forestry products as well as rubber, jute, sisal, abaca and coir.

Salient features-

a. Market access
b. Domestic support
c. Special and differential treatment
d. Export subsides

Intellectual Property Rights in Agriculture[13]**:** With the adoption of the TRIPS Agreement developing countries have been obliged to adopt protection of plant varieties by patents or by patents or by other means, without any serious consideration being given to whether such protection would be beneficial both the producers and consumers or its possible impact on food security and we also need to ask how IP protection affects the cost and access of farmers to the seeds and other inputs they need.

If the aim of plant variety protection is to provide incentives to breeders, one of the questions that arise is how the contribution of farmers to the conservation and development of plant genetic resources should be recognised and preserved[14]. Until formal breeding programmes were introduced, varietal and cultural improvements depended on a process of selection and experimentation by farmers. Formal breeding programmes have since utilised those varieties and knowledge in order to develop improved varieties of higher productivity, or with other desirable characteristics. The question is whether this contribution of farmers to conservation and innovation should be either protected or rewarded. Building on the principles

[12]Article 20 of the Agreement on Agriculture (AoA) (www.wto.org) mandates that negotiations for continuing the reform process in agriculture will be initiated one year before the end of the implementation period. As the implementation period for developed countries culminated at the end of the year 2000, the negotiations on the Agreement on Agriculture have begun in January 2000.

[13]R.D Plowman, ‘ Intellectual property Rights in plants-An ARS (Agricultural Research Services perspective’ Diversity, A News journal for the international plant genetic resources community, vol.9

[14]M AMekouar, ‘ AGlobal instrument on Agro biodiversity: The international treaty on plant genetic Resources for food & Agriculture, www.fao.org/legal/prs-01/IP024.pdf FAO legal paper(2002).

embodied in the Convention on Biological Diversity (CBD), which we discuss in the next chapter, the new International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) seeks to establish principles for facilitating access to plant genetic resources and establishing fair and equitable mechanisms of benefit sharing.

Conclusion: Thus developing countries have possibly 3 options for meeting their obligations to protect plant varieties under TRIPS. They may adopt one or a combination of the following:

a. UPOV style legislation based on the 1978 or 1991 convention(although they may now only join the 1991 convention.
b. Another form of suigeneris system including or not land races.
c. Patents on plant varieties.

Patent protection for biotechnology-related inventions is really in the interest of the majority of developing countries which have little or no capability in this technology. We would therefore recommend that maximum use be made of the possibilities under TRIPS of excluding such inventions from patent protection even where TRIPS requires patent protection to be available for ex. In respect of micro organisms, there is still scope for developing countries to restrict the scope of protection.In particular, in the absence of any universally recognised definition of what constitutes a 'microorganisms developing countries remain free to adopt a credible definition that limits the range of material covered[15]

Developing countries should generally not provide patent protection for plants and animals as is allowed under article 27.3(b) of TRIPS because of the restrictions patents may place on use of seed by farmers and researchers rather they should consider different forms of suigeneris systems for plant varieties.

The continuing review of Art 27.3(b) of TRIPS should also preserve the right of countries not to grant patents for plants and animals including genes and genetically modified plants and animals as well as to develop suigeneris regimes for the protection of plant varieties that suit their agricultural systems such regimes should permit access to the protected varieties for further research & breeding and provide at least for the right of farmers to save and plant back seed including the possibility of informal sale and exchangeAt present there appears to be little evidence that providingthe modern Bt is completely dependent on existence of biodiversity the genes required for modification are derived from wild plant and animals without them the LMOs and GMOs can't be obtained though there is no specific legislation for protection of genes in agriculture. Sustainable agriculture and protection of genetic resources are inter-related despite the presence of diverse indigenous resettles going for an exotic species which is not suitable as well as harmful to the ecosystem is a bad step though modern agricultural system is characterised by

[15]Genes are not micro organisms and neither, under a narrow definition, are cell lines although for example the UK Patent law considers the latter to be micro organisms see UK patent office manual of patent practice section 1.40 see also Adcock M & Llewellyn M (2000) microorganisms definitions & options under TRIPS , occasional paper 2 QUNO, Geneva

high yield in the long-term. The long incurred over does the income thus encouragement to the traditional farming methods with slight modification to suit the present condition is required[16].

Conclusion: In All 21 explorations were undertaken and 1532 germplasm accessions were collected comprising 1095 of cultivated plants and 437 wild accessions. The population of momordica cochinchinensis collected from the middle Andaman Island was described as a new subspecies andamanica which was subsequently validated through DNA barcoding.During 2017, 411 herbarium specimens were added to the National Herbarium of cultivated plants. Out of 28516 accessions imported from 39 countries 2911 were screened against biotic and 787 against abiotic stresses and 7343 were supplied for research use and crop improvement programme within the Country[17].

References:

1. Pardey, P. &Beintema, M. (2001) "Slow Magic: Agricultural R&D a Century after Mendel" International Food Policy Research Institute, Washington DC, p. 10. Source: http://www.ifpri.cgiar.org/pubs/fps/fps36.pdf. Note that these figures are based on purchasing power parity exchange rates which the authors consider a more accurate reflection of relative magnitudes. In ordinary $ terms, the developed country share is considerably higher (69% rather than 44%, see p.5).
2. Pardey, P. &Beintema, M. (2001), p.4 10 for data on health-related R&D, see Commission on Macroeconomics and Health (2001) "Macroeconomics and Health: Investing in Health for Economic Development", WHO, Geneva, footnote 103, p.124.
3. Shoemaker, R. et al (2001) "Economic Issues in Biotechnology", ERS Agriculture Information Bulletin No. 762, USDA, Washington DC, p. 36.
4. Alston, J. &Venner, R. (2000) "The Effects of the US Plant Variety Protection Act on Wheat Genetic Improvement", EPTD Discussion Paper No. 62, International Food Policy Research Institute, Washington DC. Source: http://www.grain.org/docs/eptdp62.pdf
5. Van Wijk, J. & Jaffe, W. (1995) "Impact of Plant Breeders Rights in Developing Countries" Inter-American Institute for Cooperation on Agriculture, San Jose, and University of Amsterdam.
6. Rangnekar, D. (2002) "Access to Genetic Resources, Gene-based Inventions and Agriculture", Commission on Intellectual Property Rights Background Paper, 3a, Commission on Intellectual Property Rights, London, p.39. Source: http://www.iprcommission.org
7. Louwaars, N. &Marrewijk, G. (1996), "Seed Supply Systems in Developing Countries", Technical Centre for Agricultural and Rural Cooperation, Wageningen Agricultural University, Wageningen, p. 99.
8. UPOV 1978. Source: http://www.upov.int/eng/convntns/1978/pdf/act1978.pdf. UPOV 1991. Source: http://www.upov.int/eng/convntns/1991/pdf/act1991.PDF.
9. IPGRI has produced a useful document which discusses the issues developing countries should consider in adopting sui generis regimes. IPGRI (1999) "Key Questions for Decisionmakers: Protection of Plant

[16]The Cartagena Protocol on Biosafety (CPB), the first international regulatory framework for safe transfer, handling and use of Living Modified Organisms (LMOs) was negotiated under the aegis of the Convention on Biological Diversity (CBD). The protocol was adopted on 29th January 2000.

[17] India 2019 – A reference Manual published by Publication Division, Ministry of Information & Broadcasting.

Varieties under the WTO TRIPS Agreement", IPGRI, Rome. Source: http://www.ipgri.cgiar.org/publications/pubsurvey.asp?id_publication=41. A more detailed review we have drawn on here is Leskien, D. &Flitner, M. (1997) "Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System", Issues in Genetic Resources.

10. "African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources", Organisation of African Unity, 2000, Article 26. Source: http://www.grain.org/publications/oau-model-law-en.cfm
11. "Protection of Plant Varieties and Farmer's Rights Act", Government of India, 2000. Source: http://www.grain.org/brl/pvp-brl-en.cfm
12. This idea comes from Leskien and Flitner (1997). 25 Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the legal protection of biotechnological inventions, Official Journal L 213, 30 July 1998, pp.13-21, (Articles 11 and 12). Source: http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod! See Directive 98/44EC, Article 9 (and also Article 8). 27 Barton, J. & Berger, P. (2001) "Patenting Agriculture", Issues in Science and Technology, Summer 2001, p.4. Source: www.nap.edu/issues/17.4/p_barton.htm
13. The potential benefits and risks of GM crops for developing countries are discussed in Nuffield Council on Bioethics (1999) "Genetically Modified Crops: The Ethical and Social Issues" Nuffield Council on Bioethics, London, Chapter 4. Source: http://www.nuffieldbioethics.org/filelibrary/pdf/gmcrop.pdf
14. Source: http://www.syngenta.com/en/media/printer.asp?article_id=234
15. The big six companies were normally regarded as AstraZeneca, Aventis, Dow, DuPont, Monsanto, and Novartis, which became five in 2000 with merger of the agricultural arms of Novartis and AstraZeneca.
16. De Janvry, A., Graff, G., Sadoulet, E. &Zilberman, D. (2000) "Technological Change in Agriculture and Poverty Reduction" University of California, Berkeley. Concept paper for WDR on Poverty and Development 2000/2001, pp.6-7. Source: http://www.worldbank.org/poverty/wdrpoverty/background/dejanvry.pdf
17. Wilkinson, J. &Castelli, P. (2000) "The Internationalisation of Brazil's Seed Industry: Biotechnology, Patents and Biodiversity", ActionAid Brazil, Rio de Janeiro, p.49. Source: http://www.actionaid.org.br/e/pdf/seed.pdf
18. Byerlee, D. & Fischer, K. (2001) "Accessing Modern Science: Policy and Options for Agricultural Biotechnology in Developing Countries", IP Strategy Today, No. 1, p.2. Source: http://www.biodevelopments.org/ip/ipst1hr.pdf
19. Shoemaker, R. et al (2001), p.37. 40 Genes are not microorganisms and neither, under a narrow definition, are cell lines although, for example, the UK Patent Law considers the latter to be microorganisms. See UK Patent Office Manual of Patent Practice Section 1.40. See also, Adcock, M. &Llewelyn, M. (2000) "Microorganisms, Definitions and Options under TRIPS", Occasional Paper 2, QUNO, Geneva.
20. IUPGRResolution5/89.Source: http://www.mtnforum.org/resources/library/iupgr91a.htm 43 IUPGR Resolution 4/89 44 Text of the ITPGR. Source: http://www.fao.org/ag/cgrfa/IU.htm 45 ITPGRFA Article 18.5 46 ITPGRFA Article 12.3