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Plant Variety Protection and Food Security: Lessons for Developing Countries

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One of the requirements of TRIPS Article 27.3(b) is that plant varieties should be protected either by patents or by an effective *sui generis* system or some combination thereof. The moot question is how plant variety protection could help ensure food security in developing countries? Research evidences from developed countries indicate differential impacts of plant breeders' rights across crops. Increasing role of private sector in plant breeding was accompanied by appropriation strategies, and high level of market consolidation in seed industry resulted in higher seed prices. Though, rate of varietal release was increased but new varieties had a shorter life span. In case of developing countries, plant breeders' rights facilitated access to improved foreign variety, in certain cases, but this contributed little to food security. Therefore, developing countries need to learn from such experiences and structure their PVP legislations in such a way which ensures food security and sustainable use of biodiversity. This could be achieved by strengthening public R&D support to agricultural research, maintaining crop genetic diversity, and developing localized seed production and delivery systems through efficient institutional mechanisms. This would go a long way towards conservation and sustainable utilization of plant genetic resources and ensuring food security at local, regional and national level. This paper contributes towards informed policy decisions to deal effectively with the possible implications of Plant Variety Protection (PVP) legislations on agriculture, particularly, on food security. At this juncture, it is difficult to quantify the magnitude of long-term impacts of PVP legislations because of lack of clear empirical evidences particularly from developing countries. However, lessons may be learnt from the working of PVP legislations in developed countries as well as from emerging evidences in developing countries. The paper draws from earlier findings to synthesize the plant variety protection implications for developing countries with particular reference to India, and outline suitable policy options.

Keywords: TRIPS, Plant Variety Protection (PVP), *sui generis* system, plant breeders' rights (PBRs)

At the time of signing of WTO agreement, intellectual property rights (IPR), particularly, laws for plant variety protection in developing countries were nil or relatively under-developed compared to developed countries whose laws were already mostly in conformity with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).[1] The TRIPS Agreement, which is of greater significance for most developing countries, implies important changes in intellectual property laws of member countries relating to, among others, protection of plant varieties. Specifically, TRIPS Article 27.3(b) has wider implications for plant variety protection and food security. The Article states that parties may also exclude from patentability:

> 'plants and animals other than microorganisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes However, members shall provide for the protection of plants varieties either by patents or an effective *sui generis* system or by any combination thereof. This provision shall be reviewed four years after the entry into force of this Agreement.'

One of the direct implications of Article 27.3(b) is that member states have to provide protection for plant varieties either by patents or by *sui generis* system or a combination of both. Here, the term *sui generis* (of its own kind) is subject to both narrow and broad interpretations. Therefore, the option of *sui generis* under the TRIPS Agreement provides sufficient flexibility for countries to design a system that best fits their circumstances and meets their goals and objectives.

The basic premise behind granting legal protection to plant varieties is to encourage commercial plant breeders to invest in R&D for breeding new plant varieties and improving the existing plant varieties. Thus, IPR for plant varieties provide some assurance to breeders that they would be able to recoup the risk and cost of a value-added innovation, which is based

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upon an underlying biological resource.[2] Many developing countries have opted for a *sui generis* system of protection for plant varieties to comply with the requirements of TRIPS Article 27.3(b). Though, it is difficult to find a direct causal relationship between plant variety protection and overall agricultural development, empirical studies on the economic impacts of plant variety protection (PVP) –especially its ability to generate large private sector investment in plant breeding and facilitate the transfer of technology – have been very limited.[3] Few empirical evidences indicate that increased degree of IPR protection leads to increased profit for the dominant plant breeding company but decreases in varietal quality and both farm and overall profits.[4] Notwithstanding the pros and cons of IPRs, the emerging trends point to an increased importance of intellectual property in the future.[5]

Recent Developments

Several national and international developments concerning protection and utilization of plant genetic resources (PGR) have taken place recently owing to changing global policy environment. The attempts by India and African countries for protecting their plant genetic resources are unique. While, the Indian PVP legislation concurrently provides for farmers' rights and plant breeders' rights, Model Law evolved by the Organization of African Unity (OAU) – renamed as African Union w.e.f. 9th July 2002 – provides a basis for individual African countries to prepare their PVP legislations on the basis of four major cornerstones of sustainable PGR use, viz., access to biological resources, community rights, farmers' rights and plant breeders' rights. This paper specifically deals with Indian legislation concerning plant variety protection and farmers' rights and charts out a strategy for sustainable utilization of PGR for food security.

Indian Legislation on Plant Variety Protection

India has opted for a *sui generis* system of protecting plant varieties to comply with TRIPS Article 27.3(b) by enacting the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001. The main aims of the Act are to: a) recognize and protect farmers' rights in respect of the contribution made by them at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties, b) protect rights of the plant breeders to stimulate investment for R&D for plant breeding in public/private sector, and c) facilitate the growth of seed industry which will ensure the availability of high quality seeds and planting material to the farmers. The Act provides protection of plant varieties, rights of the farmers and breeders and aims to encourage development of new varieties of plants. Although, this multiple rights system aims to equitably distribute rights, it could pose problems of overlapping claims and result in complicated bargaining requirements for utilization of varieties leading to underutilization of resources.[6] This Act has many unique features. It strikes a balance between the rights of farmers and plant breeders by rewarding the farmers and local communities from the pool of National Gene Fund for their conservation and development efforts and, at the same time, ensuring reward for innovation by granting plant breeders' rights. The provisions for compulsory licensing and non-registration of varieties which affect public order and morality, and are injurious to human, animal, plant life and health are meant to protect public interests. For example, the Act should not allow registration of a variety containing animal genes (say of cow and pig), as it may hurt the sentiments of some communities.

The provision on farmers' rights is one of the unique features of the Act. The Act provides that a farmer would have the rights 'to save, use, sow, resow, exchange, share or sell his farm produce including seed of a protected variety under this Act in the same manner as he was entitled before coming into force of this Act'[(39.1(iv)]. The only restriction, which applies to farmer's rights, is that the farmer shall not be entitled to sell branded seed of a variety registered under this Act. The Act prohibits registration of any variety having genetic use restriction technology (GURT) to ensure that modern breeding techniques (like biotechnology) are not misused. However, while implementing the legislation, a pragmatic approach for dealing with all the stakeholders need to be adopted.

First, the well-intended provisions on benefit sharing need to be spelt out clearly. For example, depending on the extent of genetic material used, the PPV&FR Authority should specify in the beginning itself – not after issuing the certificate of registration as provided in the Act – the proportion of benefits the breeder has to share with the public. This will help remove uncertainty in the minds of private seed companies so that they can precisely earmark their

R&D portfolio for the development of new plant varieties. A transparent process of benefit sharing that recognizes farmers' or indigenous rights alongside patents and plant breeders' rights will go a long way towards providing a mutually favourable platform to all the stakeholders. Second, the provision related to expected performance under given conditions of any propagating material of a registered variety needs to be simplified. For example, if the variety or the propagating material does not perform as expected, the farmer has to approach the Authority which shall decide about the amount of compensation. It is very complex issue and, as such, unfair to the farmers. The farmer, under such circumstances, should be given a certain proportion of expected output value per unit of land as compensation. Third, the Act opens a separate route for registration of essentially derived varieties (EDVs). The Authority will grant the certificate of registration for EDVs. In fact, EDVs are similar to the initial variety except the act of derivation. Accordingly, many transgenic crops fall under this category. Instead of providing them separate channel for registration, these varieties also should pass through the same route with effective measures for their environmental impact assessment before they reach the farmers' fields. The Authority which is in place has since finalized the DUS (distinctness, uniformity and stability) test guidelines in February 2007 initially for 12 identified crops, viz., rice, wheat, maize, pearl millet, sorghum, pigeon pea, chickpea, lentil, green gram, black gram, peas and French bean. Now applications can be filed for any of these 12 crops for getting protection under the Act. Development of DUS test guidelines for other crops is under progress.

International Treaty on Plant Genetic Resources for Food and Agriculture

The objectives of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA; hereinafter referred as Treaty) are the conservation and sustainable use of plant genetic resources for food and agriculture and fair and equitable sharing of the benefits arising out of their use. It entered into force on 29 June 2004, and has 102 parties (countries) who have ratified the Treaty on 11 May 2006. The core of the Treaty is a Multilateral System for the facilitation of access and benefit sharing pertaining to 35 major food crops and 29 forage plants (Table 1). Article 12.3(d) of the Treaty has direct bearing on the access and use of plant genetic resources. It states that:

> 'recipients shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received from the Multilateral System'.

Table 1—List of crops covered under the Multilateral System (as contained in Annex I of the Treaty)

Food Crops		Forages		
		Legumes	Grasses	Others
Apple	Lentil	Astragalus	Andropogon	Atriplex
Asparagus	Maize	Canavalia	Agropyron	Salsola
Banana/plantain	Major aroids	Coronilla	Agrostis	
Barley	Oat	Hedysarium	Alopecurus	
Beans	Rice	Lathyrus	Arrenatherum	
Beet	Pea	Lespedeza	Dactylis	
Brassica complex	Pearl millet	Lotus	Festuca	
Breadfruit	Pigeon pea	Lupinus	Lolium	
Carrot	Potato	Medicago	Phalaris	
Cassava	Rye	Melilotus	Phleum	
Chickpea	Sorghum	Onobrychis	Poa	
Citrus	Strawberry	Ornithopus	Tripsacum	
Coconut	Sunflower	Prosopis		
Cowpea	Sweet potato	Pueraria		
Eggplant	Triticale	Trifolium		
Faba bean/vetch	Wheat			
Finger millet	Yam			
Grass pea				

Source: ftp://ftp.fao.org/ag/cgrfa/it/ITPGRe.pdf (31 May 2007)

It is obvious that Article 12.3(d) lacks clarity and is open to different interpretations by various stakeholders. Because of this ambiguity, some developing countries have refused to include in the Multilateral System their most valuable crops, such as, soybean (China), groundnut (Latin America), and tropical forage grasses (Africa).

This legally bound Treaty assures member states a 'facilitated access' to these 64 crops/group of crops through a Multilateral System which will be governed by the Governing Body (GB). The GB of the Treaty comprises countries that have ratified it, will exercise control over about 6,50,000 accessions of the crops covered under the Treaty (for details, see www.cgiar.org/impact.genebanksdatabases.html). These accessions are held in-trust for the world community by the Consultative Group on International Agricultural Research (CGIAR). On 16 October 2006, eleven CGIAR centres, which hold *ex situ* collection of crops covered under the Treaty, signed an agreement with the GB placing these collections within the purview of the Treaty. In exchange for access to this common seed pool, those who develop commercial products based on plant genetic resources received from the Multilateral System would pay a percentage of their profits into a fund to be administered by the GB. This fund shall be used for exchange of information, access to and transfer of technology, capacity building, and taking into account the priority activity areas under the guidance of the GB. Thus, the GB will have a crucial role in addressing the apprehensions of the member countries and ensuring equitable sharing of benefits from PGR use.

In its first session, during 12-16 June 2006 (Madrid, Spain), the GB of the Treaty worked out a formal mechanism to facilitate access and benefit sharing of genetic resources. For this, a Standard Material Transfer Agreement (SMTA) was adopted by parties to the Treaty as a guide for legal contracts to facilitate access and standardize benefit-sharing requirements for the 35 different crops covered by the Multilateral System established by the Treaty. Under the transfer agreement, companies who sell patented seeds from Treaty material are required to pay 1.1% of their revenue to the providers of genetic resources. The SMTA also recognize Food and Agriculture Organization (FAO) as the third party beneficiary. The GB also adopted the rules of procedure, including decision making by consensus, financial rules, funding strategy, a model agreement with the International Agricultural Research Centres of the CGIAR and other international institutions. In the midst of this multifaceted progress, it was realized that one of the key remaining challenges is to raise the visibility and political profile of the Treaty, as well as the parties' understanding its technical and legal implications. It was highlighted that the governments need to promote the standard MTA as a key tool for benefit-sharing, and to persuade those private sectors holding *ex-situ* collections of crops to join the Multilateral System, as well as build capacity of all parties' negotiators to fully understand the consequences of the MTA implementation. Therefore, long-term impact of the implementation of the Treaty on the access and use of plant genetic resources is yet to be seen.

TRIPS-plus Agreements

More recently, there has been a trend for developed countries to seek commitments on IP standards from an increasing number of developing countries in bilateral and regional trade and investment agreements that go beyond TRIPS.[7] This is being achieved not only through global treaties but also regional and bilateral trade and investment agreements between developed and developing countries. A close perusal of salient features of few bilateral agreements clearly establishes that these agreements seek protection standards higher than that required under TRIPS. Higher emphasis on plant variety protection indicate that the *sui generis* option available under TRIPS is gradually being reduced to UPOV-type legislation by the developed countries in their attempt to harmonize the IP laws worldwide (Table 2). This has major implications for sustaining agriculture growth, ensuring food security and farmers' rights under TRIPS-plus standards of IP protection which may ultimately lead to full-fledged patents on all forms of life if developing countries fail to take full advantage of the flexibility in designing their *sui generis* legislations for plant variety protection.

Impact of Plant Variety Protection – Some Evidences

Theoretically speaking, the impact of PVP regime would vary depending on the specific plant characteristics, institutional structures and stage of agricultural development. For example, countries whose economy is mainly dependent on traditional

Table 2—TRIPS-plus Agreements

Agreement	Year	Features
European Free Trade Association (EFTA)–Egypt Free Trade Agreement (FTA)	2007	Egypt is obliged to join UPOV (1978 or 1991 Act) and accede to the Budapest Treaty by 2011. Also, patents must be provided in 'all fields of technology' ('at least' those covered under the TRIPS Agreement).
Japan-Malaysia FTA	2005	Malaysia must recognize the importance of protecting new plant varieties in a manner consistent with internationally harmonized system. For this purpose, Malaysia has to ensure that rights relating to new plant varieties are adequately protected.
EFTA-Korea FTA	2005	Korea is obliged to patent plants and animals.
EFTA-Tunisia FTA	2004	Tunisia must join UPOV (1978 or 1991 Act) and accede to the Budapest Treaty by 2010. Tunisia will also do its utmost to accede to all IPR treaties to which EFTA states are party.
EU-Syria FTA	2004	Syria shall follow the 'highest international standards' including, not limited to, the TRIPS Agreement. Syria shall also accede to the Budapest Treaty and the UPOV Convention (1991) within 5 years. However, Syria may opt for an 'adequate and effective' system. for protection of plant varieties in place accession to UPOV.
EFTA-Lebanon FTA	2004	Lebanon must join UPOV (1978 or 1991 Act) and accede to the Budapest Treaty by 2008.
USA-Singapore FTA	2003	Under the terms of treaty, Singapore agrees to provide patents on all forms of plants and animals (each Party may exclude inventions from patentability only as defined in Articles 27.2 and 27.3(a) of the TRIPS Agreement). GM plants and animals would also get patent protection and the country has to join the UPOV. (This is America's first free trade agreement in Asia).
US-Jordan FTA	2000	Each party must give effect to UPOV (1991) Convention. Parties may not exclude plants and animals from patent protection and must provide patent term extension to compensate for unreasonable regulatory approval delay.
US-Vietnam Agreement on Trade Relations	2000	Parties may not exclude from patent protection inventions that encompass more than one variety of animal or plant.

Source: www.ustr.gov; www.grain.org (26 May 2007)

agriculture dominated by subsistence farmers will have less to gain from introduction of strong PVP.[8] Therefore, PVP legislation should give due attention to national interests such as those of farmers and local communities as well as the seed sector and emerging use of cutting-edge technologies (e.g., biotechnology). Some empirical evidences recognize the significance of IPRs as incentives for spurring innovation.[9] On the other hand, studies have found that patent protection given to an innovator may be too little, too much or of the wrong kind because of the diverse real world complications.[10] In the light of the above, the following section presents highlights of the empirical evidences of impacts of plant breeders' rights (PBRs) as provided under PVP legislations both in developed and developing countries.

Impact of PBRs in Developed Countries

Most of the evidences on working of PBRs and their impact have emerged from United States of America (USA) and the United Kingdom (UK). To capture the impact of PBRs, researchers studied three variables: (i) R&D expenditures; (ii) new varieties released; and (iii) market concentration.

Modest and uneven (crop-wise) impact of PBRs was found on the R&D expenditures. Only few crops (wheat and soybean) experienced increases in private investment. But no clear indication was found that the increase in R&D expenditures was entirely on account of the availability of PBRs. Results on market concentration revealed that top five PBRs holders in UK, accounted for 69% of the grants during 1965-74 which increased to 79% in 1986-95.[11] Though, there were more number of varieties released annually (in case of USA and UK) under PBRs regime, but these varieties were not economically good. In fact, instances of cosmetic breeding (for example, breeding of nominally differentiated varieties that are otherwise identical) and planned obsolescence were found under the PBRs regime.[12] Though, new and contemporary varieties are productive, but there are no convincing results that higher productivity is on account of the 'breeding effort' alone and not due to adoption of wider input packages (modern input and agronomic practices) used for growing these varieties.

Data on the North American seed market revealed that in case of hybrid corn and soybean, top five

companies account for 69% and 51% share, respectively.[13] In case of cottonseed, Monsanto alone controls 84% of the market on account of its purchase of Delta and Pine Land. Further, concentration in seed industry has reduced biotech research intensity in the United States in the 1990s.[14] Similarly, PVP Act of United States did not lead to any increase in experimental or commercial wheat yields. However, the share of US wheat acreage sown to private varieties has increased from 3% in 1970 to 30% in the 1990s, implying that PVP Act served primarily as a marketing tool with little impact on excludability or appropriability.[15] However, recent work found supporting evidence to the hypothesis that PVP has contributed to the genetic improvement of soft white winter wheat in Washington State.[16]

This indicates that PBRs have differential impacts across crops. Moreover, the increasing importance of private sector in plant breeding is accompanied by appropriation strategies that might have deleterious distributional and allocative impact. For example, increase in the varietal release rate is accompanied by a shortening life span of varieties. The evidences also suggest that high level of market consolidation has developed in the seed industry and this market power has been used not only to control seed prices but also resulted in decrease in biotech research intensity.

Impact of PVP in Developing Countries

A wide variety of commentators accept that there is 'little evidence'[17] or 'mixed and inconclusive evidence'[18] about the direct benefits of introducing IPR in plant varieties in developing countries. A case study in five countries (China, Colombia, India, Kenya and Uganda) noted that there is relatively little empirical evidence on performance of PVP protection in the developing countries.[19] Few researchers, however, are of the opinion that if least-developed countries do not experiment with strengthened IPR as a means of bringing more private innovative activity in the effort to capitalize on new technology, the productivity gap will surely widen.[20] Consequently, a detailed empirical analysis of the effects of adopting PBRs would be useful for making informed choices in policy formulation and implementation. This section presents available evidences of impact of PBRs in developing countries on the basis of three criteria; research focus, access to varieties, and impact on public sector plant breeding.

Research Focus

One of the early studies on the impact of PBRs analysed evidences from five Latin American countries.[21] It concluded that *de facto* division of labour has evolved with multinational corporations (MNCs) predominantly focusing on hybrid crops and the public sector (and domestic breeding companies) almost entirely focusing on open-pollinated varieties. Even in the absence of IPR, liberal seed regulations and economic reforms had a positive impact on the growth of seed industry in India.[22] While the interest of private sector was in hybrids and commercial seed market, public sector focused on the requirements of small-scale farmers in vulnerable areas. Given the performance of the Indian seed industry in the past, it would be difficult to predict significant changes in the seed industry because of the strengthened IPR regime, as macroeconomic and R&D policies will continue to determine industry growth in the years to come.[23] Thus, PVP alone is a relatively weak form of IPR protection, which allows plant breeders to appropriate only limited returns from their innovations.[24] However, implementation of new regulations for seed and plant variety protection has changed the structure of seed industry and provided an important incentive to invest in PVPs both by public research institutes and commercial firms in China.[25]

Access to Varieties

One of the arguments for granting PVP in developing countries is that it will enable access to improved foreign varieties, e.g. Monsanto refused access to BT-cotton in Brazil, despite extensive crop losses from infestation because of absence of proprietary protection.[26] Therefore, it is claimed that absence of PVP is a restriction on access to germplasm. In this context, cut flower industry of Kenya makes an interesting reading. The entire cut flower industry in Kenya is export driven, 90% of the over 40 types of flowers are exported to mainly European countries. The industry is dominated by the MNCs and much of the profit leaks out *via* foreign-owned MNCs. Though, Kenya joined UPOV in 1999 with a ratification of 1978 Act, it had a statue on the books in 1972. Interestingly so far, only one PVP has been granted for a 'food crop', French beans, for export. The rest were all for ornamentals. Further, over 90% of the grants were made to foreign nationals. Thus, the availability of PBRs did little to generate incentives for plant breeders (domestic or foreign) to develop food crops.[27]

Impact on Public Sector Plant Breeding

The most debatable point under the strengthened PVP regime is the role of public plant breeding sector. The PVP regime is expected to adversely affect the freedom to conduct agricultural research under strengthened IPR. On a positive note, shrinking resource base of public sector and fewer options for internal revenue generation may necessitate institutional linkages between public and private sector provided the issues of accountability and transparency are addressed to the satisfaction of both. Initial effects of IPR on the plant breeding sector make it clear that the ease of implementing PVP seems to have been overestimated, and opportunities to minimize the transaction costs of acquiring and enforcing rights are being missed.[28] Appropriate policy actions can deal effectively with emerging IPR in plant varieties, and reap possible revenue generating opportunities for public plant breeding programme. For example, in response to prompt policy action in China, public organizations were able to protect a large number of varieties in a short period of time and generated revenue by commercializing them.[29]

Lessons for Developing Countries

With the adoption of TRIPS Agreement, developing countries have been obliged to adopt protection of plant varieties either by patents or by an effective *sui generis* system or a combination of both. Unfortunately, there are only a few empirical evidences on the possible impact of PVP protection on producers, consumers and food security in developing countries. Partly, it may be attributed to the fact that most developing countries have enacted PVP legislations only recently and it would be too early to quantify the impact of PVP on various stakeholders. Meanwhile, we may draw lessons from evidences on impact of PVP in developed countries and experiences of developing countries in implementation of PVP legislations. In the light of these, focus should be on the following:

Crop Genetic Diversity

Plant genetic diversity is vital for the breeding of food crops and thus one of the central preconditions for food security. One important feature of subsistence farming is that the traditional varieties grown by subsistence farmers contain a lot of genetic diversity. It is the foundation upon which plant breeding depends for the creation of new varieties and is, therefore, a critical aspect of food security. At the global level, only 30 crops provide over 95% of dietary energy with wheat, rice and corn alone accounting for more than one-half. But there are many plant species with greater importance to vast population at regional level, i.e., staple crops such as, yam, proso millet, fonio, groundnut, oca, taro/cocoyam and breadfruit, and many vegetable and fruit species which include a wide variety of 'wild plants' and weeds that are gathered by people and contribute to nutrition and dietary diversification.[30] Regulating access and use of such a wide gene pool is going to be one of the major challenges for developing countries, as FAO Treaty is mandated to deal with 64 crops only.

Local Seed System Development

In traditional seed system, farmers continuously search for new planting material from neighbours, next village, and the next valley or through more distant trading routes. Studies have shown that local seed systems do have many valuable characteristics, which have provided seed security to farmers over time. These systems are innovative and acquire materials and adapt technologies as they appear.[31] Formal sector supply of seeds to marginal areas will always have many problems. Since resource limitations will continue, public seed supply should be designed to take advantage of local seed system for producing and distributing seed. This will help in on-farm seed production, supply and resource conservation. Efforts should be made to train farmers in saving seed on-farm, assistance in development of low-cost seed stores and local gene bank technology. These changes necessitate significant changes in policy makers' perspectives.

Focus of Public Sector Plant Breeding

Plant breeding activities in the public sector should be driven by strategies and techniques that broaden the genetic base of the material farmers receive. For example, more emphasis should be given for breeding of public germplasm for specific adaptation, building multiple traits in plants instead of relying on simple single-gene trait and participatory plant breeding and varietal selection. Farming systems in developing countries are characterized by diverse environments. In case of marginal environments, private sector has little incentives to invest and cater to the requirements of marginal and poor farmers in these areas. Therefore, the public sector research should continue

its focus on crops for these areas, thereby investing more in public sector plant breeding programmes for developing crop varieties which perform best under adverse environmental conditions and meet the requirements of farmers in marginal areas.

Institutional Set Up

One of the priorities of the developing countries should be to put in place efficient institutional mechanism for distribution of quality seeds. Access to reliable information on modern technology (varieties/hybrids) and development of a decentralised seed distribution network are going to play a major role in the performance of agriculture under new IPR regime. Economic viability and social acceptability should be the main criteria for promoting new technologies instead of policy supports (like price support, input subsidies, etc.), which are unsustainable in the long run. Appropriate and effective institutions would also have a major role in complying with international obligations for protecting plant genetic resources.

Conclusion

The TRIPS Article 27.3(b) has wider implications for use of plant genetic resources and food security, particularly, for agriculturally-based developing economies. India has responded to TRIPS requirements by enacting a *sui generis* legislation (PPV&FR Act, 2001), which aims to provide protection for plant varieties, rights to the farmers and breeders and incentives for development of new varieties of plants. While it is too early to assess the impact of the implementation of PPV&FR Act, we should draw upon similar experiences of other countries to deal with the implications of plant variety protection. Experiences of developed countries show that PBRs had differential impact across crops. The evidences also found that there was high level of market consolidation in the seed industry and this market power was used for realizing higher seed prices. Preliminary evidence of working of PBRs in developing countries indicate that while private sector entirely focus on hybrid crops, public sector research is more oriented towards open-pollinated crops. In some cases, PBRs did facilitate access to improved foreign variety but contributed little to food security. Therefore, there is a need to provide further support to public agricultural research to take care of the requirements of farmers in the marginal environments. Moreover, developing countries should put collective efforts for sustainable use of their plan genetic resources and ensuring food security for their farming population in disadvantaged regions. These efforts should focus on more support to public plant breeding, efficient institutional mechanism for localized seed delivery, proper input use policies and other regulatory framework to ensure that PGR are used in a manner that gives adequate incentives to farmers, proper rewards for innovative efforts and ensure food security for rapidly growing population in developing countries.

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