

## Intellectual property rights protection for plant varieties in India: status, emerging issues, and challenges

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**Abstract** Under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO), India recently adopted the *sui generis system* of intellectual property rights (IPR) protection to plant varieties. The creation and provision of IPR for plant varieties in the seed sector at the global and national levels has led to several challenges: an interplay of IPR and competition, overlapping IPRs, and an interplay of IPR and other regulations. India can draw some insights from global initiatives in providing IPR protection to plant varieties.

**Keywords** Plant variety protection (PVP), intellectual property rights (IPR), farmers' rights, initiatives, new plant breeding techniques, seed, access

**JEL classification** O31, O34

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO) mandates that member countries provide plant varieties intellectual property rights (IPR) protection through patents, or an effective *sui generis* system, or a combination of both. Varietal development is a cumulative or sequential process; therefore, IPR protection for crop varieties has important implications for varietal development research. The protection of plant varieties through IPR affects the price of seeds, the exercise of farmers' rights (as consumers of seed, as breeders, and as conservators of biological resources) and, thereby, global food security. This study examines the status of IPR protection to plant varieties in India. It also traces the emerging issues and challenges in the seed sector due to the provision of IPR protection to plant varieties.

### Intellectual property rights (IPR) protection for plant varieties in India

India enacted the Protection of Plant Varieties and Farmers' Rights Act (PPVFR Act) in 2001 to fulfil its

obligation under the TRIPS. India constituted the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA) for registering plant varieties and providing protection through IPR. In 2007, the PPVFRA started receiving applications; by the end of October 2018, it had notified 156 crop species for protection.

Under the PPVFR Act, plant varieties can be registered under four categories: extant variety, new variety, farmer's variety (a subset of extant variety) and Essentially Derived Variety (EDV). Two types of extant variety are eligible for registration: extant varieties notified under the Seeds Act, 1966, and extant varieties about which there is common knowledge (Varieties of Common Knowledge (VCK)). Transgenic plant varieties are also eligible for protection under the PPVFR Act, subject to environmental safety clearance from the Genetic Engineering Appraisal Committee.

Private seed companies, public sector research organizations, and farmers are applying for registration. As on 12 January 2018, the PPVFRA had received

**Table 1 Status of PVP applications received by PPVFRA (12 January 2018) and PVP certificates issued (31 December 2017)**

	Farmer	Individual breeder	Private	Public	Total
Total number of applications	10,356	2	3,593	1,839	15,790
Share of different category applicants in total applications (%)	66	0	23	12	100
Number of crops	98	1	40	78	107
Number of crops in which the category of applicant is major player	74 (69)		12 (11)	21 (20)	
Overall portfolio diversification (Herfindahl index)	0.290	1.000	0.127	0.068	0.173
Rank	Top five crops in number of PVP applications				
1	Rice (53)	Tetraploid cotton (100)	Tetraploid cotton (27)	Rice (19)	Rice (40)
2	Maize (4)		Maize (13)	Wheat (9)	Tetraploid cotton (7)
3	Pigeon pea (3)		Rice (12)	Maize (8)	Maize (7)
4	Mango (3)		Pearl millet (7)	Sorghum (6)	Brinjal (3)
5	Black gram (2)		Tomato (7)	Tetraploid cotton (5)	Pearl millet (2)
Share of top five crops in total PVP applications (%)	65	100	66	47	59
Total number of PVPs registered	1,277		685	1,081	3,043
Share of PVPs registered in total applications	12	0	19	59	19
Number of crops with respect to which PVPs were registered	11	1	23	47	49
Overall PVP certificates diversification(Herfindahl index)	0.934	1	0.147	0.071	0.270

Source Computed from PPVFRA data

Note Figures in parentheses indicate percentages

15,790 applications seeking plant variety protection (PVP) with respect to 107 crop species; farmers made 66% of these applications, private seed companies 23%, and the public sector made the rest (Table 1). The Herfindahl index was used to measure the overall diversification in the PVP application portfolio; the overall diversification was highest in the case of the public sector, followed by the private sector.

The share of rice varieties was 12% in the private sector applications portfolio, (ranking third), 19% in the case of the public sector (ranking first), and 53% in the case of farmers' varieties (ranking first). This indicates that in the crop research portfolio of the private sector, rice is of less importance than crops like tetraploid cotton and maize. Rice and maize were the common crops among the top five crops (in terms of PVP applications) across different categories of owners.

The PPVFRA began issuing PVP certificates in 2009; by the end of 2017, it had registered 3,043 plant varieties (Table 1). The PVP registration certificates were issued for 11 crops in the case of farmers, 23 crops in the case of private industry, and 47 crops in the case of the public sector. On average, 338 plant varieties were registered per year for protection, of which 142 were from farmers, 76 from the private sector, and 120 from the public sector (Table 2).

Of the 3,043 PVP registration certificates issued, 2,594 (85%) were for extant varieties; the share of new varieties was very low. In the case of new varieties, the share of the private industry was 73% and that of the public sector 27%, indicating the dominance of the private sector. From 2009 to 2017, on average, 37 new varieties per annum were registered from the private sector against 13 new varieties from the public sector.

**Table 2 Progress in plant variety registration**

Year	Farmer	Private			Public			Total			All	
	Total	Extant	New	EDV	Total	Extant	New	Total	Extant	New		EDV
2009	3	14	2		16	149		149	166	2	0	168
2010					0	49		49	49	0	0	49
2011		9	12		21	92	3	95	101	15	0	116
2012	3	29	25	1	55	153	1	154	185	26	1	212
2013	46	61	43		104	143	11	154	250	54	0	304
2014	459	45	80		125	221	28	249	725	108	0	833
2015	200	64	57		121	57	7	64	321	64	0	385
2016	345	78	70		148	55	57	112	478	127	0	605
2017	221	55	40		95	43	12	55	319	52	0	371
Total	1,277	355	329	1	685	962	119	1,081	2,594	448	1	3,043
Average	142	39	37	-	76	107	13	120	288	50	-	338
Distribution of PVP certificates across different category of owners (%)												
Extant	49		14				37			100		
New			73				27			100		
Total	42		23				36			100		

Source Computed from PPVFRA data

The share of new varieties in the PVP certificates portfolio was 48% for the private sector and 11% for the public sector.

Out of 3,043 varieties registered for PVP, only 523 (17%) were hybrids (Table 3). Private hybrids had a 70% share of total hybrids, and the private sector had a 64% share in extant hybrids and a 79%, share in new hybrids. Hybrids constituted 53% of the private sector's portfolio of PVP certificates but only 15% of the public sector portfolio. On average, 41 hybrids were registered per annum for PVP from the private sector against 17 hybrids from the public sector. The share of new hybrids in total hybrids was 42% in the case of the private sector and 25% in the case of the public sector.

The maximum number of PVP registrations was observed with respect to rice crop, followed by maize and tetraploid cotton (Table 4). In hybrids, maize, tetraploid cotton, and pearl millet were the top three crops in terms of PVP registration, and the private sector had a share of, respectively, 52%, 89%, and 71%. Among the top three crops across different categories of owners of PVP certificates for hybrids, maize was the common crop. Totally, hybrids were registered for 22 crops; public sector hybrids were registered for 18 crops and private sector hybrids for 16 crops. Details

of dominance of different owners in different category of varieties is presented in table.5

Totally, 55 companies obtained PVP certificates for their crop varieties. Of these, the PVP certificates portfolio of 29 companies consisted of only 1 crop, and of only 8 companies more than 5 crops (Table 6). These 8 companies together contributed 58% of PVP varietal registration. The maximum number of companies participated in the registration of rice varieties, followed by tetraploid cotton, pearl millet, and maize. The share of PVP certificates of these 4 crops constituted 71% of the PVP certificates of the private sector.

Across crops, the top four companies' share in PVP certificates (C4 ratio) ranged from 48% to 100%. The C4 ratio ranged between 53% and 88% for crops in which private companies' PVP certificates exceeded that of the public sector; between 53% and 88% in the case of new varieties; between 35% and 100% across different crops; and between 39% and 100% in the case of hybrids of different crops.

The PVP certificates by company are analysed (Table 7). The companies that ranked first and second in terms of the number of crops (with respect to which they registered their plant varieties) did not rank first or

**Table 3 PVP certificate portfolio by owner category (31 December 2017)**

Type of variety	Farmers	Private	Public	Total	Share of private sector
<b>Hybrids</b>					
Extant		210	117	327	64
New		155	40	195	79
EDV		1		1	100
Total	0	366	157	523	70
<b>Typical varieties</b>					
Extant	1,277	145	845	2,267	6
New		174	79	253	69
EDV				0	
Total	1,277	319	924	2,520	13
<b>All varieties</b>					
Extant	1,277	355	962	2,594	14
New		329	119	448	73
EDV		1		1	100
Total	1,277	685	1,081	3,043	23
<b>Share of hybrids in respective category total PVP certificates</b>					
Extant	0	59	12	13	
New		47	34	44	
EDV		100		100	
Total	0	53	15	17	
<b>Share of new in hybrids and extant varieties</b>					
Hybrids		42	25	37	
Typical varieties	0	55	9	10	
All varieties	0	48	11	15	

Source Computed from PPVFRA data

second in terms of the total number of PVP certificates. This indicates that companies adopt diverse strategies of crop portfolio diversification in research. The C4 ratio of new varieties exceeded that of extant varieties. The C4 ratio of hybrids was 50% of the C4 ratio of typical varieties, indicating more competition in the case of hybrids. This is also evident from comparing the number of companies registering hybrids (45) to those registering typical varieties (31).

In India, under the PPVFR Act, annual plant varieties are protected for 15 years and tree species and vines for 18 years. The statutory protection period for 318 varieties—all extant varieties, and accounting for 10% of PVP certificates issued—expired on 31 December 2017. Out of these 318 varieties, only 57 were hybrids (accounting for 17% of extant hybrids registered). As on 31 December 2017, protection was effective for 98% of the private company varieties

registered but for 72% of the public sector varieties registered. Of the 318 varieties for which the protection period expired on 31 December 2017, the maximum were with respect to rice crop (63), wheat (39), and maize (60) in that order. The maximum number of hybrids for which protection expired was in maize, followed by pearl millet, and tetraploid cotton. Recently, through notifications, the PPVFRA extended the time limit for registering extant and farmers' varieties of different crops.

### Emerging issues and challenges

#### Interplay of intellectual property rights and competition

Providing plant varieties IPR protection has an economic rationale: improve the participation of the private sector in varietal development research by

**Table 4 PVP certificates issued by crop (31 December 2017)**

Crop	Total number of PVP certificates issued	Distribution of PVP certificates across different owners (number)			Crop	Total number of PVP certificates issued	Distribution of PVP certificates across different owners (number)		
		Farmer	Private	Public			Farmer	Private	Public
Amaranthus	1		0	1	Maize	221	6	110	105
Barley	9		0	9	Muskmelon	2		0	2
Black pepper	3	3	0	0	Okra	30		16	14
Black gram	17	1	1	15	Onion	6		0	6
Bottle gourd	3		1	2	Pearl millet	119		85	34
Brinjal	16		4	12	Pigeon pea	30	3	6	21
Cabbage	1		0	1	Potato	23		8	15
Castor	7		3	4	Pumpkin	2		0	2
Cauliflower	4		1	3	Rapeseed	17	5	1	11
Chickpea	46	2	0	44	Rice	1,525	1,234	124	167
Chilli	7		0	7	Ridge gourd	1		0	1
Coconut	6		0	6	Rose	1		1	0
Cucumber	2		0	2	Safflower	6		0	6
Diploid cotton	41		15	26	Sesamum	5		0	5
Field Pea	25		0	25	Small cardamom	7	6	0	1
Finger millet	5		0	5	Sorghum	134	4	47	83
Garden pea	2		0	2	Soybean	30		2	28
Garlic	6		0	6	Spinach	1		0	1
Green gram	31		1	30	Sugarcane	43		1	42
Groundnut	34		0	34	Sunflower	54		45	9
Indian mustard	64	2	15	47	Tetraploid cotton	216		169	47
Jute	17		0	17	Tomato	30		21	9
Kidney bean	10		0	10	Turmeric	4		0	4
Lentil	11		0	11	Wheat	163	11	8	144
Linseed	5		0	5	Total	3,043	1,277	685	1,081

Source Computed from PPVFRA data

providing them the incentive of exclusive control for a specific period and thereby enabling them to recover their research investment. More than 400 private seed companies of diverse capacities operate in India, but only 55 of these companies have obtained PVP certificates. This indicates an interface between IPR and competition in the Indian seed sector, specifically in the upstream research sector.

Providing plant varieties IPR has led to a clear-cut demarcation of the upstream research sector, downstream seed market, and the in-between technology commercialization (IPR licensing) market in the seed sector. As on 31 December 2017 in India,

with respect to PVPs for hybrids, Bayer was one among the top four companies in pearl millet, rice, and sorghum; Monsanto was among the top four companies with respect to tomato crop; and Syngenta was one among the top four companies with respect to maize and sunflower crop.

The PVP regime provides for exempting researchers and farmers. Therefore, it is claimed that as IPR, PVP is less effective than patents. But, in the context of hybrids, this claim is irrelevant (Bhutani 2011). Hence, there is a need for cautiously monitoring concentration in upstream PVP ownership (specifically with respect to hybrids), the downstream seed market, and

**Table 5 Dominance of different owners in PVP registration (31 December 2017)**

	Type of variety	Crops	Number of crops
Number of farmers' PVP certificates > than private PVP certificates	All	Rice, wheat, cardamom, rapeseed, black pepper, and chickpea	6
Number of farmers' PVP certificates > public sector PVP certificates	All	Rice, cardamom and black pepper	3
Number of private sector PVP certificates > public sector PVP certificates	All	Maize, okra, pearl millet, sunflower, tetraploid cotton, and tomato	6
	New	Cauliflower, diploid cotton, Indian mustard, maize, okra, pearl millet, pigeon pea, potato, rice, sorghum, soybean, sunflower, tetraploid cotton, and tomato	14
	Hybrids	Bottle gourd, bread wheat, brinjal, cauliflower, diploid cotton, Indian mustard, maize, okra, pearl millet, potato, rice, sorghum, sunflower, tetraploid cotton, and tomato	15

Source Computed from PPVFRA data

**Table 6 Frequency distribution of private companies based on number of varieties registered under PPVFRA for crops (31 December 2017)**

Range of number of crops	Number of companies	Total number of varieties registered for PVP	Share in total PVP registrations of private sector (%)
1	29	102	15
2-4	18	186	27
5-10	6	324	47
>10	2	73	11
	55	685	100

  

Range of number of companies	Number of crops	Total number of varieties registered for PVP	Share in PVP registrations (%)
1	11	14	2
2-4	6	42	6
5-10	5	143	21
>10	4	486	71
Total	26	685	100

Source Computed from PPVFRA data

**Table 7 PVP certificates concentration and distribution across private companies**

	Type of variety						
	All	Extant	New	EDV	Hybrid	Typical varieties	
Total PVP certificates	685	355	329	1	366	319	
Total number of companies	55	48	39	1	45	31	
Number of PVP certificates of	Top most company	134	95	87	1	45	89
	Top 4 companies	312	163	165	1	122	210
Share of PVP certificates (%)	Topmost company	20	27	26	100	12	28
	Top 4 companies	46	46	50	100	33	66
	Equal distribution	2	2	3	100	2	3
Number of PVP certificates		Number of companies					
1–10	39	39	31	1	34	25	
11–20	8	6	6		6	3	
21–30	2	2			4	1	
31–40	4	-	1		1		
41–50	-	-					
>50	2	1	1			2	
All	55	48	39	1	45	31	

Source Computed from PPVFRA data

technology/trait licensing practices. Competition in one layer of the seed sector will influence competition in the other layers. In the case of transgenic cotton, some seed companies alleged that a few other seed companies were abusing their dominance in licensing and sub-licensing their technologies, and filed cases with the Competition Commission of India (CCI). The CCI is investigating the matter (CCI 2016).

Another channel through which IPR creation in the plant variety sector can influence competition is through structural change in the seed industry, that is, consolidation. When PVPs are strengthened by way of the EDV clause, concentration in PVP may have more impact on seed market consolidation and concentration (Srinivasan 2005). The PPVFRA's recent guidelines make it mandatory to protect the parents of hybrids along with hybrids (as a package) irrespective of whether the hybrid is new or an EDV

Until recently, six big companies viz. Monsanto, Syngenta, DuPont, BASF, Bayer, and Dow collectively controlled more than 75% of the agrochemical market worldwide and 63% of the commercial seed market;

they were referred to as the 'Big Six' (ETC 2015). After some recent, ongoing consolidation involving Dow-DuPont, Bayer-Monsanto, and Syngenta-ChemChina—the Big Six are now the 'Mighty Four'. The mergers and consolidation appear to be driven by economies of scale and scope by access to complementary IPRs. Patent alliances and IPRs are accelerating the mergers of global seed chemical companies (Lianos et al. 2016), which have increased the concentration in the seed and agrochemical industries and reduced the number of companies.

Some of these companies own patents for gene sequences and several important genetically modified traits (ISAAA 2018) and licences for new breeding tools. Corteva Agriscience, the crops section of Dow-DuPont merged entity, has licences to the clustered regularly interspaced short palindromic repeats (CRISPR) technology from the teams at both the Broad Institute at the Massachusetts Institute of Technology (MIT) and the University of California at Berkeley (Deering 2018). The mergers of these companies can have implications for competition in plant varietal research (innovation market), technology (licensing)

markets, and seed markets (Maisashvilli et al. 2016; Manne and Gibby 2017) in terms of price and seed choice. Hence, the competition authorities in several countries gave only conditional approval for the mergers of these companies. In India, too, the CCI has given conditional approval to Bayer's acquisition of Monsanto.

On 23 January 2019, a PPVFRA notice stated that henceforth, with respect to plant varieties protected under the PPVFR Act, the price of all categories of seeds shall be fixed under Section 28 of the Act only with the authorization of the registered breeder or their assignee as per the terms and conditions agreed upon for the purpose between the right holder and others concerned. The trait value/price fixing of varieties registered under the PPVFR Act shall be done only under the Act (that overrides any other Act as per Section 92 of PPVFR Act) during the period of protection of the variety concerned. This will lead to a dual pricing regime, one for varieties protected under the PPVFR Act, and the other for varieties not registered under the PPVFR and for varieties for which the protection period has expired (the protection period for 318 varieties expired on 31 December 2017). Prior to this notification, the seeds of protected varieties was reported to be priced higher (Venkatesh and Pal 2013). The PPVFR Act provides for compulsory licensing if a registered breeder charges an 'unreasonably high sale price' for a variety, but it is not indicated how the PPVFRA will decide whether a price is 'unreasonably high'.

### **Overlapping intellectual property rights**

#### *Concurrent overlapping of intellectual property rights*

In India, plant varieties are not patentable, but some countries operate a dual protection system—the same plant variety is protected concurrently under two IPR systems, like patents and PVP rights. This kind of overlap of IPRs affects the balance of rights between IPR owners and the public. Granting a patent to a plant variety removes the exemptions/exceptions—research or breeders' exemption and farmers exemption or rights—offered under the PVP regime. The overlap of patents and PVP rights also emerges because of the development of 'new plant breeding techniques', including transgenics and genome editing. The European Union provides for compulsory cross-

licensing for managing such circumstances (Lenßen 2006). The 'creation of a prior right may exclude the subsequent creation of another right' on a given 'subject' and it is another way of managing such circumstances (Bedasie 2012). Countries like France and Germany have incorporated breeder exemption clauses in their patent laws (Smith et al. 2016). However, it is being felt that even in countries where the patent law gives researchers exception, differences in interpretation of research exception under PVP and patent regimes might deny research exception under patent law (Tomkowicz 2011).

An overlap in IPRs can also occur due to the overlap of process and product patents. In India, the Patent Act, 1970 was amended in 2005 to introduce patents for products. Recently, an overlap of IPRs was reported in the case of Bt cotton varieties affecting farmers' ability to buy seeds, but the Government of India's attempt to regulate the prices of transgenic cotton through licensing guidelines failed (Singh 2016). On 11 April 2018, the Delhi High Court pronounced its judgment regarding a patent infringement suit filed by Monsanto: Monsanto's patent 'subject' falls within the exclusion spelt out by Section 3(j) of the Patents Act, and Monsanto can apply for registration under the PPVFR Act within three months to get the benefit of its previous patent in terms of determination of prior publication provision requirement and benefit sharing. Further, cotton seed being an essential commodity, the Delhi High Court pronounced that Monsanto is obliged to maintain the supplies to facilitate the production of Nuziveedu Seed Company's varieties for onward sale to farmers. On 8 January 2019, the Supreme Court of India (SC Judgment 16059-2018) ruled that the procedure followed in deciding the 'invalidity' of Monsanto's patent was 'certainly neither desirable or permissible in the law'. Since the issue is complex, the Supreme Court ordered the examination of more evidence in a full trial. 'Whether the nucleic acid sequence trait once inserted could be removed from the variety or not and whether the patented DNA sequence was a plant or a part of a plant etc. are again all matters which were required to be considered at the final hearing of the suit.'

#### *Sequential overlapping of IPRs*

In the Indian context, initially, the PPVFRA reasoned that parental lines of extant hybrids notified under the



Seeds Act, 1966 cannot be considered as being notified under the Act as they were not explicitly notified. Hence, they were permitted for registration under a category other than extant notified varieties (extant VCK). But later it was observed that this provision can lead to an extended protection period for a hybrid through ‘evergreening of PVP’ by sequential registration of hybrid, parental line one, and parental line two. To check this, on 5 December 2018, the PPVFRA made an order: the parental lines of extant hybrids notified under the Seeds Act, 1966, should be considered only under the category of extant varieties notified under the Act. Both the parental line and its extant hybrid will have a uniform period of protection, that is, 15 years from the date of notification under the Act.

Further, the order states, ‘the parental lines of new hybrids notified under the Seeds Act, 1966 should be considered under the category of new varieties notified under the Act provided they are filed within a period of one year from the date of commercialization of earliest/first hybrid.’ But complex situations are anticipated, such as that of a new hybrid with one new parental line and one extant parental line. As the IPR regime for plant varietal protection is still evolving in India, changes are expected in the provisions of the PPVFR Act in the near future.

### Regulatory web

Together with other regulations—seed quality, environment, and biosafety regulations, and different rules of seed commercialization (compulsory registration or minimum standards)—IPRs (patents and PV rights) determine the structure and dynamism in the plant varietal development and seed market of a country. An effective seed regulatory framework at the global level was initiated to create a World Seed Partnership to support the development of the seed sector in countries. In this partnership, there are four partners, each responsible for one primary element: the International Union for the Protection of New Varieties of Plants (UPOV) for IPR for plant varieties; the International Seed Testing Association for seed quality assurance; the Organization for Economic Co-operation and Development (OECD) for the seed varietal certification system; and the International Seed Federation for facilitating the growth of local seed industries.

In India, transgenic plants are also protected through PVP rights, but access to proprietary data on biosafety or environmental or food safety for getting approval for cultivating a transgenic crop still costs money and time. These regulations can also aid in increasing consolidation in the seed sector by creating entry barriers for new companies. Hence, there is a need to reconsider these approval issues. In addition, some uncertainty prevails over the regulation of frontier technologies—genome editing, synthetic biology—in India and over the types of IPR that will be provided for plants produced using these technologies.

Some researchers argue that DNA sequences and engineered DNA sequences created using synthetic biology can be protected by copyright. In the case of transgenic crops in the post-patent or PVP regime, and also during the PVP regime, clearances from the biosafety regulatory authority and export–import regulations can come in the way of technology transfer through ‘generic seeds’. There are some attempts in the USA to handle this kind of situation through contractual solutions like AgAccord (for a detailed discussion on these agreements, see Prasanna (2018) and Prasanna et al. (2018)).

### Effectiveness of farmers’ rights

One argument against providing strong IPR for plant varieties is that it may hinder farmers’ access to seeds, and several countries provide for farmers’ privileges or rights in their PVP legislation. The Indian PPVFR Act protects the rights of farmers as breeders, plant genetic resource conservators, and as consumers, that is, users of seeds. For registering farmers’ varieties under the PPVFR Act in India, the criteria of uniformity are relaxed, allowing double the number of off-types as otherwise permitted for other categories of varieties. Farmers’ rights are applicable to all crops notified by the PPVFRA and applicable to all category of farmers irrespective of farm size. There is no registration or renewal fee in the case of farmers’ varieties.

Despite these positive provisions, the real positive effect on farmers as breeders at the ground level (except for the higher number of farmers varieties registration) has not yet been established (for a detailed discussion on this issue, see Prasanna et al. (2018)). Regarding farmers’ rights as consumers, also, certain issues are emerging. It is evident from PVP registrations with the PPVFRA that the private sector is developing more

hybrids compared to varieties. As hybrids do not reproduce ‘true to type plants’, farmers’ rights to reuse seeds from their harvest are becoming irrelevant. PepsiCo India recently filed a lawsuit against a few farmers in Gujarat alleging infringement of its PVP rights over a specific potato variety suitable for making chips. It withdrew the case after discussions with the government, but some critics hold that this withdrawal does not constitute a triumph of the PPVFR Act (EPW Editorial 2019).

### **New initiatives**

From the innovator’s perspective, IPR is an incentive mechanism, but from the consumer’s perspective IPR establishes the terms under which individuals and firms can gain access to knowledge or information goods (anything that can be digitized) (Hemel and Ouellette 2019). The objective of providing incentives is separate from that of ensuring access to consumers, and these objectives can be handled separately (Hemel and Ouellette 2019). Supplying seeds at subsidized cost is one such attempt, but it adds to public budgetary expenses, and it does not provide researchers access to developed varieties for developing new varieties. Hence, some changes in IPR regimes, and creating other incentive mechanisms, are being attempted to address the access issue. Some of these initiatives are briefly discussed here.

### **Open source initiatives**

Based on insights drawn from open source development in the software industry, the copyleft licence in the area of copyrights and the management of the commons (Ostrom 1990), the Open Source Seed Initiative (OSSI), was taken up in the US. The OSSI approach is to use a hybrid of market and non-market components. The Association for Agriculture Ecology (AGRECOL), a non-profit entity in Germany, has taken up the Open Source Seed License (OSSL) initiative, which is covered under German civil law. The OSSI relies on the pledge mechanism, or a moral obligation approach, but the OSSL initiative is based on an enforceable licence mechanism (for a detailed discussion of these two mechanisms, see Prasanna (2018) and Prasanna et al. (2018)).

In India, the Centre for Sustainable Agriculture, Hyderabad organized an open source network, and bred, and shared eight varieties of rice, wheat, and

pulses (Lucas 2017). Hivos, an international organization that supports national initiatives for the open source system, supports the Apna Beej programme in India. Under this programme, which started in 2015, 20 varieties of rice, vegetables, and pulses have been registered so far; these are available to farmers and seed companies for breeding. It is being opined that open source seed systems will serve as a parallel system to commercial seed systems, and there will be little or no exchange of germplasm between the two domains (OECD 2018).

Meanwhile, there are some open access-type initiatives focusing on synthetic biology. The BioBricks Foundation (BBF), an informal group of leading synthetic biologists in the USA, emphasizes the democratization of synthetic biology research by utilizing open source principles (Torrance 2017). A BioBrick is a standardized continuous DNA sequence that encodes a basic biological function. BioBrick designs are standardized to allow multiple BioBrick parts to be linked together in a relatively straightforward manner. In collaboration with Open Plant—a joint initiative between the University of Cambridge, John Innes Centre, and the Earlham Institute—the BBF framed and implemented an open material transfer agreement.

### **Innovative licensing initiatives**

In November 2014, with support from the Dutch government, 11 seed companies from Switzerland, Germany, Japan, France and the Netherlands together established the International Licensing Platform (ILP) Vegetables (OECD 2018). Membership is open to all interested parties whether they own patents or not. Under the conditions of the ILP, members make all their vegetable trait-related patents available to other members. On 6 April 2018, the ILP rules were amended to include ‘also patents covering traits made with new breeding technologies like genome editing’ are accessible for licensing through the ILP ‘as long as these traits are not regulated as genetically modified’. As on 10 December 2018, ILP Vegetables had 13 members.

### **Other incentive mechanisms**

The Access to Seeds Foundation—an independent, non-profit organization based in the Netherlands—publishes the Access to Seeds Index, a relative ranking

of companies with an integrated seed business model covering the full seed value chain starting from research and development to seed distribution, based on some parameters (ASF 2019). This index attempts to use positive reinforcement to encourage the seed industry to participate in the development of smallholders. The index is published at both the global and regional levels, and it focuses separately on field crops and vegetable crops.

Recently, the first Access to Seeds Index for South and Southeast Asia was announced. It ranked 24 companies, and it was observed that collectively these reach only 20% of the smallholder farmers. Global seed companies reach only 10% of smallholders worldwide (ASF 2019). In India, of the 55 companies observed in the analysis of PVP ownership, only 11 companies could be indexed because only these companies disclose the information needed for analysis. Little data are available on the seed sector in India, and this absence of data hinders an in-depth study of the competition. Mechanisms such as the Access to Seeds Index aim to improve this situation by encouraging seed companies to be transparent.

## Conclusions

Amid the ongoing debate over the desirability and necessity of IPR protection to plant varieties, TRIPS made it mandatory for its members to have some IPR protection mechanism to plant varieties, but IPR protection is influencing competition in various layers/levels of the seed sector, and inviting the attention of antitrust agencies. The structure of the seed sector and the affordability of seed prices are influenced by the interaction of competition/antitrust policy, seed quality regulatory policy, and biodiversity management and access regulation policy. There are several policy levers in the seed sector, and these need to be balanced to achieve the multiple goals of appropriate incentives for varietal development, seed affordability, and more varietal choices available to farmers. Further, though it is mandatory for TRIPS members to have some IPR mechanism to plant varieties at the country level, within a country it is voluntary.

Only some stakeholders are using the IPR mechanism to protect their varieties. In some countries, to reduce the transaction costs of licensing, innovative licensing mechanisms are evolving across different crop groups

both during the IP protection period (like ILP) and post-IP protection period (like AgAccord). Some stakeholders are relying on non-IP mechanisms, like open source seeds, to ensure access to germplasm for future varietal development. These initiatives also need to be supported. Governments must also focus on non-IP incentive mechanisms like the Access to Seeds Index in promoting private sector participation in seed research and seed marketing.

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Intellectual Property Rights on inventions in biotechnology have become a controversial topic of discussion in present years, as such inventions cut across issues related to science and technology policies, ethics and economics, etc. These issues are also directly related with the complexities of international trade. With the use of modern biotechnology many complex issues spurred up in the IPR regime in general and patenting in particular. Since the inventions in biotechnology cut across various aspects related to science & technology policies, polity of international trade, economic and ethical issues, the business methods in biotechnology have gained more complexity. Why do we have to familiarize ourselves with the science and issues related to modern biotechnology? The Protection of Plant Variety and Farmers Right Act, 2001 (PPVFR Act) is an Act of the Parliament of India that was enacted to provide for the establishment of an effective system for protection of plant varieties, the rights of farmers and plant breeders, and to encourage the development and cultivation of new varieties of plants. This act received the assent of the President of India on the 30 October 2001. 1. Introduction: Intellectual Property Rights (IPRs) and Related Issues. IPRs are rights to thoughts, novel ideas, and information on new processes and inventions loosely defined, intellectual property is a "product of mind" and like other property, no other person can lawfully use his / her property without consent. The IPRs issues are dealt in India by Patent Act of 1970 with amendment of 1994 and design Act of 1911. Trade and merchandise Act of 1958 and copyright Act of 1957 and are also parts of IPR protection. 3.1 Patenting in Biotechnology Patenting biotechnology has emerged as an issue in the past two or three decades. By P A Lakshmi Prasanna, L V Subba Rao, A S Hari Prasad, Amtul Waris, Shaik N Meera, B Nirmala, S Arun Kumar and Divya P Syamaladevi; Intellectual property rights protection for plant varieties in India: status, emerging issues, and challenges. Agricultural Economics Research Review, 2020, vol. 32, issue 2. Keywords: Agricultural; and; Food; Policy (search for similar items in EconPapers) Date: 2020 References: Add references at CitEc Citations: Track citations by RSS feed. More articles in Agricultural Economics Research Review from Agricultural Economics Research Association (India) Contact information at EDIRC. Bibliographic data for series maintained by AgEcon Search. (). Share.