

# Crop improvement programmes in India – emerging scenario\*

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*The Indian national agricultural research system is well recognized for its contributions in the form of development of high-yielding varieties that played a pivotal role in enhancing crop productivity. With the enactment of the Protection of Plant Varieties and Farmers' Rights Act, it has become relevant to bring about changes in the varietal development programme, to get maximum advantage from the new regime. The relevant provisions of the Act will have to be kept in view and the plant breeding programmes accordingly reoriented. These include eligibility for protection, passport data, lawful acquisitions, fee for testing, benefit-sharing and commercialization of new varieties. This article attempts to discuss such provisions, which have a direct bearing on the reorientation of varietal development programme in India.*

**Keywords:** Commercialization, DUS and VCU testing, PPVFR, varietal development.

INDIAN plant breeders and geneticists have developed a large number of improved crop varieties (conventional varieties and hybrids) that have played a pivotal role in enhancing crop production and productivity and making the nation food-secure.

India did not have any legislation on protection of plant varieties till recently. The commercial varieties were, therefore, freely available for research, seed production and cultivation. However, with the establishment of World Trade Organization in 1994 and India becoming Party to it, there was a national commitment to abide by the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement. The Protection of Plant Varieties and Farmers' Rights (PPVFR) Act<sup>1</sup> was consequently passed by the Indian Government in 2001. The objectives of the Act are to (i) provide for the establishment of an effective system for protection of plant varieties, (ii) to protect the rights of farmers and plant breeders, (iii) to encourage development of new varieties of plants, (iv) to stimulate investment for research and development, and facilitate growth of the seed industry and (v) to ensure availability of high quality seeds and planting materials to farmers. Other issues related to public interest include compulsory licensing rights and prevention of the propagation of varieties using Genetic Use Restriction Technologies (GURT), which are contrary to the interest of the farmers in general<sup>2</sup>.

The rules for implementation of the Act have been notified in September 2003, called as the Protection of Plant Varieties

and Farmers' Right Rules, 2003 (hereinafter referred as PPVFR rules). In view of the operationalization of the Act, it is pertinent that Indian plant breeders and geneticists reorient and fine-tune their crop improvement programmes and activities to be in line with the provisions of PPVFR Act. The article attempts to discuss various provisions of the Act that would have a direct bearing on the activities of the crop improvement programmes, particularly in the public sector, and options available to effect changes to harness maximum benefits from the new regimes.

## Passport data and lawful acquisition of parental lines

The Act requires that the application for registration of plant varieties should be accompanied with complete passport data of the parental lines from which the variety has been developed, along with the geographical locations in India from where the parental material has been taken, and all information relating to the contributions if any, of any farmer, village, community institution or organization in breeding, or developing the variety [Section 18 (1) e, PPVFR Act]. This provision, thus, makes it mandatory that the breeders maintain complete record of the passport information of the material/germplasm used in the breeding programmes, which would be required at the time of protection of the variety. This also has implications for plant genetic resource centres, where it should be mandatory to deposit the germplasm along with associated passport information.

Initially germplasm was collected and evaluated, and the desirable ones used and many times conserved. Generally, neither a need was felt nor were there resources to conserve all collected germplasm. With the advent of the Green Revolution, high-yielding varieties rapidly spread and re-

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placed land races/farmers' varieties in 1960s and 70s. As a result, germplasm collection/assembling and conservation came into focus, but collection and compilation of passport information did not get due attention. Genetic resource centres made appreciable progress in germplasm collection/assembly, but have a large germplasm with incomplete or no passport details. It is, therefore, important to make all-out efforts to update passport information and document the same. This would not only help plant breeders to register their varieties under the PPVFR Act but also assist farmers and communities in realizing benefit-sharing.

Application for registration of varieties also requires a declaration that the parental genetic material used to develop the variety has been lawfully acquired [Section 18 (h), PPVFR Act]. This implies that parental material must be obtained through a Material Transfer Agreement (MTA) even from public sector institutions or genebanks. If the material has been received from farmers or communities, permission to use the material would be required from the appropriate representative, which may be in the form of an MTA or a consent. However, it may also be noted that for exploration and collection of germplasm, one has to intimate the concerned State Biodiversity Boards, according to the Section 7 of the Biodiversity Act<sup>3</sup>, 2002.

### Eligibility for protection

The Act allows registration for protection of new plant varieties that include essentially derived varieties, extant varieties or farmer's varieties provided they are novel and conform to the criteria of distinctiveness, uniformity and stability (Section 15, PPVFR Act). The protection, however, will be presently available only in case of genera and species notified by the Government of India, and not for all crops. Even in the notified species, it will be the discretion of the developer to get a variety protected or not, and not binding to get all varieties protected.

According to Section 15 of the Act, 'novelty' means commercial novelty, i.e. the propagating or harvested material of the variety should not have been sold or otherwise disposed off earlier than one year in India, from the date of filing of application of registration, or outside India, not earlier than six years in the case of trees or vines or, not earlier than four years in any other case. However, trial of a new variety which has not been sold or otherwise disposed off shall not affect the right to protection. 'Distinctiveness' means that a variety is clearly distinguishable by at least one essential characteristic from any other variety, whose existence is a matter of common knowledge. 'Uniformity' implies that the variety should be sufficiently uniform in its essential characteristics subject to variation as expected from features of its propagation. 'Stability' requires that the essential characteristics remain unchanged after repeated propagation. The new varieties will be subjected to DUS testing by the PPVFR Authority. These tests will be necessary for all new varieties, except essen-

tially derived varieties. The PPVFR Authority shall develop and publish in its journal, guidelines for DUS tests for each crop (Section 29 (9), PPVFR Rules)<sup>4</sup>. The tests are envisaged to generate comprehensive data on the attributes of a variety, so as to compare these with the varieties of common knowledge or similar existing varieties before granting protection. These shall be field and multilocation based for at least two crop seasons, at a minimum of two locations, along with special laboratory tests (Section 29, PPVFR Rules).

The varietal development programme would, therefore, be required to take care of these criteria. The plant breeder has to take care that the new variety is distinct from all existing varieties by at least one essential character. The criteria of uniformity would be particularly important in composites, synthetics and multi-lines, which are variable varieties. The acceptable limits of variability within these varieties will have to be defined and adhered to. Thus, a plant breeder has to keep in view DUS characters of the new variety, unlike earlier, when the focus was on traits of value for commercial use (VCU) only.

### Fee for DUS testing and protection

The plant breeders or the organizations to which they belong, will have to pay a fee, up to a maximum of Rs 50,000 per variety, for conducting DUS tests [Section 29 I (9), PPVFR Rules]. In addition, an annual fee of up to a maximum of Rs 10,000 per year shall be required, for retention of the registration of the variety (Section 39, PPVFR Rules). Evidently, it is going to be expensive. Therefore, public sector institutions, particularly those having multiple crop improvement programmes, such as agricultural universities (AUs) and some institutes of the Indian Council of Agricultural Research (ICAR), may have to critically examine whether to go for DUS testing of a large number of varieties developed every year and continue to pay the annual fee for protected varieties. They would have to generate enough data on VCU before they opt for DUS testing or for protection and its continuance. This would require good in-house evaluation of the experimental varieties (discussed later in detail) and priority-setting. In any case, appropriate financial provisions would have to be reflected in the plans and budgets of the organizations.

### Protection of extant varieties

The extant varieties are those notified under the Seed Act, 1966 including farmers' varieties. The varieties which have been released during the last 15 years can be protected. The Registrar shall register every extant variety within three years from the date of notification under the Act, with respect to the genera and species eligible for registration subject to conformity to the criteria of distinctiveness, uniformity and stability as laid down under the legislation (Section 24, PPVFR Rules). The public sector institutions

will, therefore, have to take a judicious view as to which of the released varieties need to be protected. Further, there are a large number of farmers' varieties/landraces possessing specific traits, which continue to be cultivated. Various institutions and universities, particularly those in the agricultural stream, need to play a proactive role in getting these resources collected, characterized/evaluated, conserved and documented. In fact, this should be taken up as a national responsibility and challenge. The farmers and communities need to be empowered to protect these materials and lay claims to benefits arising out of their utilization. If not as commercial varieties under the PPVFR Act, these may be registered as germplasm with the National Bureau of Plant Genetic Resources (NBPGR)/ICAR and also conserved in the National Genebank in NBPGR, New Delhi and provided national identity. This would provide authenticity to the claims of farmers and communities in case the same germplasm is utilized for developing new varieties by someone else for commercial gains.

### Commercial seed production – involvement of private sector

The public sector crop improvement programmes in ICAR institutes/AUs have so far focused on the development of improved varieties. Commercial seed production is neither their mandate nor do they have resources for the same. Thus, an argument is often heard that a given variety is superior, but there is no seed production. With protection of a variety developed by a plant breeder using public funds, it would be obligatory on his part to make arrangements for its commercial seed production. Therefore, public sector institutions will have to develop partnerships with seed producing agencies. According to the PPVFR Act, a breeder may authorize any person to produce, sell, market or otherwise deal with a variety registered under the Act, subject to such limitations and conditions as may be specified in the regulations [Section 28 (2), PPVFR Act].

In the present scenario, the private sector may play a predominant role in commercial seed production of varieties bred by the public sector. This would require promotion of public–private partnerships for mutual benefit<sup>5</sup>. For this, plant breeders in the public sector will have to be better equipped with data on performance of a variety in the target environment and its expected impact. They must have reliable data to assess the same and negotiate with potential partners as well as to supply information to the partners. This has implications on the present system of evaluation of experimental varieties, as discussed later. Faith and confidence are critical to have a mutually beneficial and long-lasting partnership.

### Breeding objectives

The objectives in the plant breeding programmes would have to be more focused. While on one hand, public sector

organizations would be required to develop varieties for stress ecologies and less privileged situations, on the other they would have to be market-savvy. This would require greater orientation of research according to the needs of the farmer, industry and consumer. In case of export-oriented agricultural commodities, researchers will have to keep in view the requirements and trends of international market and trade.

### Evaluation of experimental varieties for VCU

For release of varieties at the state level, the procedure for evaluation of experimental varieties varies from state to state, but generally these are tested for 3–4 years in research station trials and 1–3 years on farmers' fields. The procedure in All-India Coordinated Trials at the national level is uniform across crops. There is a three-year evaluation system: first year – Initial Varietal/Evaluation Trial (IVT/IET); second year – Advance Varietal/Evaluation Trial (Year I) (AVT-I/AET-I) and third year – Advance Varietal/Evaluation Trial (Year II) (AVT-II/AET-II). The prerequisites for entering the experimental varieties in IVT, however, vary from crop to crop. In some cases minimal data are required.

In the changed scenario, the testing protocol may need modification.

- (i) In-house testing would have to be enhanced so that plant breeders get a fair idea of the performance of the experimental variety and its target environment before the same is submitted to the PPVFR Authority for DUS testing.
- (ii) At the state level, farmer-field trials are generally conducted by State Department of Agriculture/Horticulture and Directorate of Extension Education of AUs, generally these trials include one experimental variety and check cultivar(s). These trials would have to be strengthened in terms of the number of experimental varieties, number and spread of trials and above all, for the quality of their conduct. The objective is to get precise information on the performance of the experimental variety and its target environment.
- (iii) Release of varieties at national level or in agro-ecological zone(s) of the country is solely based on the data generated in All-India Coordinated Trials. No farmer-field trials are conducted. Earlier there used to be minikit trials but these were discontinued because of poor response in terms of quantity (number of trials) planned and conducted and delayed receipt of data. Under the changed scenario, there will be an urgent need to conduct a large number of farmer-field trials to generate reliable and precise information on the performance and target environment of an experimental variety. AVT-II material may be evaluated in unreplicated trials on the farmers' fields and it may

be undertaken along with research station evaluation. These trials may be undertaken for one year along with AVT-II (if possible for two years along with AVT-I and AVT-II). These may be formulated by Project Directors/Coordinator, All India Coordinated Crop Improvement Projects, and conducted by the extension wing of the AUs/ICAR institutes; participation of the State Departments of Agriculture/Horticulture being discretionary. Conductance of these trials needs wider discussions among ICAR, AUs, Central and State Departments of Agriculture/Horticulture, so that the pitfalls encountered earlier in minikit trials are avoided.

Participation of farmers in experimental variety evaluation is also important from another angle. The PPVFR Act requires that the breeder has to disclose the performance of the variety, and farmers have the right to claim compensation in case the variety does not perform as claimed [Section 39(2), PPVFR Act]. Therefore, participation of farmers in experimental variety evaluation gains more importance.

### DUS and VCU testing – simultaneous or otherwise

The presumption is that DUS testing by the PPVFR Authority and national level VCU evaluation under All-India Coordinated Trials will start simultaneously. This may generally be so, but not necessarily. In case an experimental variety has extraordinary trait(s), such as male sterility, the developer may like to first get the variety protected and then submit for national level evaluation for VCU. There is also a possibility that an experimental variety may show marginal superiority at in-house trials, but performs appreciably better in All-India Coordinated Trials in some agro-ecology/niche away from the region/state, wherein in-house trials were conducted. In such a situation, DUS testing and protection may get delayed. However, these strategies will have to be fine-tuned with the provisions of the proposed Seed Act, which would regulate the marketing of seeds.

While taking decisions to initiate DUS and national level VCU testing or even the number of years for research stations and farmer-field trials, it should be kept in mind that the time gap between varietal development and commercialization should be as minimal as possible, and protection being for a fixed period of time, it may not be advisable to delay VCU testing and formal release.

### Commercialization and benefit sharing

Issues of licensing would have to be dealt with from a purely commercial angle and would require marketing expertise. The options would include: (i) lump-sum payment or (ii)

annual royalty based on sales/profit. There is no immediate definitive answer to these issues nor to the amount of one-time payment/annual royalty. One will gain experience and expertise with time. However, in the beginning, one may opt for a combination of both with a clause for the review of the agreement after 2–3 years. Further, this may be dealt on a case-to-case basis depending upon the crop, area of adaptation and variety. Granting exclusive or non-exclusive rights to seed producer(s) is another issue. Though there must be required checks and transparency in the negotiation procedure, it is equally important to have quick negotiations and decisions without much paper work and bureaucratic hassles. It may be desirable and may also become possible over a period of time to involve partner(s) of the private sector in farmers' field evaluation, so that the partners get a fair idea of the worth of the varieties.

### Capacity building

Reorientation of the programmes and activities as discussed above would essentially require appropriate capacity building, particularly in the policy areas on commercialization of technologies. A team of experts would be required for conducting negotiations, generating market intelligence, etc. Moreover, awareness generation about IPRs among scientists, administrators, policy makers, opinion makers and others is important.

Effort should be made to strive for capitalizing on our national resources and capabilities to attain IPR advantage at national and international levels with an effective and relevant action plan, for bringing in IPR culture in our working<sup>6</sup>. There will of course be hindrances to material, technology and knowledge transfer, but these have to be overcome so as to keep pace with international developments. The mind-set has to be changed to consider the IPR regimes as an asset and means of rewarding agricultural research and not as a threat.

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