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Varietal Release, Notification and Denotification System in India

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Abstract

Agriculture is the backbone of India and improved agricultural practices principally depend on the use of newly evolved improved variety. In the Indian scenario, a statutory varietal release system is working where notification and denotification process are playing a crucial role in quality regulation of seed. Crop research institutes of ICAR (Indian Council of Agricultural Research), SAUs (State Agricultural Universities) and private seed companies are the main pillars to develop improved varieties in India. The thumb rule is, the improved variety must have a higher yield compared to the existing one (national and state check varieties) and this is ensured via several multilocational evaluations at a different level. This article covers the Indian regulatory system of variety release, evaluation process at a different level, and the importance of notification and denotification. This information will help the scientific community in regards to suggesting improved variety for general cultivation by farmers.

Keywords: agriculture, variety release, notification, improved variety, denotification

1. Introduction

India is a fast-growing economy and agrarian country. Almost 70 percent of the Indian population depends on agriculture and its allied sectors to obtain employment and sustain livelihood. The seed is considered as a basic and key input in agriculture. High-quality seed production was the major concern in the Indian subcontinent till the 1960s. Before that India was mostly dependent on the USA for food grain (PL480) to mitigate its hunger [1] and feed large human population. In order to reduce the dependence of food on foreign countries and to meet the food and nutritional demand of burgeoning population and to become self-reliant in food grain production, Indian Government established All India Coordinated Crop Research Projects (AICCRPs) and other institutes in a systemic manner to produce a large number of varieties with assured seed quality in all major crops. The production of high-quality seeds was one of the pillars to change the position of Indian agriculture into the new world order. The ultimate intention was to introduce the newly evolved high yielding cultivars to the resource-poor farmers for broad-spectrum cultivation in the area of their adoption.

By seeing this scenario, the Government of India acknowledged seed an essential commodity under the Essential Commodities Act, 1955. On October 1964 Varietal Release System (VRS) came into existence with the formation of the Central

Variety Release Committee (CVRC) at the national level, and State Variety Release Committees (SVRCs) at each state level. A Central Seed Committee (CSC) was established under the Ministry of Agriculture, Cooperation and Farmers Welfare provided in the Seeds Act, 1966. The functions of the CVRC were taken over by the CSC in 1969 to ensure the quality of seeds on sale and notification of the kinds/varieties. To perform the function at central level to release/notification, provisional notification and de-notification of cultivars, CSC constituted a Central Sub-Committee on Crop Standards, Notification & Release of Varieties for Agricultural Crops and Horticultural Crops, while to perform similar functions at state level, State Seed Sub-Committee (SSSC) was constituted [2].

2. Development of plant genetic material (in house breeding)

Entries (pure lines/open pollinated varieties/composites/synthetics/hybrids etc.) are developed by the concerned plant breeders/agencies through scientific temperament and extensive breeding programs for the benefit (food and nutritional security) of humankind. Different conventional (Introduction, selection, hybridization followed by selection etc.) and advanced (tissue culture-based techniques like somaclonal variation, anther and pollen culture; mutation, marker assisted breeding, transgenic or genome editing techniques) breeding methods are being used by the different agencies (ICAR or non-ICAR national institutes, SAUs, private national or multinational companies etc.) to generate elite material for high yield potential, nutritional quality and other associated traits. Developed elite materials are being tested by the concerned plant breeder/s at their research station for three to four years in replications for stability and selected superior cultivars enter into the All India coordinated crop improvement projects (AICCIPs) trials for further testing in multi-environments across the country.

3. All India coordinated crop improvement projects system of varietal testing

First AICCIP was started in way back of 1957 by ICAR on maize crop for systemic testing of entries and for release of high yielding new maize varieties. In general, the three-tier system of multi-location evaluation is used for three years except perennial fodder crops (requires four years-one for crop establishment and three for evaluation) in India. Multilocational trials are conducted by the Project Coordinator (PC)/Project Director (PD) of AICCIPs [3] with the help of concerned principle investigators. The AICCIPs have been developed for all the major crops including forage crops. The AICCIPs come under the umbrella of ICAR, has great role in the development of improved crop varieties and generation of production and protection technologies that directly benefit farmers for their economic amelioration. All AICCIP trials are well organized, systemic and conducted through a uniform testing procedure across the centers as per crop standard. It is a powerful system to screen large number of entries and recommend well-tested, superior, and adapted new cultivars to the end users. The flow chart of varietal release and notification in India is illustrated in **Figure 1**.

Newly entered material/entries into the three-tier system must have the following requirements.

- Station trial or preliminary yield trial-Concerned plant breeder must perform station or regional trial and proposed entry must have undergone censorious

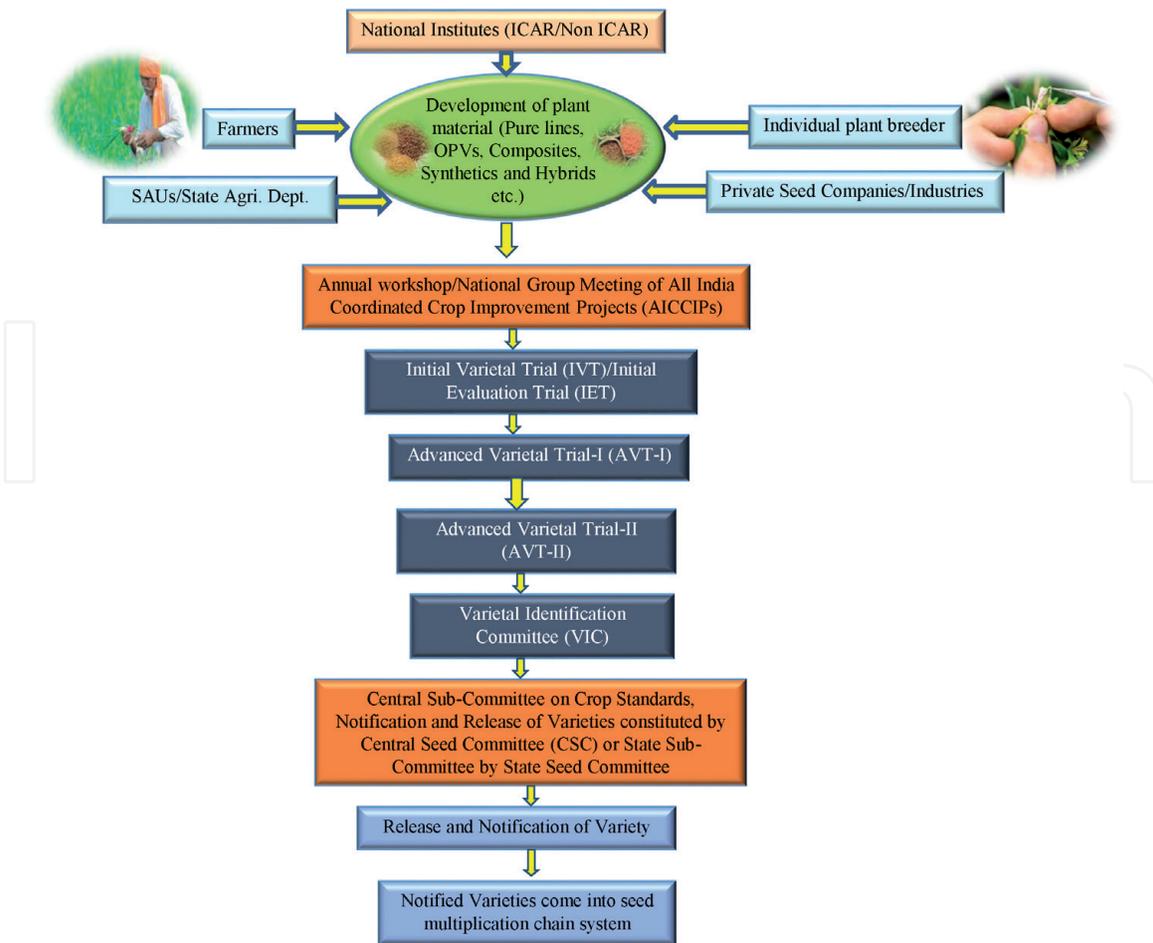


Figure 1.
 Flow chart of plant varietal release and notification system in India.

evaluation process or screening (insect pests and diseases). Crop based quality parameters and tolerance to key abiotic stresses are also to be screened as per the requirement. Pre-coordinated trial data on yield, trait stability and other related agronomic traits must be available to the PC/PD in support of the relevance of his/her entry [4].

- The entry must have a high degree of genotypic stability, phenotypic uniformity, germination percentage and physical purity (as per the minimum seed certification standards).
- The entry must have few distinct diagnostic traits which make it different to all remaining varieties. These distinct traits help to identification of variety during legal infringement (DUS testing) [5].
- All the information related to the development of entry *i.e.* parentage or pedigree should be available to the PC/PD by the concerned plant breeder/ agency. If the performance of entries are same in the coordinated trials, then preference will be given to the variety which has been developed by the using of diverse parents in breeding program.
- Private companies can enter their material into the coordinated trial system as similar to other agencies but have to pay the prescribed fee for their entries as per guideline of the Government of India.

- All the material (product of selection, hybridization followed by selection, synthetics, composites, and hybrids, etc.) shall be subjected to the same system.

4. Three tier system

The AICCIP centers for various crops are located at ICAR institutes or State Agricultural Universities (SAUs) or other volunteer centers recommended by AICCIP workshop based on covered crop area, adaptability, and agro-climatic condition etc. It involves various steps [6].

4.1 Initial varietal trial (IVT)

The time duration of the initial varietal trial (IVT) is one year. All the entries, which were superior to their respective station trials, would be introduced into the IVT. These entries would be used for multi-location trials along with checks. In general, three checks (national, zonal and local checks) are being used for efficient evaluation of entries across the centers. The national check (a crop variety which had been released previously for whole country) would be used for a long period but zonal (a crop variety which had been released previously for specific zone) and local checks (high yielding local variety) can be replaced based on the requirement. These checks cannot be replaced after the IVT. Maintenance of genetic purity, germination and physical purity of new material are the prime objectives of the concern plant breeder/agency. The IVT trials are conducted in such a manner that minimum difference of yield (5–10%) and other ancillary traits can be measured. Experimental layout (experimental design, number of replications and treatments) is the prime responsibility of the PC/PD through concerned principle investigator. The cultural practices *i.e.* seed rate, date of sowing, row to row and plant to plant spacing; weed, fertilizer and water management etc. shall be strictly followed by the IVT centers as per guideline of PC/PD. The plot size of IVT is smaller than advanced trials. An IVT includes the maximum number of locations across the country to evaluate varietal adaptation and performance. The number of testing locations varies with crop across the zones. A team of scientists (plant breeder, agronomist, pathologist, entomologists etc.) will monitor all the trials as per the recommendation of the PC. Project coordinator constitutes monitoring teams (includes scientists from various disciplines such as plant breeding, agronomy and plant protection) for evaluation of trials. Each member of monitoring team submits their report to the PC based on their observation during trial monitoring. Each crop has different objective and requires different technical requirement for their evaluation. For example, The IVT centers will generate information related to days to flowering, physiological maturity, plant height, lodging, threshability, disease, and pest tolerance, green fodder yield, dry matter yield, and nutritional quality traits for forage crops. Technical program is formulated during workshop or national group meet and PC will specify characters on which data shall be recorded. Entries which are superior over the best check in terms of yield and other related traits will be promoted into the advance varietal trial-I. The superiority is primarily decided based on yield potential and other related important traits such as quality traits. In some agricultural crops, where a large number of entries enters into the IVT system then; IVT is preceded by testing of these entries for one year in the National Screening Nursery.

4.2 Advance varietal trial-I (AVT-I)

Based on superiority (5–10%) over the best performing check, superior entries will enter into the AVT-I from IVT. The number of tested entries in the AVT-I will be less than IVT. The plot size is large in AVT-I as compared to IVT, therefore data generated on yield and other ancillary traits will be more realistic, accurate and minimal chances of error. The number of testing locations should be more as compare to IVT in a given zone for more realistic data on yield and other economically important traits, varietal adaptation, biotic and abiotic tolerance, quality parameters, etc. National, zonal and local checks (which were used in IVT) shall be used for critical analysis along with the entries. During AVT-I, additional data on disease and or insect pest tolerance under artificial epiphytotic condition must be generated by the experts. Same as IVT, monitoring team would be deputed by the PC/PD at different growth stages of crop and observed data shall be submitted to the concerned PC/PD. Based on the performance of entry over the best performing check-in the respective zone, the superior entries would enter into the AVT-II.

4.3 Advance varietal trial-II (AVT-II)

All the requirements shall be fulfilled as similar to AVT-I. However, few additional data will be generated at AVT-II stage *i.e.* response of entries to different dates of sowing, seed rate, spacing between plant to plant and row to row (population density), behavior in different level of fertilizer and irrigation by sponsored agronomists; response of diseases and pests by the plant pathologists, crop quality parameters by the biochemists. The seed technology center will develop descriptors which help in the seed certification process. All the processed and analyzed data on yield and other related traits, across the locations/centers (cooperating and volunteer) shall be submitted to the PC. On the basis of these data, annual reports are being made in each crop. All the data of superior entries are comprehensively discussed in the annual workshop/national group meetings by the PC/project director. After completion of the AVT-II, the concerned breeders are informed to submit varietal proposal based on the performance of their entries during three years of evaluation.

5. Procedure for varietal identification

Based on three year performance, best performing test entries shall be identified in the annual crop workshop or national group meet at the pre-defined institute/university. The Zonal Coordinators and Principal Investigators attend the national group meet to provide wider aspects of information on the varieties. After the approval from Deputy Director General (Crop Science) of Indian Council of Agricultural Research (ICAR), a “Varietal Identification committee (VIC)” constituted in advance of annual workshop or national group meet. All the committee members (**Table 1**) shall be informed well in advance by the PC or PD [3]. Principal investigators (PIs) of different disciplines can assist in the process of discussion but they do not have the right to vote. Only committee members have the right to cast vote. The VIC provides detailed information on recommended entries to the Central Sub-Committee on Crop Standards, Notification, and Release. This committee has sole right to release and notify the best-performing entry into national wise or zonal wise based on the recommendations of the VIC.

S.N.	Representative	Organizational position
1	DDG (Crop Science)/ his or her nominee	Chairman
2	Project Coordinator/Project Director of AICCIP	Member Secretary
3	Director of Research of institute/SAUs of that region where the meeting is held	Member
4	Agricultural Commissioner (Department of Agriculture)	Member
5	One nominee of Seed organization (NSC, SSC)	Member
6	One representative of private seed agencies	Member
7	One representative of crop-based industries	Member
8	Project coordinator (seed technology)	Member
9	Two eminent scientists of that institute	Member

Source: [3] Tandon et al., 2015.

Table 1.

Organizational setup of varietal identification committee (VIC). The committee comprises one chairman and nine members.

6. Eligibility criteria for identification of the variety

- The candidate variety must have a minimum of three years of yield and other ancillary trait data from multi-location coordinated trials.
- At least two-year data on disease and pest reaction at a hot spot or artificial epiphytotic condition.
- The candidate variety must have at least one-year data on agronomic performance like seed rate, dates of sowing, planting density, irrigation, and fertilization. In forage crops, three year rigorous evaluation must be done for annual crops (seed yield data for third year only) and four year for perennial crops (one year for crop establishment and other three years for evaluation).
- The concerned breeder must have at least a minimum requirement of nucleus seed so that breeder seed can be generated easily.
- The concerned plant breeder should have pure seed for planting of 5 ha area. If he or she did not match the requirement, then identification can only be postponed for one year.

All these issues shall be discussed by the project coordinator in the annual workshop itself. The candidate variety must be phenotypically uniform (plant height, maturity, etc.) and stable in performance throughout the years.

7. Central sub-committee on crop standards, notification, and release

Central Sub-Committee on Crop Standards, Notification, and Release of Varieties appointed by Central Seed Committee under Section 3 of the seed act, 1966 during 1994. The committee comprised one chairman and 17 members (**Table 2**).

Central Sub-Committee releases varieties as per the benefit of the stakeholders and need of regional, zonal or national importance, and the State Seed

Sub-Committee releases varieties beneficial for particular state. Notification of variety is compulsory on regulating the seed quality under the provision of Seed Act, 1966. Notification usually authorizes certified seed production throughout the country, by private or public seed multiplication organizations. Once the Central Sub-Committee accepts the proposal, the varieties/hybrids will be released for the concerned agro-climatic zone/s (may cover one or more number of states or nationally). Simultaneously, it must be notified for seed certification purpose in the country. During the release, the concerned breeder must have a minimum amount of seed which can be sown at least ten-hectare area [3]. Later on, seed multiplication is the responsibility of various seed agencies (NSC, SSC, private seed companies and progressive farmers, etc.). The significant differences between released and notified varieties are illustrated in **Table 3**.

S.N.	Representative	Organizational position
1	Deputy Director General (Crop Sciences), ICAR	Chairman
2	Deputy Commissioner (QC) DAC & FW, GOI	Member Secretary
3	Directors of State Seed Certification Agencies, or their representatives	Member
4	Project Directors of Departments of Agriculture of all states, or their representatives	Member
5	Project Coordinators/Directors of AICCIPs	Member
6	Agricultural Commissioner, GOI	Member
7	Representatives of the seed industry, NSC, State Seed Corporations, private seed companies	Member
8	Representatives of ICAR, ICAR institutes, NGOs	Member
9	Progressive farmers	Member

Source: [7] SeedNet India Portal; QC-Quality Control, DAC & FW-Department of Agriculture, Cooperation and Farmers Welfare, GOI-Government of India.

Table 2.
 Organizational setup of central sub-committee on seed standards, release, and notification of variety (agricultural crops). The committee comprised one chairman and 17 members.

S.N.	Released variety	Notified variety
1	It is not a statutory function under the Seed Act, 1966	Statutory function and variety will be registered under Section 5 of seed act 1966.
2	It cannot be used for seed certification	Only notified varieties to come under seed certification
3	No guarantee on seed quality for farmers	Assured seed quality
4	Seed law enforcement agencies (seed inspector etc.) cannot draw and test seed samples	They have the right to draw and test seed samples
5	These are not assets of Govt. of India	Notified varieties are assets of Govt. of India
6	Its main purpose is to make available the information of cultivar to the public and its area of adoption	The main purpose is seed quality regulation
7	Difficult to trace out the genesis	The notification of the varieties will help to trace out its genesis.

Table 3.
 Critical differences between released and notified varieties.

8. Central seed committee (CSC)

It is a legal body constituted by the Department of Agriculture, Cooperation and Farmers' Welfare (DAC&FW), Ministry of Agriculture and Farmers' Welfare (MoA&FW), Government of India to advise central and state government on matters related to the implementation of seed act, 1966 and other related functions. The core committee includes one chairman and eight members to be nominated by the central government and one person to be nominated by the Governments of each State (Table 4). State Seed Committee (SSC) has a similar role at the state level. The CSC and SSC are empowered to release varieties but only CSC can notify those [8].

S.N.	Representative	Organizational position
1	Secretary, DAC&FW, MoA& FW, GOI	Chairman
2	Additional Secretary (In charge Seeds), MoA& FW, GOI	Member
3	Agricultural Commissioner, MoA& FW, GOI	Member
4	Deputy Director General (Crop Sciences), ICAR	Member
5	Joint Secretary (In charge Seeds), MoA& FW, GOI	Member
6	Progressive farmers/ seed growers (4) nominated by the Central Government	Member
7	One representative from each State Govt.	Member
8	Director of National Seeds Project, MoA& FW, GOI	Member Secretary

Source: [9] SeedNet India Portal; MoA & FW- Ministry of Agriculture and Farmers Welfare.

Table 4.

Organizational setup of central seed committee (CSC). The committee comprises one chairman and nine other members by the central government.

9. Empowerment of central seed committee

- The CSC has authority to release varieties (pure lines/hybrids/composites/synthetics) developed by central research institutes (ICAR/non-ICAR), AICCIPs, private or corporate sector, and other organization as per the scientific data authenticity for zonal basis (which may include more than one state) or at national level.
- The CSC has authority to approve proposals received from the State Variety Release Committees/State Seed Sub-Committees for varieties developed by the State Research Institutes but is considered suitable for areas outside the state (based on their performance).
- The CSC can delimit the regions or tracts for the cultivation of varieties approved for release.
- The CSC can advise the ICAR regarding the manner in which the National Register of Approved Varieties may be maintained, and to suggest the standard description of crop varieties.
- The CSC can notify kinds/varieties for the purpose of the Seeds Act and the areas of their notification.

- The CSC specifies minimum limits of germination percentage and purity for the notified kinds/varieties of seeds as per minimum seed certification standards.
- The CSC specifies the “mark” or “label” in respect of notified kinds/varieties.

The State Seed Sub-Committees are constituted by Central Seed Committee and are authorized to set up a State Seed Laboratory, State Seed Certification Agency (SSCA) and an Appeals Authority, and to appoint seed inspectors and seed analysts. The differences between Central Sub-Committee and State Sub-Committee are given in **Table 5**.

S.N.	Central sub-committee	State sub-committee
1	Authorized by Central Seed Committee	Authorized by State Seed Committee
2	Releases varieties for regional/zonal/national level	Only for concerned state/regions within the state
3	Statutory body for varietal notification	It cannot notify varieties
4	Notification followed by seed certification	Certified seed cannot be produced without notification
5	Members in the committee are appointed by the Central Govt.	Members in the committee are appointed by the State Govt.

Table 5.
 Critical differences between central sub-committee and state sub-committee.

10. Empowerment of state seed sub committee

There are some rights which have been provided by the Central Seed Committee for proper functioning of seed chain in respective state in India. These empowerments are-

- The State Seed Sub Committee will advise the state government on all matters related to the execution of the Seeds Act, 1966.
- Reviewing the implementation of the Seeds Act in the state and send periodic reports to the state government and the Central Seed Committee.
- Inspect, analyze and report on the State Seed Testing Laboratory.
- Advise on educational and promotional measures for proper enforcement and understanding of the Seed Act.
- Planning for different crop varieties to be grown in different regions of the state, and to review the assessment of seed requirements.
- Considering the release of new varieties for the state and recommend their notification to the Central Seed Committee.
- Monitoring the performance of newly released varieties in the state.

Being agriculture as a state subject in India, centrally released varieties are not directly accepted by all the states for which they have been released. Each state has its own regulatory system which they have to follow for varietal release in the state. They

have to pass through all the steps of the concerned state release procedure before they approve for cultivation in the state *viz.*, state wise multi-location trials for three years and adaptive trials based on the requirement. The notification requires that the variety must have been tested at least for one year in the AICCIP trials and recommended for release in the state by the AICCIP Varietal Identification Committee.

11. Necessity of notification

Since only notified varieties will be under the purview of Seed Law Enforcement, hence it is necessary to bring the seed of a particular crop variety under notification system. The seed inspector can only draw a sample from notified variety for analysis and ensure the seed quality [10, 11]. A released variety cannot come under seed chain without notification by the Gazette of India. Therefore, these issues will make the notification as necessary requirement for other things to act on it. The notification is made by the Central Government on the recommendation of the Central Seed Committee. Thus, notification is prerequisite for production of certified seed which ensures high quality of seeds to the farmers. After notification, variety becomes asset of government of India. The breeder seed can only be produced after the notification of variety and notified varieties enter into seed chain. Notification also helps in the genesis of original variety based on its pedigree and also regulates any kind of infringement in the later stages of varietal promotion.

12. Denotification of varieties

Released varieties can be denotified if they are not performing well in the area of their adoption or have been in cultivation for more than 15 years or are not much in demand. Denotification can be done based on the recommendation of central seed committee by the government of India.

13. Conclusion

There are several ways and means to increase the crop production and productivity, however using genetically pure and high-quality seed is first and prime objective in agriculture. Therefore the variety which will be used by farmers must have undergone several evaluations in order to ensure its stable yield potential, tolerance to biotic and abiotic stresses and these criteria are being fulfilled by a legal varietal release system. The main objective of the varietal release system in India is to introduce newly developed, high yielding varieties to the farmers for broad-spectrum cultivation in the area of their adoption and only those varieties will be notified which are superior to existing one. It provides choice to the farmers to cultivate a specific variety, based on their need for crop diversification. In India, the systemic framework has helped farmers to get high quality of seed from market and production has increased many folds since the inception of AICCPs. Notification is mandatory to release a variety, though the release process itself does not have legal cover.

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Conflict of interest

The authors declare no conflict of interest.

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