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Transformation of Variety Release and Notification System in India- Six Decades of the Seeds Act, 1966: A Review

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ABSTRACT

The official system of release of crop varieties in India has been in operation for more than six decades since October 1964. The Central Government decided to legalize this system and regulate the quality of seeds of varieties and enacted the seeds act on December 29, 1966. The act came in to force in whole of India and State of Sikkim with effect from September 2, 1968 and May 8, 1987, respectively and October 1, 1969 only for certain provisions of some sections. The first Central Seed Committee and Seed Rules were formed in 1968. The Seeds Act, 1966 was amended in 1972 resulting in to the creation of first Central Seed Certification Board in 1984. The first set of 56 varieties was notified with effect from October 1, 1969 as per section 5 of the Seeds Act, 1966; for specific state/s and for 15 years, but, the bar of 15 years for notification of varieties was removed in 2006 since the notification of May 15, 1990. A total of 7326 high yielding varieties/hybrids having tolerance of biotic and abiotic stresses and enhanced nutritional quality of 96 field crops have been released and notified till 2024. Among them, 242 varieties were de-notified until cut-off notification of May 15, 1990. Another land mark policy decision during the last six decades was enforcement of Protection of Plant Varieties and Farmers' Rights Act, 2001 and Protection of Plant Varieties and Farmers' Rights Rules, 2003 for protecting the rights of various stakeholders such as plant breeders, researchers and farmers initiating an era of intellectual property rights in agriculture and registration of 9210 varieties. The Central Government initiated regulating the price of Bt cotton since 2016-17. The future-regulating system of variety release and notification and seed quality through any legislation should address various issues like the plant variety protection regime including benefit sharing, development of varieties by utilizing new emerging technologies such as gene-editing, biotech crops and harmonizing Indian and international seed production/certification standards to cater the need of Indian farmers and also promote seed export.

Key words: Central seed certification board, Central seed committee, Field crops, Protection of plant varieties and farmers' rights act, 2001, Seeds act, 1966, Variety release and notification system.

Agriculture and allied sector (forestry and fishing) in India, during the last five years (2019-20 to 2023-24) contributed from 17.6% (2023-24) to 20.4% (2022-23) to the Gross Value Added (GVA) at the current basics. The growth of GVA due to this sector during the corresponding period ranged from 0.7% (2023-24) to 6.2% (2019-20) at constant (2011-12) basic prices. Agriculture and allied sector grew at 4.7% during 2022-23 at constant (2011-12) basic prices (Anonymous, 2024a). High yielding crop varieties coupled with quality seed are pivotal for Indian agriculture. Enhanced availability of quality seed of new varieties consequently increased seed and variety replacement rates in almost every crop during the last 15 years resulted in high yield and production (Chauhan *et al*., 2020, 2021, 2022). The present paper reviews the major land mark decisions pursuant to the Seeds Act, 1966 and their impact on system of release and notification of varieties, role of private sector in varietal development, intellectual property rights regime in India and also offers suggestions for future regulatory framework for quality seed production and promoting seed export.

Genesis of the Seeds Act, 1966 and landmark decisions during the last six decades

The central government (Government of India) thought it prudent to regulate the quality of seeds of the varieties and

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parliament passed seeds bill 1966 and that became the Seeds Act, 1966 (54 of 1966) on December 29, 1966.It has enabled the Indian Seed sector to be vibrant and globally competitive and also played important role in achieving and sustaining food security by providing quality seed to the farmers in the era after green revolution. It regulates the seed trade in India by providing standard frame work for quality seed production, testing and marketing including price regulation, thus, very well serves the interest of farmers. The central Government (Government of India) exercising powers conferred by various sections/sub-section/clauses/ sub-clauses of the Seeds Act, 1966 through statutory order (Explanation) [S.O. (E)] and general statutory rules (G.S.R.) from time to time amended the rules to match the emerging needs of different stakeholders, *viz*., researchers, farmers and seed industry during the past six decades to make Indian seed sector a vibrant one. In pursuance of sub-section 3 of section 1 of the Seeds Act,1966, Department of Agriculture under Ministry of Food, Agriculture, Community Development and Cooperation, Central Government notified vide S.O. 3122 dated August 29, 1968 and declared the enforcement of this Act in whole of India with effect from September 2, 1968 for the provisions of sections 1 to 6(both inclusive); 8 to 11 (both inclusive); 18 and 22 to 25(both inclusive) and vide S.O. 461 (E) dated May 8, 1987 in the State of Sikkim. However, provisions of the sections 7,12,1 to 17(both inclusive) and 19 to 21(both inclusive) of the Act came in to force with effect from October 1, 1969 vide S.O. 4049 dated September 24, 1969 and State of Sikkim with effect and May 8, 1987 (Anonymous, 2024f). A land mark notification was G.S.R. 389 (E) dated June 10, 1981 exercising the powers conferred by section 25 of the Seeds Act, 1966 amending rule 17 to 17A of Seed Rules (1968) and called Seeds (Amendment) Rules, 1981 that mandated certification agency to ensure that seed conforms to the Indian minimum seed certification standards published by Central Seed Committee and vide G.S.R. 63 (E) dated January 28, 2015 called seeds (Amendment) rules, 2014 where by form I to VIII were substituted (Anonymous, 2024f).

Ministry of Civil Supply, Government of India brought Seed under the Essential Commodities Act (ECA), 1955 (10 of 1955) by exercising powers conferred by sub-clause (xi) of clause (a) of section 2 of the ECA vide S.O.140 (E) dated February 24, 1983. The Central Government exercising powers conferred by section 3 of the ECA, vide S.O. 932 (E) dated December 30, 1983 made Seeds (Control) Order, 1983 defining, dealer licensing, enforcement authority, amendment of licence, maintenance of records and submission of returns and subsequently in 1994 appointed joint secretary (Seeds), as controller for the purpose of this order [S.O. 480 (E) dated June 29, 1994). Further, Seeds (Control) Order, 1983 was amended in 2006 [G.S.R. 444 (E) dated July 26, 2006] and Clause 8A was inserted mandating dealers to ensure that quality of seeds should conform to the prescribed standards for notified kind or variety of seeds under section 6 a, b of the Seeds Act, 1966 and any other specific standards relating to size, colour and content of the label [Seeds (Control) Amendment Order, 2006] and Seeds (Control) Amendment Order, 2014 further amended Seeds (Control) Order, 1983 [G.S.R. 890 (E) of December 12, 2014] amending paragraph 4 enhancing fees for license application and renewal of license (Anonymous, 2024f). The Central Government initiated regulating the price of Bt cotton since 2016-17 for the whole of India exercising authority as contained in sub-clause (1) of clause 5 of the Cotton Seed Price (Control) Order, 2015 vide S.O. 686 (E) dated March 8, 2016.

Central seed committee

The institutionalized and official variety-release system was adopted in India in October 1964. The Central Variety Release Committee (CVRC) at the Centre and State Variety Release Committee (SVRC) in various states were constituted for releasing the varieties. In pursuance of sub-sections 1, 2 and 3 of section 3 of the Seeds Act, 1966, the first Central Seed Committee (CSC) vide S.O. 3490 and 3491 dated September 26, 1968 was constituted with Joint Secretary and In-charge of Seeds Division as Chairman and Deputy Secretary (Seed Development), Department of Agriculture, ministry of food, Agriculture, Community Development and Cooperation, as Secretary with total strength of 29 members. The CSC took over the functions of CVRC in November 1969. The CSC constituted a Sub-Committee on Crop Standards, Notification and Release of Varieties (CSN and RV). The CSN and RV and State Seed Sub-committees discharge the function of release of varieties at central and state level, respectively. But, only the CSC is empowered to recommend to the Central Government to notify crop varieties for both central and states. The CSC witnessed several changes in Chairman, Member-Secretary and strength along with nomenclature of parent ministry over the years. The present Ministry of Agriculture and Farmers Welfare came in to existence after several transformations from first Ministry of Food, Agriculture, Community Development and Cooperation (1968); Ministry of Agriculture (1972); Ministry of Agriculture and Irrigation (1975); Ministry of Agriculture (1980); Ministry of Agriculture and Rural Development (1985); Ministry of Agriculture (1986); Ministry of Agriculture and Farmers Welfare (2015). Similarly, Department of Agriculture under the Ministry (1968) changed to Department of Agriculture and Cooperation (1979) until 2014 transformed to Department of Agriculture, Cooperation and Farmers Welfare (2015) and again changed to Department of Agriculture and Farmers Welfare (2021). The Chairman of the CSC also changed several times over the years; Joint Secretary and In-charge (Seeds Division) in 1968; Agricultural Commissioner in 1978; Additional Secretary (Crops) in 1981; Additional Secretary (Seed Development Section) in 1984; Secretary to Government of India (Department of Agriculture and Cooperation) in 1986. The Secretary of the CSC also changed from Deputy Secretary

(Seed Development) in 1968; Deputy Secretary (Seed Division) in 1970; Director (Seeds) in 1981; Director (Inputs) in 1984; Deputy Secretary (Seeds) in 1986; Deputy Commissioner (Quality Control) in 1991; Director (National Seeds Project) in 1993; Deputy Secretary (NSP) in 1996; to Deputy Commissioner (Quality Control and Certification) in 2001. The total strength of CSC also altered during the last six decades to address the emerging challenging and to provide adequate representation to various stakeholders from 29 in 1968 to 36 in 1970; 39 in 1978; 41 in 1984; declined to 37 in 1986 but again increased to 42 in 1991; 44 in 2001; 45 in 2008; 46 in 2010 and 45 in 2013 and 46 in 2018 (Anonymous, 2024f). Presently, the CSC is being Chaired by Secretary (Department of Agriculture and Farmers Welfare) with Deputy Commissioner (Quality Control and Certification), Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, as Secretary and has total strength of 46 [S.0. 2025 (E), April 27, 2022]. The CSC under section 3(5) reconstituted two Central Sub-committees on CSN and RV, *viz*., one each for Agricultural and Horticultural Crops being chaired by Deputy Director General (Crop Science) and Deputy Director General (Horticulture Science), ICAR, New Delhi [Order 3(5) dated June 6, 2022]. The CSC has fixed tenure of two years and being regularly reconstituted. The Sub-committee CSN and RV on Agricultural Crops and Sub-committee CSN and RV on Horticultural Crops had 92 and 31 meetings respectively, till 2024 (Anonymous, 2024f). The Central Government after consultation with the CSC has been notifying crop varieties for both central and states under the aegis of the concerned Department under the then Ministry since 1969. The crop variety notifications have been, invariably duly signed by Joint Secretary (Seed Division), Government of India. Nevertheless, a few variety notifications were signed by Director (Inputs), Seed Division (S.O. (E) 596 of August 13, 1984) and Additional Secretary (Seed Division) of the Ministry [S.O.(E) 1178 of July 20, 2007 and S.O.(E)1703 of October 5, 2007] (Anonymous, 2024f).

Central seed certification board

To maintain high quality seeds and propagating materials of notified kinds and varieties of various crops grown and distributed and sustain its uninterrupted availability to the stakeholders, a frame work for seed certification was devised to ensure the physical identity and genetic purity of varieties. It is a legally approved system for quality control of seed multiplication and production. The seed certification was conceptualized to address the issues of the rapid loss of varietal identity during production cycles. Swedish workers were the first to initiate the process of field evaluation of the seed crops with the visits of agronomists and plant breeders especially of progressive farmers who took seeds of new varieties from them. This process of field inspection was found very effective in maintaining the varietal purity in the production chain. In 1919, scientists from USA and Canada converged in Chicago, Illinois, USA and formed an international crop improvement association (ICIA) that later renamed as association of official seed certification agencies (AOSCA) in 1969 laying the foundation for present day seed certification. The field evaluation of the seed crop and its certification started in India with the establishment of National Seed Corporation, 1963. The agriculture ministry notified national seed corporation limited vide S.O. 4208 dated November 25, 1968 in pursuance of section 8 of the Seeds Act, as a certification agency for Uttar Pradesh State and also for Rajasthan (only up to March 1970) vide S.O. 550 dated December 12, 1969 (Anonymous, 2024f). However, with the enactment of the Indian Seeds Act in 1966 and formulation of the seed rules in 1968, the official seed certification agencies (SCAs) were created in different states in pursuance of section 8 of the Seeds Act, 1966. First official seed certification agency was established in Maharashtra during 1970 as a part of Department of Agriculture. However, Karnataka was the first state to have an autonomous seed certification agency in 1974 (Anonymous, 2024f). Certification is being carried out by certification agency notified under section 8 of the Seeds Act, 1966. Later on states have their own certification agencies and presently, in India, 22 and 18 states have SCAs and seed corporations, respectively. Globally as well as in India, certification of seed is not mandatory.

The Seeds (Amendment) Act, 1972 (55 of 1972) approved by Indian Parliament on September 9, 1972 (Anonymous, 2024d) amended the principal Act (the Seeds Act, 1966) bringing seedlings, tubers, bulbs, rhizomes, roots, cuttings, all type of grafts and other vegetative propagated materials of food crops or cattle fodder under its ambit. Several sections, clauses and sub-clauses were amended / added to the principal Act. The major changes were: Section 2 was amended to the extent in clause 11, after sub-clause (iii), a new sub-clause, namely, (iv) jute seeds was inserted. New sections 8A to 8E were inserted to empower the central government to create a central Seed certification board to advise the central as well as state governments on all matters pertaining to certification and coordinate the functioning of the agencies established under section 8. Further, the composition of board, duration and procedure for its functioning were also delineated under various sections inserted in section 8 of the principal Act Sub-section (3) of Section 9 of the principal act was amended by substituting the words ‘prescribed standards’ instead of ‘minimum limits of germination and purity specified for that seed under clause (a) of section 6’ provided that such standards shall not be lower than the minimum limits of germination and purity specified for that seed under clause (a) of section 6’. In sub-section (2) of section 25, after clause (f) another clause ‘(ff) the standards to which seeds should conform’ was inserted. Besides amendment 8A to 8E, the central government has adequate powers to give directions to the States under Section 23 of the principal Act. The Central seed certification board and

the Central Seed Committee have important role of advising the Central and State Governments in all matters pertaining to release of crop varieties and quality seed production.

Consequently, the Central Government vide S.O. 404 (E) dated May 24, 1984 in pursuance of powers contained in clause (i), (ii), (iii) and (iv) of sub-section 2 of Section 8A of the Seeds Act, 1966 reconstituted Central Seed Certification Board (CSCB) with Secretary, Department of Agriculture and Cooperation as Chairman; Director (Inputs) as Secretary and 18 members from both public and private sectors and farmers (Anonymous, 2024f). Public sector was represented by both central and state government officials including SAUs. The CSCB also evolved over the years as the case with the CSC. The CSCB has Deputy Secretary (Seeds) as Secretary and total of 22 members in reconstituted board during 1986; Director (National Seed Project) as Secretary in 1993; Deputy Secretary (NSI) as secretary in 1996; Deputy Commissioner (Quality Control) as secretary in 2001; Deputy Commissioner (Quality Control and Certification) in 2003. During 2012, the reconstituted CSCB has 17 members [S.0. 1769(E), August 9, 2012] but none was designated as Secretary. The total number of members in CSCB was increased to 22 [S.0. 4098(E), December 20, 2016] with Deputy Commissioner (Quality Control) as member secretary. Since 2019, the CSCB has strength of 21 members including Chairman but no Secretary or member secretary [S.0. 1071(E), February 28, 2019; S.0. 3513(E), August 24, 2021 and S.0. 1777(E), April 6, 2022]. The Secretary (Agriculture and Farmers Welfare), Ministry of Agriculture and Farmers Welfare is the Chairman of the CSCB (Anonymous, 2024f). The Board has fixed tenure of two years and being regularly reconstituted; provide the necessary guidelines for certification. On the recommendation of the Board, the Central Government published the first edition of Indian Minimum Seed Certification Standards in 1988 which was later updated during 2013 (Trivedi and Gunasekaran, 2013). Recently, to carry out certification work, Assam Seed Certification Agency for Arunachal Pradesh, Meghalaya, Nagaland and Tripura Seed Certification Agency for Mizoram and Manipur have been assigned the responsibility by the Central Government (F.No.13-49/2023 SD.IV E- 134332 dated October 22, 2024, (Anonymous, 2024f).

Impact of the Seeds Act, 1966 on variety release and notification system

Notification of varieties

The varietal identification committees under various AICRPs, chaired by Deputy Director General (Crop Science/ Horticulture Science) identify candidate varieties after three years of properrigourostesting of genotypes (Chauhan *et al.*, 2016a; Chand *et al.*, 2020). The proposals of identified candidate varieties are then considered by the Central Sub-Committee on CSN and RV for Agricultural or Horticultural Crops, as the case may be. The Central Seed Committee then either reject or accept the recommendations of the Sub-Committee and recommends to the Central Government to notify the varieties in the official publication, 'The Gazette of India'. The notification of varieties was issued earlier by the Department of Agriculture and Cooperation or Department of Agriculture, Cooperation and Farmers Welfare and now Department of Agriculture and Farmers Welfare and duly signed by joint secretary (Seeds). Candidate varieties those are identified through testing in the national programme through AICRPs for more than one state are termed as central varieties and the ones recommended by the States Sub-variety Release Committee as state varieties. Nevertheless, both follow the same chain of testing, identification and recommendation of the concerned Central Sub-committee on CSN and RV and finally approval of the Central seed committee.

Exercising powers conferred by section 5 of the Seeds Act, 1966, which mandates notification of varieties to qualify for entering the formal quality seed production chain, the Central Government after consultation with Central Seed Committee, issued the first ever notification to regulate quality of seeds of varieties vide S.O. 4045 dated September 26, 1969 that came in to effect from October 1, 1969. This notification contained a total of 56 varieties comprising 40 of cereals [rice (10), wheat (9), maize (14), sorghum (3) and pearl millet (4)]; three of oilseeds [groundnut (1) and soybean (2)], 12 of cotton and one of horticulture crop [bhendi]. Of these, 35 and 21 were for more than one and single state, respectively. Rice variety, IR 8, was released for the whole country except Gujarat. Further, S.O. 4046 dated September 26, 1969 notified the germination and purity limits with respect to seed of notified varieties (Anonymous, 2024f). The variety notifications were area specific, *viz*., varieties were notified for specific state/s and for a period of 15 years until 1978. Hence, there were multiple notifications of a variety for various states. Such varieties were also classified as central varieties in the present study. Thereafter, varieties were notified for the whole country but period of notification remained the same until 2006. The Central Government in pursuance of the clause (b) of section 6 of the Seeds Act, 1966 through S.O. 124 (E) dated February 2, 2005 amended the earlier notification number 767 (E) of November 6, 1991 and inserted that varieties would be notified for cultivation in State/s or Union Territories and season, thus, area specific varieties were again notified thereafter. Despite this notification, varieties continued to be notified and sold for the purpose of agriculture for the whole of India and area specific varieties. But, the notification/s released thereafter also continued to mention the applicability of notification for the whole country for marketing the seeds for the purpose of agriculture until 2010. But, the notification S.O. 1661 (E) dated July 20, 2011, clearly mandated that the varieties of seeds should be notified varieties to be sold for the purpose of agriculture in the state/s and union territories as specified in the notification. However, all the varieties notified irrespective of the state qualified for the

purpose of seed production and quality control for the whole of India until 2018. Since the notification S.O. 3220 (E) dated September 5, 2019 the varieties are being notified and marketed in the specified state/s only for the purpose of agriculture (Anonymous, 2024f). Till 2024 (The Gazette of India S.O.4388 (E) and S.O.4917 (E) of October 8, 2024 and November 13, 2024), 7326 high yielding varieties/ hybrids of 96 crops comprising cereals (13), food legumes (18), oilseeds (15), commercial crops (10) [cotton, jute and allied fibres (6), sugarcane, sugar beet and tobacco], forages (27) and other potential crops (13), have been notified in pursuance of section 5 of the Seeds Act, 1966 since the first notification in 1969 (Anonymous, 2024, f,g,h). Of these, 24 varieties were provisionally notified for two years and six varieties of rice from Bangladesh were also notified as per India-IRRI collaborative programme, for Bihar and West Bengal for three years. Among the total released varieties, cereals followed by food legumes has largest share of 48.3% and 18.8%, respectively (Fig 1).

De-notification of varieties

The seeds act, 1966 envisioned that after 15 years a notified variety would be de-notified for the purpose of seed production but also provided an opportunity for re-notification subject to recommendation of the variety sponsoring organization or state/s where the variety used to grow. Chauhan *et al.* (2016b) reported that 250 varieties were de-notified until 2006. However, Government of India vide S.O. 1573 (E) dated September 20, 2006 removed the bar of 15 years for notification of varieties by deleting the phrase 'period of 15 years' for notification of varieties since the notification number S.O. 386 (E) dated May 15, 1990 (Anonymous, 2024f). Thus, varieties of field crops released during 1969-1989 [until notification number S.O. 915 (E) November 6, 1989] were for a definite period of 15 years unless de-notified and those notified since S.O. 386 (E) dated May 15, 1990 were for indefinite period (Anonymous, 2024e). However, till the cut-off notification S.O., in all, there were 242 varieties stood de-notified (Shanmugham and Gunasekaran, 2003). And, 12 varieties de-notified since the S.O. 386 (E) dated May 15, 1990 and thereafter were again deemed to be notified and qualify for seed production in the formal seed chain. The highest number of de-notified varieties was in rice (54) followed by cotton (46) and wheat (31). Cereals (139), fibres (47), oilseeds (21) and food legumes (35) accounted for 57.4%, 19.4%, 8.7% and 14.4%, respectively, of the total de-notified varieties (Shanmugham and Gunasekaran, 2003).

Central vs state varieties

Of the 525 released and notified during 1969-1978, there was predominance of state released varieties (79.1%). Except, this period, the varieties were released and notified for the entire country until 2010. During the last decade (2011-2020) and first four years of the current decade, of the 3405 notified varieties, 1836 (53.9%) were central varieties (Fig 2). The number of centrally released varieties surpassed that of state varieties and contributed 51.8% and 56.5%, respectively, to the total released and notified varieties in India during the corresponding period (Anonymous, 2024f, g).

Public vs private varieties

Chauhan *et al*. (2016b) and Prasad *et al*. (2017) comprehensively discussed the genesis of seed sector since 1929 and quality assurance systems prevalent in India. Third phase of the World Bank Supported National Seed Project launched in 1989-90 played a pivotal role in empowering private seed industry in addition to various public sector organizations. Indian seed sector has evolved gradually since 1960's with involvement of large number of private firms with focus on research and development especially

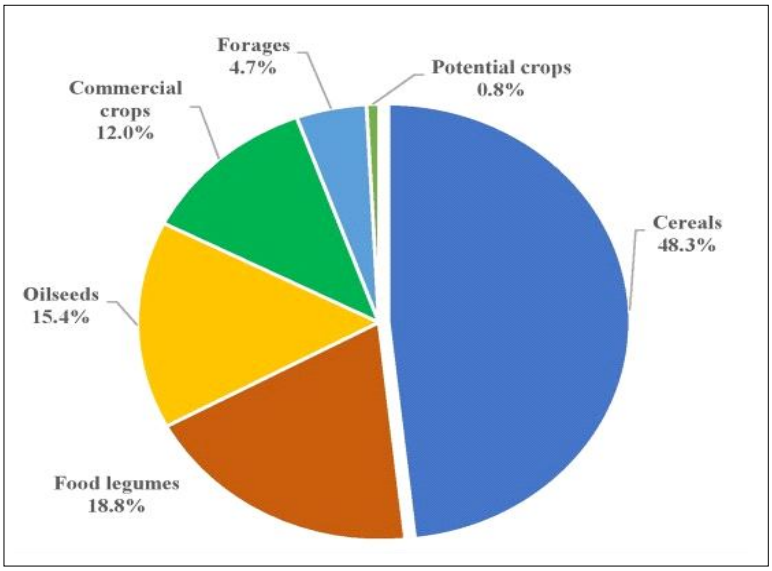


Fig 1: Share of different field crops in the total number of varieties released during 1969-2024.

crop breeding and private sector attained rapid-growth under liberalized government policies. Nevertheless, the private sector has been involved in large scale production and marketing of quality seed especially, of vegetables and hybrid corn, cotton, pearl millet, rice, sunflower and Indian mustard. The share of private sector in quality seed production during the last 20 years increased from 38.9% (2009-10) to 74.0% during 2022-23 (Anonymous, 2024a). Multinational companies have their own breeding programmes and also market the product whereas, Indian companies have breeding programme on limited scale and also market the crop varieties developed by the public sector organizations. But, both were not the part of national variety release and notification system. Because, notification and certification of variety is not essential and only labelling is mandatory for marketing seed in India. The New Policy on Seed Development (NPSD) of 1988 envisioned enhancement of seed replacement rate of various crops to attain higher food production and also create conducive environment for growth of the competent localized seed industry by permitting import of useful germplasm. The objective of the NPSD was to make globally available the best seed and planting materials to the Indian farmers. Accordingly, the imports of seed in small and large quantities were permitted for vegetables, flowers, ornamentals, oilseeds, pulses, fodder and coarse cereals like maize, sorghum and other millets following the extant guidelines of Government of India (Chauhan *et al*., 2016b). Modification of the NPSD (1988) in 2011 allowed the import of wheat and rice also. Further, Government policies like New Industrial Policy (1991), Export and Import Policy (2009-14) and subsidies only for seeds of released and notified varieties encouraged the private seed companies to have a dynamic breeding programme and get varieties formally released and notified as central and/or state. This led to vigorous efforts by the private sector and consequently its share increased in number of formally released and notified varieties which was earlier only the domain of public sector organizations. During 1991-2005, 23 imported varieties/ germplasm lines by private sector having special traits like high oleic oil sunflower, sweet sorghum, low erucic and low glucosinolates rapeseed, corn hybrids and a cytoplasm-male-sterility based cotton hybrid (PKVHY-2 [AHH 468]) from public sector were provisionally notified for two years (Shanmugham and Gunasekaran, 2003). And, several of them such as PAC 36 and PAC 1091 of sunflower and Hyola 401 of gobhi sarson notified provisionally in 1992, 1992 and 1997, respectively, were later notified during 1998, 1998 and 2001, respectively, as per the extant guidelines under section 5 of the Seeds Act, 1966. Nevertheless, private sector varieties were notified as early as 1978 (Nimbkar 1 of cotton) and 1982 (Lok 1 of wheat; JK Hy.1 and JK Hy.11 of cotton). Until 2010, there were only 83 notified varieties of cereals, oilseeds and cotton from the private sector (Anonymous, 2024 f, g). Overall, 577 varieties of field crops from private sector were released and notified since 1969 in India (Fig 3) with the cereals (rice, wheat, maize, pearl millet and sorghum) and commercial crops (cotton, jute, sugarcane) have predominant share of 56.8% and 31.2%, respectively. Private sector predominantly contributed (161) to the total Bt varieties/hybrids of cotton (193) released in India.

Protection of Plant Varieties and Farmers' Rights Act, 2001

India joined World Trade Organization (WTO) in 1995. On being signatory to the WTO agreement, mandating each member country to implement the agreement on trade related aspects of intellectual property rights (TRIPS) by either following International Union for Protection of New Plant Varieties (UPOV) convention framework of plant breeders' rights or having *sui generis* system of protection of plant varieties (PPV) but should also be in conformity with UPOV. The UPOV Convention was adopted in Paris, France in 1961 and was revised during 1972, 1978 and 1991, but, India is not a member (Gautam *et al*., 2012). But,

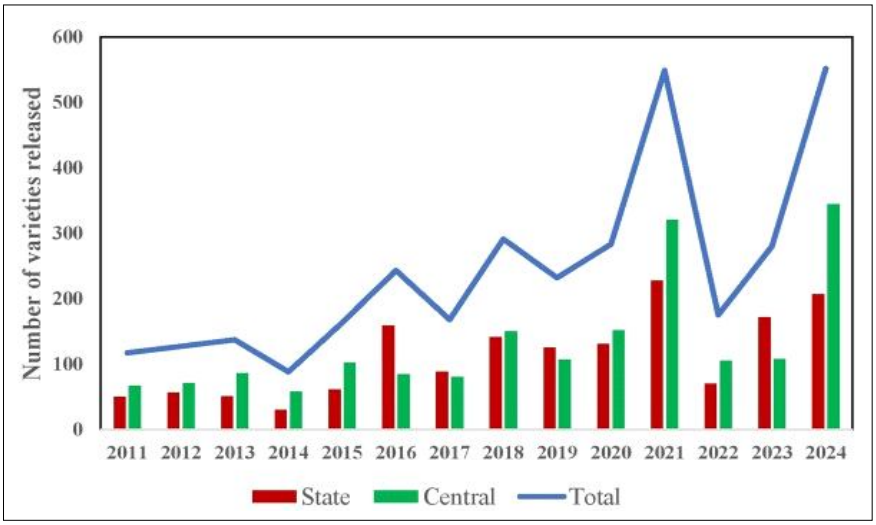


Fig 2: Total, state and central varieties released during 2011-24.

UPOV convention prevents the farmers from either reusing the farm-saved seeds or exchanging them with their neighbours.In pursuance of WTO agreement, India enacted Protection of Plant Varieties and Farmers' Rights Act (PPV and FRA) [53 of 2001) on October 30, 2001 after meaningful consultations among the diverse stakeholders, thus, launched intellectual property rights (IPR) regime in Indian Agriculture and legal frame-work to regulate it. The PPV and FRA, 2001 recognizes Breeders' Rights, Researchers' Rights and also envisions defining and protecting Farmers' Rights. It recognizes farmers as plant breeders and they can register their varieties; farmers engaged in the conservation of genetic resources of land races, wild relatives of economic plants and their improvement through selection and preservation are recognized and rewarded and protecting the traditional practices of the farmers of saving seeds from one harvest and using the saved seeds for sowing for their next harvest or sharing them with other farm neighbours. Farmer can save, use, sow, re-sow, exchange, share or sell his farm produce including seed of a variety protected under the PPV and FRA, 2001 in the same manner as prior to this Act. But, he cannot sell the branded seed of a protected variety under the Act. There is a provision for compensation to the farmers for non-performance of a variety under section 39(2) of the act. However, farmers were exempted from the liability of the infringement of the Act. The Act besides protecting the IPR also envisions accelerating agricultural development in India and promoting investment for research and development and vibrant and competitive seed industry ensuring availability of quality seed and planting materials to the Indian farmers. The PPVAFRA, 2001 came in to force in whole of India with effect from November 11, 2005 (ss. 2 to 13 (both inclusive) vide notification No. S.O. 1588 (E) November 11, 2005 and ss. 95, 96 and 97 and ss. 1 and ss. 14 to 94 (both inclusive) with effect from October 19, 2006 vide notification No. S.O. 1797 (E) October 19, 2006 and clause (d) and many other clauses in the PPV and FRA, 2001 were either omitted or substituted by Act 33 of 2021 with effect from April 4, 2021(Anonymous, 2024f). The PPV and FR Rules, 2003 were published vide G.S.R. 738 (E) of September 12, 2003 and also amended by G.S.R. 834 (E) of December 30, 2004; G.S.R. 731 (E) dated October 14, 2008, inserting a fee of Rs.1000 for registration of extant varieties as notified under section 5 of the Seeds Act, 1966. The PPV and FR Rules, 2003 related to fees and posts under various schedules were also amended in 2009 called [PPV and FR (Amendment) Rules, 2009] vide G.S.R. 901 (E) dated December 19, 2009 and [PPV and FR (Amendment) Rules, 2015] vide G.S.R. 494 (E) dated June 15, 2015 (Anonymous, 2024e).

Protection of Plant Varieties and Farmers' Rights Authority was established by Department of Agriculture and Cooperation, Ministry of Agriculture on November 11, 2005. The Authority has 15 members with Chairman as Chief Executive Officer and Registrar General as Member Secretary. The PPV and FR Authority has five branch offices at Ranchi (Jharkhand), Guwahati (Asam), Pune (Maharashtra), Palampur (Himachal Pradesh) and Shivamoga (Karnataka); each has notified jurisdiction area in the country. The PPV and FR Authority established Plant Registry under the Chairmanship of Registrar General of the Authority that registers diverse kinds of plant varieties (Gautam *et al*., 2012) such as New Variety [NV] (a variety meeting the criteria of novelty, distinctiveness, uniformity and stability); Extant Notified Variety [ENV] (a variety available in India and is notified under section 5 of the Seeds Act, 1966 and no field tests are conducted for evaluating DUS); a Farmers' Variety [FV] (a variety has been traditionally cultivated and evolved by the farmers in their fields or is a wild relative or land race or a variety about which farmers possess the common knowledge); Extant

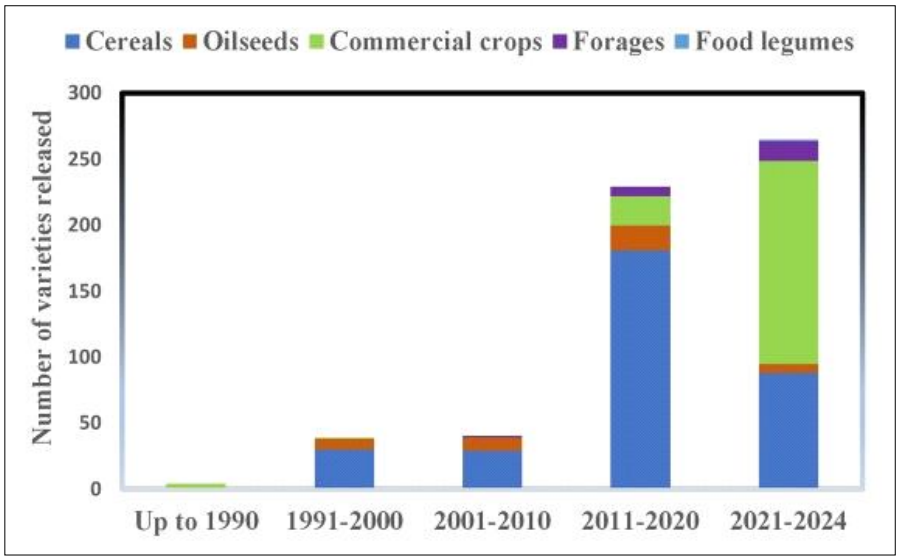


Fig 3: Varieties of different field crops developed by private sector during the last six decades.

Variety of Common Knowledge [VCK] (a variety which is not released and notified under the Seeds Act, 1966 but well documented through publications or any other variety that is in public domain and about which there is common knowledge, common knowledge is information that is widely known, undisputed and easily verified). The Government of vide G.S.R. No. 452 dated June 29, 2009 in The Gazette of India notified the criteria for DUS for registration of farmers' variety and a variety about which there is common knowledge. Essentially Derived Variety [EDV] (a plant variety that is predominantly derived from another variety or from a variety that is itself derived from the initial variety conforming to the initial variety in all aspects except for the differences that result from the Act of derivation).

The Central Government utilizing powers contained in sub-section (2) of section 29 of the PPV and FRA, 2001 notified first set of 11 crops for registration of varieties under the said Act vide S.O. 993(E) dated April 10, 2010 (Anonymous, 2024f) cumulating to 205 until S.O.1836(E) dated April 25, 2025. The Authority after notification of crops initiated formulation of guidelines for registration. The basic requirement for registration of varieties was distinctiveness, uniformity and stability (DUS) of a variety. Consequently, crop specific DUS guidelines were developed after engaged consultations among the stakeholders and crop specific DUS centres were identified. A total of more than 160 DUS centres were developed till date (https:// plantauthority.gov. accessed on July 4, 2025). The registration that started with 12 crop species in 2007 (Gautam *et al*., 2012) reached to 203 crop species until 2024 after preparing the DUS guidelines for diverse crops comprising cereals, pulses and legumes, oilseeds, fibres, sugar crops, spices crops, vegetable crops, flowering plants, medicinal and aromatic plants, tree species, forest and plantation crops, fruit crops, cash crops and cotton.

The PPV and FR Authority received 19888 applications and issued registration certificates for 9210 varieties for granting protection rights as on June 30, 2025. The first set of 168 varieties was registered during 2009. Number of registered varieties increased substantially over the years except 2010 when it was the lowest (49), the number peaked to 833, 1259 and 2017 during 2014, 2023 and 2024, respectively. Of the total varieties registered, field crops accounted for 86.2% (7943) of the total certificates issued comprising cereals (5727; 62.2%), fibres (873; 9.5%), legumes (747; 8.1%), oilseeds (518; 5.6%) and sugar crops (78; 0.8%). Among the 1102 horticultural crops, contribution of vegetables and fruits was 9.0% (829) and 2.9% (273), respectively. The other crops (spices, trees and plantation, flowers, medicinal and aromatic and cash crops) accounted for only 1.8% (165) of the registered varieties. Majority of the registration certificates issued were for farmers' (4847; 52.6%) followed by private (2410; 26.2%) and public sector (1953; 21.2%) varieties. Of the total certificates, 35.6% were issued during 2023 and 2024 only (https: //plantauthority.gov. accessed on July 15, 2025). Among the various categories of varieties registered, the contribution of new varieties and EDVs was only 15.6% and 0.2%, respectively, (Fig 4).

Future outlook

To achieve and sustain the food and nutritional security of the country in future, supply of quality seeds of highest standard is foremost input of agrarian enterprise. The Seeds Act, 1966 has been playing a pivotal role in the service of the farming community in the country by providing quality seed at affordable prices. But, this act has certain limitations like only covering notified varieties, thus, excluding a large number of varieties from the stringent quality control mechanism, being marketed in the country by private as well as public sector. Further, notification of variety and certification are not mandatory. Commercial crops, plantation crops and transgenic materials fall outside the ambit of this act. Seed quality control measures like certification and seed testing are exclusively under public sector regime (Anonymous, 2024b).

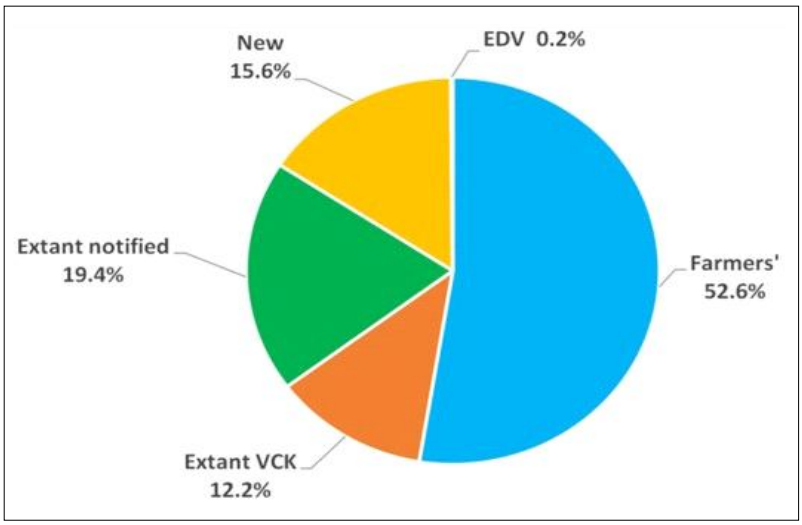


Fig 4: Category-wise distribution of registered varieties in India.

Further, in view of the changing seed production technologies, emerging new technologies such as transgenics, tissue culture, soil less agriculture, liberalised economy and greater participation of private seed sector and increasing seed import and export avenues. There is greater thrust on seed quality assurance with safeguarding interest of the farmers. Therefore, there is urgent need to up-scale seed production, quality and regulatory standards. To address all these concerns, the seeds bill was introduced in the Rajya Sabha on December 9, 2004 and has been referred to the standing committee on agriculture (Anonymous, 2024b). The Seeds Bill, 2004 aims at to regulate the quality of seeds sold and replace the Seeds Act, 1966. The significant features of the Bill are:

- Compulsory registration of varieties for a fixed period but can be prematurely cancelled for specifically stated reasons and no business of selling or supplying any seed of unregistered variety but farmers are exempted from compulsory registration.
- Enhancement of penalties: Penalties of Rs.500/Rs.1000 with or without imprisonment (The Seeds Act, 1966) will be enhanced to Rs.25,000/Rs.5,00,000 with or without imprisonment.
- Labelling of expected performance is mandatory to assure quality of seed sold to the farmers.
- Compensation to the farmers for the losses in case of seed failure.
- The Farmers' Rights as envisioned in the PPV and FRA, 2001 shall be protected.
- Seed health is an additional standard for quality seed.
- **Regulate import and export of seeds:** The import of seeds shall be subjected to Plant Quarantine [PQ] (Regulation of Import in to India) Order 2003 and other relevant acts and conform to minimum seed health standards in addition the extant ones. All imports of seed shall be subjected to registration.
- **Declaration of genetic use restriction technology (GURT):** Importer of seed or planting materials needs to declare that such material is or is not a product of transgenic manipulation or involve GURT.

The Seed Bill, 2004 was amended twice, *viz*., November 9, 2010, for the figure year 2004, the figure year 2010 was substituted besides many other changes and later on February 17, 2011 again substituting the figure year 2004 by the figure year 2011 (Anonymous, 2024d). Despite all these developments, the said seeds bill has yet to be passed by Parliament to become an Act and replace the Seeds Act, 1966. The Ministry of Agriculture and Farmers' Welfare released draft Seeds Bill 2019 in the public domain on October 19, 2019 for views and comments. Consultations among the various stakeholders were again pursued in 2020 to pass this bill. The National Academy of Agriculture Sciences (NAAS) intensely deliberated the said bill along with challenges to Indian Seed Sector and made certain recommendations for evolving a robust seed policy and developing state-of-art seed system infrastructure in the country (NAAS, 2020).The major comments on the draft Seed Bill 2019 were expansion of ambit of bill by bringing agri-horticultural, forestry, green manures, narcotics, plantation, medicinal and aromatic plants; registration of varieties should be extended to the transgenic crops also; mandatory registration of seed producers, processing plants and plant nurseries; seed health; inclusion of farmers in the apex policy making body like Central Seed Committee; compensation to the farmers and enhanced penalties (NAAS, 2020).

Biotech crops

Despite uncertainties on adoption of genetically modified crops as except Bt cotton no other crop was approved for cultivation. But biotech crops developed through utilizing molecular breeding and several other approaches of genetic manipulations such as gene-editing are the future crops. The Indian Council of Agricultural Research (ICAR) initiated AICRP on Biotech Crops during 2023-24 and later in April 2024 rechristened it All India Network Project on Biotech Crops involving four agricultural (pigeonpea, cotton, sugarcane and groundnut) and three horticultural (potato, banana and pomegranate) crops. Recently, ICAR launched a mega project on 'Enabling climate resilience and ensuring food and nutritional security through genome editing in agricultural and horticultural crops' in February 2024 until March 31, 2026. The project involves 27 agricultural and 15 horticultural crops with a budgetary provision of Rs.500 crores. The Ministry of Environment, Forest and Climate Change (MoEF and CC), Government of India in 2022, exempted genome-edited plants without 'foreign gene/free exogenous DNA' derived from the process of SDN1 and SDN 2 and thus allowing open field trials and eventual characterization and release of such products to the farmers. The Seeds Bill 2019 should also include regulation of such products and also address IPR issues involved.

Harmonization of Indian and international seed production/certification standards

Owing to availability of largest arable land in the world with diverse agro-climatic conditions, making production of seed of any variety or any crop feasible, India have great opportunity for seed export also besides fulfilling seed requirement of its own. During 2024-25, availability quality seed (5.32 m t) was higher by 10.4% than the requirement (4.82 m t). Indian seed market was valued at US$ 4.9 billion during 2021 accounting for about 11.3% of the global seed market and projected to grow at much faster CAGR of 6.6% during 2022-27 (Anonymous, 2024c). Global seed trade during 2022 revealed that India earned foreign exchange worth US $ 177.0 million by exporting 84367 t seeds of field crops, vegetable crops and flowers. Of this, field crops had major share of 46.3% (value) and 78.2% (quantity). However, India's contribution to global seed export was extremely low 1.10% (quantity) and 1.09% (value). India also imported 41662 t seed of various crops costing US $

175.0 million almost negating the export earnings and its share in the global seed import was only 0.59% in quantity and 1.21% in value.The share of field crops was 74.4% (quantity) and 32.0% (value) in the total import to India (Anonymous, 2025). In pursuit of increasing seed export, India joined OECD seed schemes in 2008 and launched Indo-german collaboration in seed sector during 2014 to be OECD compliant state. International seed testing association (ISTA) provides international seed standards and ISTA accredited laboratories are authorized to issue orange and blue international seed analysis certificate which is indispensable for global seed trade. But, in India, of the eight ISTA accredited laboratories only two are in the public sector despite having 167 public sector notified seed testing laboratories in the country. Prasad *et al.* (2017) compared the global and Indian seed quality assurance systems and suggested need for revisiting Indian minimum seed certification standards, 2013. The future-legal frame should have robust seed policy encompassing harmonizing seed production, certification and testing standards and create competent human resources and state-of-art infrastructure matching international seed industry, regulatory systems, market intelligence and IPR issues to create demand for seed and facilitate export.

CONCLUSION

The Seeds Act, 1966 came in to force with effect from September 2, 1968 paving the way for the creation of robust regulatory-frame work for quality seed production in India by establishing central seed committee and central seed certification board. Currently, there are 22 state seed certification agencies and 18 state seed corporations in India. Timely interventions were made by government of India exercising powers conferred under various sections /sub-sections /clauses/sub-clauses of the seeds act, 1966 through various statutory orders (Explanation) or general statutory rules to address the emerging challenges and issues and make the system relevant and effective. A total of 7326 high yielding varieties/hybrids of 96 field crops including 577 from the private sector have been released and notified since 1969 until 2024. Among them, 242 varieties were de-notified. Intellectual property rights regime in agriculture was initiated by enacting PPV and FRA, 2001 and 9210 including about 52.6% farmers' varieties were registered. Some suggestions such as Intellectual property rights including benefit sharing, use of new emerging biotechnologies and harmonizing Indian and international seed production/certification standards should be adequately addressed in future seed regulatory frame-work.

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Conflict of interest

The authors declare that they have no conflict of interest.

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