



Mapping the Landscape, Challenges, and Opportunities for International Seed Trade in India - A Fact Finding Study

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SeedNL

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Abbreviations Used

ABS	Access and Benefit Sharing
ADG (Seeds)	Assistant Director General (seeds)
AICRP	All Indian Coordinated Crop Research Project
ASI	Access to Seed Index
BDA	Biological Diversity Act, 2002
BS	Breeder Seed
CAGR	Compound Growth Rate
CAU	Central Agricultural University
CBD	Convention on Biodiversity
CGIAR	Consultative Group on International Agriculture Research
DAC	Department of Agriculture and Cooperation
DPPQS	Directorate of Plant Protection, Quarantine and Storage
DUS-Test	Distinctness, Uniformity and Stability Test
EDV	Essentially Derived Varieties
EXIM	Export-Import
EU	European Union
FAO	Food and Agriculture Organisation of UN
FS	Foundation Seed
GM	Genetically Modified
GOI	Government of India
HYV	High Yielding Varieties
IARI	Indian Agricultural Research Institute, New Delhi
ICAR	Indian Council of Agricultural Research
IFFCO	Indian Farmers Fertiliser Cooperative Limited
IISS	Indian Institute of Seed Science, Mau
IIVR	Indian Institute of Vegetable Research
INR	Indian Rupee
IPR	Intellectual Property Rights
ISPM	International Sanitary, Phytosanitary Measures
ISTA	International Seed Testing Association
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
JS(S)	Joint Secretary (Seeds) (DAC&FW)
KRIBHCO	Krishak Bharati Cooperative Ltd.
KVK	Krishi Vigyan Kendra (Agriculture Extension Centre)

LS	Labelled Seed
MLT	Multi Location Trials
MNCs	Multinational Companies
MOA&FW	Ministry of Agriculture and Farmers Welfare of India
MOEFCC	Ministry of Environment, Forests and Climate Change
NAAS	National Academy of Agricultural Sciences
NBA	National Biodiversity Authority of India
NBPGR	National Bureau of Plant Genetic Resources
NPPO	National Plant Protection Officer
NPSD	National Policy on Seed Development
NS	Nucleus Seed
NSAI	National Seed Association of India
NSC	National Seed Cooperation
NSPM	National Sanitary, Phytosanitary Measures
OECD	Organization for Economic Co-operation and Development
OPV	Open Pollinated Varieties
PEQ	Post-entry quarantine
PGR	Plant Genetic Resources
PPV & FRA	Protection of Plant Varieties and Farmers' Rights Authority
PPV&FRA, 2001	Protection of Plant Varieties and Farmers' Rights Act, 2001
PRA	Pest Risk Assessment
PVP	Plant Variety Protection
QDS	Quality Declared Seed
R&D	Research & Development
SAARC	South Asian Association for Regional Cooperation
SAUs	State Agricultural Universities
SATHI	Seed Authentication, Traceability and Holistic Inventory
SFCI	State Farms Cooperation of India
SIAM	Seed Industry Association of Maharashtra
SMSP	Sub-mission of Seeds & Planting Material
SMTA	Standard Material Transfer Agreement
SPS	Sanitary and Phytosanitary measures

SRR	Seed Replacement Rate
SSC	State Seed Cooperation
SSCA	State Seed Certification Authority
TL	Truthfully Labelled (Seed)
UPOV	International Union for the Protection of New Varieties of Plants
USD	US Dollar
VCU-Test	Value for Cultivation and Use Test
VRR	Variety Replacement Rate

Preamble

SeedNL, a Public-Private organisation, which was established in February 2020 by the Netherlands Min. of Agriculture, Nature and Food Quality, the Netherlands Min. of Foreign Affairs, & Plantum, aims to strengthen the seed sector in other countries, provide appropriate access to quality seeds for all farmers and increase productivity and farmers' income, engaged Dr. Malavika Dadlani, former Joint Director (Research), former Head, Division of Seed Sci. & Technol., IARI-ICAR, and former President, Indian Society of Seed Technology to conduct this study during Nov. 2023 to April 2024.

I. Methodology: The preparation of this document is based on the facts elicited from:

1. Examination of datasets, reports and other documents pertaining to seed chain, regulations and related issues available in the public domain.
2. Collection of information from industry partners using formatted questionnaires, and personal interactions.
3. Engagement with seed industry associations for collective viewpoints for identifying the major problems in the sector, mapping the gaps, and future outlook.
4. Interactions with the officials of various government departments* (both at Central and State levels) to discuss the major concerns expressed by the industry partners and seeking possible ways to address these.
5. Interactions with breeders and seed specialists from research organisations, industry veterans*; and further discussions with seed industry for their feedback on #4.
6. Collective engagements with industry partners, associations and government departments during the National Seed Congress organised by the DAC, GOI and ISST, at Aurangabad during 11-13 December, 2023, and Gujarat Seed Congress organised by Gujarat Seed Association on 21 Dec, 2023 at Gandhinagar.
7. Synthesis of information and preparation of Report.

8. Presentation of the draft at Stakeholders Workshop, follow up and revisions.
9. Presentation of the findings at two Round Tables organised in the Netherlands and in India for further discussions, and revision.
10. Submission of the final report.

*List of persons interacted and interviewed is attached as Annexures 1.

II. The National Scenario

Agriculture engages 44.5% of the total workforce and contributes 17.5% to the gross domestic product in India (GOI, 2020). This heavy dependence of the work force makes agriculture a critical sector to foster inclusive economic growth. Indian agriculture has registered a substantial growth during the last 50 years, transforming the food scenario, during which the production of major agricultural commodities such as food grains, vegetables, fruits, milk, egg and fish increased several folds, resulting in increased per capita availability of food despite the concomitant increase in population. As a result, while population grew 3.81 times between 1951 and 2021, the food production increased to 8.83 times, raising the per capita food availability by 2.30 times (R. Chand & J. Singh, NITI Working Paper 02/2023). Quality seed of improved plant varieties played a key role in this transformation. Today the Indian agriculture is moving towards commercialization, strengthening direct and indirect linkages between farm and non-farm sectors. Such linkages are expected to generate better income and employment opportunities within and outside agriculture, leading to an overall economic growth (NAAS Policy Paper 98, 2021).

III. The Indian Seed System

The national seed supply system in India developed through the 60s and 70s with an effective liaison between the public research institutions and seed production organisations, enactment of Seeds Act, 1966 and establishment of the National Seed Corporation in 1963, and of several State Seed Corporations subsequently. The All India Coordinated Crop Improvement Projects in different field crops, vegetables, and seed (NSP) played vital roles in developing improved varieties of different crops suitable for different agro climatic conditions, whereas the ICAR institutions and agricultural universities (SAUs and CAUs) make available breeder seeds (BS) of these varieties to the public as well as private seed companies for further multiplication and marketing. There are more than **5800 varieties released through AICRP in field crops and over 500 in vegetables**, though only about 10% of these are in seed supply chain. A close collaboration with international organizations, particularly the Consultative Group on International Agriculture Research (CGIAR) institutes, contributed significantly in variety development programmes by providing access to the germplasm available globally, conducting collaborative research, collective testing and evaluation. Introduction of semi-dwarf, high yielding and fertilizer responsive varieties of primary food

security crops wheat and rice ushering the Green Revolution was a landmark in the history of Indian agriculture, which highlighted the contribution of seeds of genetically improved varieties, which was produced mainly by the NSC, SSCs and cooperatives eg., KRIBHCO, IFFCO etc.

In the subsequent years liberalised seed policies (New Policy on Seed Development, 1988, National Seed Policy, 2002), and introduction of Protection of Plant Varieties & Farmers' Rights Act, 2001 (PPVFRA, 2001) contributed significantly in strengthening the seed sector by increased competitiveness, more investment in seed sector, and improving the availability of the seed and planting material of superior varieties and hybrids in India through research, production, import and export. ***This not only improved the agricultural productivity, but also created rural employment opportunities in hybrid seed production, specially of vegetables with high profitability (B:C ratio 2.77:1; Poonia, 2013), and created other commercial horticulture avenues, such as multiplication of planting materials of fruit plants and vegetables, and floriculture for domestic and export markets etc.***

The public sector agencies involved in research and production of seed (mainly Breeder Seed – BS, also some quantity of TL and CS) and planting materials, comprise of 65 ICAR Institutes, three Central Agricultural Universities (CAUs), 48 State Agricultural Universities (SAUs), National Seed Corporation Ltd (NSC), and 17 State Seed Corporations (SSCs). Whereas, the quality control is ensured through the monitoring of BS, and inspection of Foundation and Certified seeds (FS & CS) by 25 State Seed Certification Agencies (SSCAs) and testing in 145 Notified Seed Testing Laboratories (STLs). However, certification of seed is not compulsory in India, but labelling is. Public sector seed producing agencies normally deal in the production and marketing of Certified seed (CS) of open pollinated varieties (OPVs) of major field crops, and distribute at least 50% of these through the government schemes and programmes. NSC is the largest public sector seed agency, which annually produces seeds of an unparalleled number of ~600 varieties of >60 crop species meeting the needs of different regions through its 12 Regional Offices, and a network of 2,800 dealers. It owns >22,000 ha farm land for seed production and trial purposes, in addition to nearly 8,500 registered seed growers (Report of NSC Review Committee, 2023). The State Seed Corporations (SSCs), on the other hand, produce mostly the seeds of crops / varieties popular in their respective or neighbouring states. In general the public sector seed corporations deal in high volume seeds of food security crops with low profitability. NSC and SSCs have very high potential for export of certified seeds of 259 varieties of 31 crops listed under OECD (many of which are produced by the seed corporations routinely), particularly to the African, South and South Eastern Asian, Central Asian and Middle Eastern countries. It can also enlarge its export in the EU countries. However, they are short of well trained professionals.

Vegetable seeds form an important segment, and is dominated by the private companies both in terms of market share (by value or by volume) and variety spread with a large basket of a number of temperate and tropical vegetables, including hybrids as well as OPVs. Seed multinationals, especially with the principals based in Europe dominate this segment. Though

the hybrid vegetable seed production is taken up extensively in India, a significant proportion, especially of temperate vegetables, are also imported from the Netherlands and other EU countries.

Presently ~10-15% of nearly 550 companies in the private sector (including indigenous as well as companies of foreign origin or MNCs), are contributing in research and technology development (R&D), as well as in quality seed production and marketing, out of which nearly >10% companies invest 5-10% of their annual turnover in R&D (A. Rana, National Seed Congress, 2023). While the private companies release most of their varieties through multi-location trials (MLTs) conducted on their own, or by a third party, few varieties are released through the All India Coordinated Research Projects . A large number of seed companies (~80%) depend primarily on the varieties developed by the public institutions. The breeder seed (BS) of these are either obtained through official channels (advance indent submitted to DAC through NSAI), or seeds of any subsequent generations (FS or CS) are procured from official or unofficial sources and used for further multiplication. Normally, the genetic purity and the quality standards of CS or truthfully labelled (TL) seed procured from research institutions are very high, and often used subsequently for producing TL Seed for commercial production.

Earlier, the private sector was concentrating pre-dominantly on hybrids and varieties of low volume, high value crops, but lately it is expanding rapidly to high volume field and horticultural crops, as well as in OP varieties. **The formal sector is estimated to fulfil about 63% of the total seed requirement at present (S. Kumar, National Seed Congress, 2023) of which the share of the private sector in total seed production is growing steadily to over 65%.**

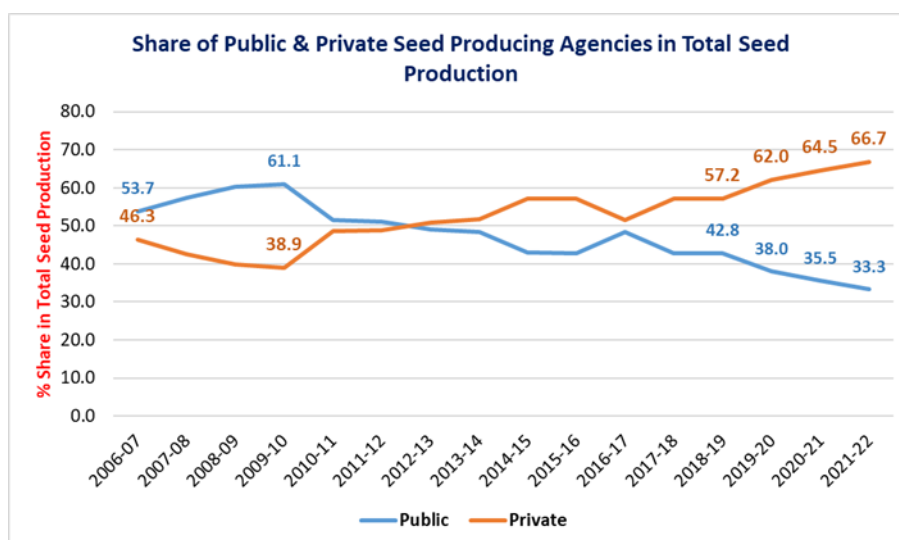


Fig. 1 (Source: S. Kumar, NSC, 2023)

Overall there has been a rising trend in the use of quality seed as reflected (Fig.2) by increasing SRRs and VRRs (IISS, 2023), though SRR is still low in certain crops and in states viz., Bihar, Jharkhand, Odisha. Factors which contributed most in the enhanced demand and use of quality seeds are:

- Increased choice of varieties from public and private sectors in all crops and increased availability of quality seeds of a range of HYVs and hybrids.
- Government policy and incentives to promote newer varieties (<10 years old) through government schemes and programmes.
- Aggressive marketing efforts by the private sector resulting in substantial increase in the availability of quality seed.
- Growing awareness among farmers about the advantages of using high quality seeds of genetically improved varieties for higher productivity and greater tolerance against biotic and abiotic stresses.
- Wide-scale adoption of hybrids by farmers (necessitating seed replacement annually).
- High expansion in cultivation of vegetables due to increased market demands, strong networking, and introduction of small packages by private companies.
- The cost of seed is small (3-6%) in the overall cost of cultivation, hence if the quality seed is accessible, price is seldom considered a constraint.

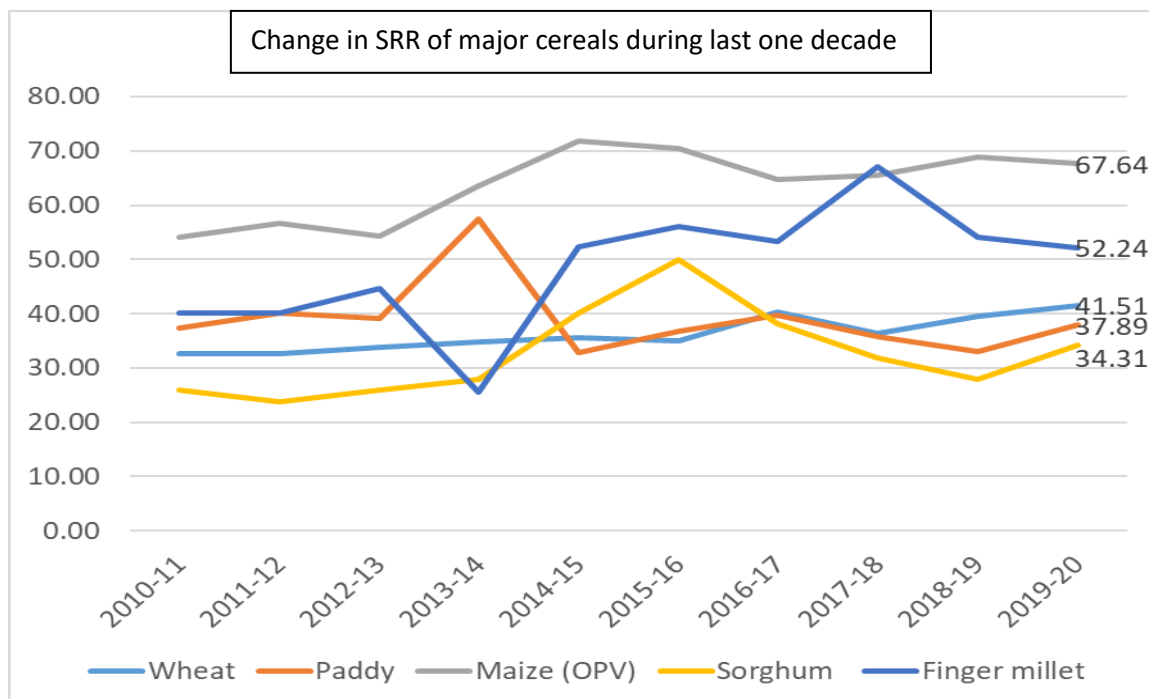


Fig. 2. (S. Kumar, National Seed Congress, 2023,)

IV. Existing Regulatory Framework

The Government of India has played an important role in developing such policies and programs that not only supported the seed industry but also kept in view the interests of smallholder farmers who constitute 85% of the farming population. A favourable enabling environment fuelled the rapid growth and development of the seed sector, making it one of the most mature in the region (ASI, 2019). To provide adequate scope of business for small and medium players, the provisions under the Seeds Act, 1966 are quite liberal. Variety Registration/Notification for release, as well as seed Certification are not compulsory under the prevailing law. Though Seed Certification is applicable only to the notified varieties (Section 5, Seeds Act, 1966), labelling (a form of self-certification) is compulsory for all seeds of notified kind/variety offered for sale (Section 7, Seeds Act, 1966) with same quality standards as that of CS. However, it is estimated that the proportion of certified seed on sale varies only from 30-40% in major food crops. More than 90% seeds of vegetables, and >95% in cotton are of TL class (personal communications, NSAI, 2024; MSSCA, 2024), though the quality is at par with the MSCS. Only around 5-7% TL seeds (under SCO sampling) are found to be below standards in different states (source: SSCA, Maharashtra; Telengana). However, as the variety registration is not a pre-requisite to marketing seed, there is no means to check the varietal purity and performance, nor it is required under the law.

Since the enactment of the Seeds Act, several significant developments took place in agriculture, many of which directly influenced the seed scenario, necessitating the introduction of new laws, or amendments of the existing ones. Presently, the Indian seed system is governed by at least 14 Acts and Orders (and subsequent amendments) regulating various components, as listed below:

1. Seeds Act (1966) & Seed Rules (1968);
2. Seeds Control Order (1983);
3. New Policy on Seed Development (1988);
4. Export Regulation and Quarantine- Plants, Fruits and Seeds (Regulation of import into India) Order (1989);
5. Protection of Plant Varieties and Farmers' Rights Act (2001);
6. Biological Diversity Act (2002);
7. Plant Quarantine Order (2003);
8. The Destructive Insects and Pests Act (1914);
9. Standards, Weights and Measures Act (1976); Package Commodities Act (1986); Consumer Protection Act (1986);
10. The Environment Protection Act (1986);
11. Proposed New Seeds Bill (2004);
12. Patents (Third Amendment) Act (2005);
13. Agricultural Produce Marketing Law (Amendment, 2009);
14. GM and GE crop seeds are also regulated by the Biotechnology Regulatory Authority of India (BRAI) Bill, 2013.

However, as agriculture in India is governed by the state legislation, implementation of laws and additional regulatory mechanisms within certain provisions under the law are decided by the states in the farmers' interests from time to time. Hence, there is lack of uniformity and harmonisation of such regulations or the procedures followed in different states. **Keeping this in view, the GOI has undertaken review and consultations to suitably amend the New Policy on Seed Development (NPSD, 1988) to a Seed Policy for Amrit Kaal, which will be based on the principle of "One Nation One Policy" and will create an ecosystem that puts the Farmers First, and among other things will encourage use of bio-fortified varieties; promote innovations and inclusiveness by including the start-ups and seed FPOs, and is universal in terms of using market intelligence and expanding the market reach globally. It is expected that harmonization of Rules will bring a parity of procedures in all states.** Besides, it will also seek to reduce C footprints from the seed business through the use of environment-friendly treatments and packaging (P.K. Singh, National Seed Congress, 2023).

V. Adoption of New Improved Varieties/Hybrids

The severity and impact of climate uncertainties and shifts in consumers' preferences have created demand for newer crops and varieties in seed market in the last 2-3 decades, also bringing in many hybrids. The AICRPs of ICAR in the last 10 years have made a special effort to release climate resilient crop varieties having ability to withstand abiotic and biotic stresses likely to be faced. As a result, nearly 1970 of the 2380 varieties recommended for release till 2023 were climate resilient (Yadava, National Seed Congress, 2023). An effort has also been made by the GOI to increase the Seed Replacement and Variety Replacement Rates (SRR & VRR) by encouraging newer varieties and discouraging >10 yrs old varieties under government programs and through seed subsidies. Thus, among ~2200 varieties of all crops in CS chain, ~80% are less than 10 years old. Though there is a constant increase in newer vegetable varieties as well, a reliable assessment is not possible as it is dominated by Truthfully Labelled Seed from the private sector, where obtaining authentic data is difficult. The problem is more compounded in the absence of Compulsory Variety Registration, as there are no means to distinguish same variety (genotype) being marketed in different names by different (or same) companies.

Though the hybrid research in India started in early 60s, it made a significant commercial impact only with the release of cotton hybrids in 1972, seed of which was produced in large scale by adopting an innovative manual technology of emasculation and pollination. Subsequently, systematic research in the public sector undertaken during the 80s and 90s, and its further promotion by a special program undertaken by the ICAR in the late 90s resulted in the release of hybrid varieties in many important field crops and vegetables. This was complimented by the research contributions of the private sector, mainly the MNCs, focussed in the development and release of a large number of 'research' hybrids in almost all high value crops. Hybrid seed segments in maize, rice, sunflower are dominated by the private sector.

Release of Bt cotton hybrids for commercial cultivation in 2002 was a landmark in the Indian seed system. During the period of 2002 to 2011-12 cotton seed segment recorded an unprecedented rise in the use of Bt hybrids, at an annual GR of ~20%, with the market share rising to >85%, which reached ~95% of 12 million ha area in 2014 (ICAR-CICR, ISAAA, Yes Bank Analysis, 2015).

The vegetable seed market is dominated by the private sector, covering >90% share. Adoption of hybrids in vegetables has seen a phenomenal rise in the last two decades. More than 30% vegetable varieties released by the public sector through the AICRP (Vegetables) are hybrids, which has increased the annual production of vegetables from 88.62 million tonnes in 2002 to 178.17 million tonnes in 2018 (T. K. Behera, National Seed Congress, 2023). Currently, more than 80% of all vegetable seeds are hybrids (MOA&FW, Yes Bank Analysis, 2015; NSAI, personal communication, 2023). Highest proportions of hybrids are sold in okra, tomato, hot and sweet peppers, eggplant, cabbage, cauliflower, cucurbits, beet root, radish and sweet corn. Of these almost all hybrid seeds of cabbage, Nantes type carrot and seeds of some exotic vegetables, which are becoming increasingly popular among urban population, are imported in India by the MNCs and Indian private seed companies. Both by value and volume, okra occupies the largest share in F1 vegetable seed market (13%).

Due to the popularity of hybrid seeds cotton, vegetables and maize occupy top 3 positions (by value) in the Indian seed market (Mordor Intelligence, 2023 & NSAI, personal communication, 2023). ***The Access to Seed Index (ASI), which measures and compares the availability of seeds from different companies to the smallholder farmers in different parts of the world recorded that the top 9 seed companies in India (4 were Netherlands based) with high access to farmers hold ~37% of market share (WBB, 2019; ASI, 2021).*** India, an exporter of hybrid vegetable seeds, mainly okra, tomato, hot pepper, cucurbits etc. has the potential to emerge as a leading exporting country. ***Thus, there is ample scope for further growth both horizontally and vertically.***

VI. Vegetatively Propagated Planting Materials

Many plant spp., especially of horticultural importance, such as potato, fruit plants, plantation crops, ornamentals, medicinal and aromatic species etc., are cultivated commercially by using planting materials other than the true seeds. Such planting materials (seeds) are required to be sold by the nurseries registered under the Directorate of Horticulture in the respective state. Import and export of planting materials are regulated under WTO-SPS Agreement., Import of agricultural commodities into India is regulated by Plant Quarantine (Regulation of Imports into India) Order 2003 notified under Section 3 (1) of DIPA which is intended to prevent the introduction of any insect, fungus or pest which could be destructive to crops. The New Policy for Seed Development (NPSD), 1988 allowed import of vegetable seeds under open general license (OGL) to facilitate international seed business. Imports of plants and plant materials are subject to pest risk analysis (PRA) to protect from the risks of introduction

of alien pests. Phytosanitary certification (PSC) provides assurance of safety from quarantine and regulated pests and vectors to the importing countries. Plant quarantine operations in India are carried out by the Directorate of Plant Protection, Quarantine and Storage (DPPQS), which functions under the aegis of the Ministry of Agriculture and Farmers' Welfare.

Considering India's skilled human power and growing market, many breeders from EU and Americas are keen to export new varieties of ornamentals, and other horticultural species to be multiplied in India for global as well as domestic markets. This could create enormous potential for Plant Tissue Culture Industry in India. However, due to a lengthy import procedure with 2-3 years PEQ, this opportunity is not being fully exploited. ***Relaxation of the PRA procedures for import of in-vitro materials, generated under aseptic (sterile) and climate- controlled conditions, and accompanied by the required phytosanitary certificate from the exporting country, combined with 1 year PEQ or lab based diagnostics may need to be considered to expand the scope of horticultural industry.***

Potato is one of the top food security crops (though ambiguously listed under vegetables) in India. The second largest producer of potatoes in the world, India requires more than 5.4 million tons of potato seed tubers annually. With a seed multiplication ratio of only 1:6 and lengthy process of multiplication, production of quality potato seed is a big challenge in India. ***It is estimated that certified seed potato perhaps fulfils < 10% of the requirement. Though farmers buy potato seed almost every year, there is practically no institutional mechanism to monitor the quality of seed potatoes (Strategy Paper #14 NAAS, 2021).*** Quality assurance of the TL seed is also difficult, as a substantial proportion of tubers that are used for sowing are not labelled as "seed potato". ***Demand for potato seed import is growing, especially to meet the demand for processed potato market. However, the potato breeders in Europe and elsewhere consider export of improved genetics to India somewhat risky, because of big relaxations accorded to farmers under PPVFRA.***

The strict PRA regulations involving the import of tissue cultured and aseptically raised planting materials to India is a deterrent for import of many horticultural species, including seed potato. ***Reconsideration to modify Farmers' Rights for vegetatively propagated planting materials and strict implementation of the existing provisions against the violation of Plant Breeders' Rights may be looked into.*** There is also a need to relook the lists for PRA for in vitro aseptically raised planting materials where it is so certified by the concerned departments of the exporting country.

VII. Factors Conducive to Promote Seed Export Market

Unlike many other growing or developing economies in South Asia, India has the following advantages for supporting international seed trade.

- Plant Protection Act PPVFRA, 2001 is in place and has registered close to 6374 Certificates (Cereals: 4319; Fibre: 550; vegetables: 507; oilseeds: 381; legumes:365 etc.) as on 09.01.2024. Of these 4106 are Farmers' and 1527 are Extant varieties.

- Notified varieties are released after 2-3 years of multi-location trials, collective evaluation of various agronomic traits and collective mechanism of decision making, hence are well adapted to different zones and countries.
- Private sector R&D has access to rich global germplasm resources, adopts modern breeding technologies and has a fast varietal turnover suited to target ecologies. Recent revisions in the BDA, 2023 has relaxed many clauses making it industry-friendly.
- OECD certification covers 28% of global seed exports. India is an OECD member country, participating in 6 of the 8 schemes, with 259 varieties in 20 crops (OECD Seed Schemes, 2022-23). India has its strength in Wheat, Rapeseed & Mustard, Sunflower hybrids, Sorghum hybrids/OPVs, Maize hybrids, Cotton hybrids, Solanaceous vegetables, Cucurbits etc. International market survey may be undertaken and seed companies with crops and their varieties, which have export potential, need to be identified through the national seed associations.
- With over four Regional Plant Quarantine Stations and 75 PQ Examination Centres a sound system exists for ISPM 38 compliance necessary for imports and exports of seed and planting materials.
- There are 28 ISTA Member Labs, largest in the world, of which 8 are Accredited ISTA Labs (2 in Public & 6 in Private sector), India has adequate capability in conducting seed testing precisely.
- The National Seed Project (NSP) has 65 Seed Production Centres located in the ICAR institutes and SAUs with trained scientific and technical human power (S. Kumar, NSC,2023), which has the capacity to produce BS of notified varieties required for OECD certified seed production for export.

Yet, India's annual share in export and import market of seed and planting material is very poor, and dwindling merely around 1 % (Fig. 3) annually.

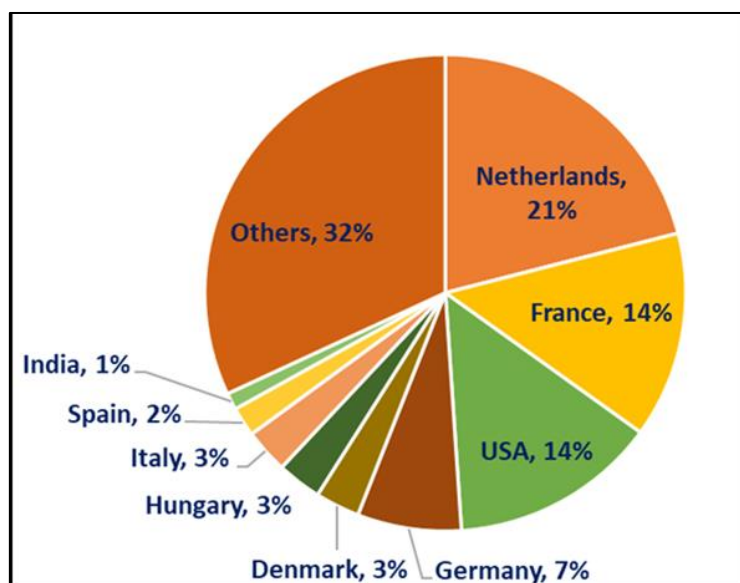


Fig. 3. Share (% by value) of Countries in the Global Seed Exports (ISF, 2022)

Simplification of regulatory mechanism; strong capacity building in PQ and PVP to improve Ease of Doing Business; incentives to the seed industry for export promotion and bilateral or multilateral international collaborations can boost India's seed export significantly. ISTA accredited labs or other labs having necessary competence and infrastructure, both in the public and private sectors, may be accredited by the DPPQS as Phytosanitary Service providers as per provisions specified in NSPM-23. Similarly, for conducting special trait tests PPVFRA may identify public or private laboratories.

VIII. Capacity Building to Strengthen the Seed Sector

Strengthening seed production, quality assurance and distribution network through substantial capacity building, and revamping of seed production farms/systems under various organizations, both public and private, needs to be examined to make them economically viable/profitable. Capacity Building and improvement in Seed Testing Laboratories (STLs) for seed health testing, new technologies like use of molecular markers for variety purity, verification of trait purity in case of GM varieties, contamination with undesirable genes/traits etc., are also needed. Notified STLs are not required to obtain NABL accreditation, whereas NABL accredited or ISTA private labs are not entitled to official quality assurance. ***A system of making Refresher Training Course in Seed Testing at ISTA Accredited laboratories could be made mandatory to ascertain proficiency of Seed Analysts of notified labs.***

Though DUS testing is undertaken in SAU/ ICAR institutions, as these are not the primary responsibility of the concerned officials, often get a low priority. There is no system to ensure that they are adequately trained and credited sufficiently for this. Unlike other countries, there is no provision to maintain a register of trained DUS professionals and engage them contractually on need basis. Some efforts were made in the last 5 years under the Indo-German Bilateral Project on Seed Sector Development (IGPSSD) for capacity building in

- Seed Testing following ISTA procedures
- Certification following OECD Seed Schemes and
- DUS testing following UPOV and other aligned systems

More attention is needed to build capacity, both in public and private sector for DUS testing, and special tests using molecular, chemical and imaging technologies. Similarly training is required for seed quality assessment, seed health testing, and new seed enhancement technologies for sustainable agriculture. Collaboration with advanced centers of seed technology in the Netherlands, will be a welcome step.

IX. Major Constraints Identified

- **Lack of verifiable dataset:** Poor Centre-State coordination. Agriculture being a state subject, the flow of information between the federal and state agencies is not effective. Since variety registration is not compulsory, it is impossible to assess the 'Actual' number of varieties developed and/or marketed by different agencies.
- Traceability of seed chain is a must. Recently introduced SATHI (seednet.gov.in) portal is a welcome move. **However, this does not cover TL seeds. It requires the seed companies to provide genetic information. This may be made voluntary, as long as these are registered with PPVFRA.**
- **The Seeds Act, 1966 is obsolete in today's context, which needs immediate replacement with the proposed (New) Seed Bill 2014.** New quality standards must also be prescribed to meet the present need. In view of the present advancements in seed processing and storage technology, companies must be encouraged to invest in better processing and conditioned storage ensuring High Quality Standards for prolonged periods. Hence, **necessary incentives, eg., longer validity for expiry; or Star (*) ratings for seeds of protected varieties processed finely and meeting 5-10% higher than the MSCSs, can be thought of.**
- Poor performance of public sector: a) as the public sector seed companies are heavily dependent on seed supply to various government schemes and programs, they do not have the freedom of the price fixing as per demand and mandated to sell only certified seed (of notified kind/variety), they are not free to expand their business to face the market forces; b) their presence in vegetable segment is negligible as there is a serious issue of the supply of BS of vegetables (personal communication, Seeds Division, DA&FW, 2023).
- Low proficiency of the Notified Seed Testing Laboratories: The level of proficiency of seed analysts in many Notified labs in the public sector needs improvement. On the other hand, **private sector labs, having ISTA or NABL Accreditation are not included for the purpose of quality testing.**
- Ambiguity of central and state mechanisms of implementation of the provisions under Acts and regulations. Example: Seed licensing in different state being very divergent and costly, put extra burden (monetary, procedural and time). **There needs to be agreement on a uniform, robust, but simplified system applicable in the whole country.**
- **The regulatory mechanisms regarding the licensing of nurseries, production and marketing of seedlings, and other planting materials of horticultural crops, including potato are very poor. A uniform and effective regulatory system is needed.**
- There is lack of clarity regarding the interpretation of many provisions in the seed laws. Ex: sampling of the seed for revalidation for testing seed quality parameters (Physical Purity, Germination and Moisture). **Regular trainings and Refresher courses needed.**
- Many new technologies are available for enhancing seed performance, which are especially relevant in meeting the challenges of Climate change (seed priming and

hardening), offer sustainable solutions (use of biostimulants), and also reduce pesticide use (polymer coating with pesticides). However, their application is limited to only TL seed in the absence of necessary regulatory mechanism and testing guidelines. ***In the present scenario of sustainable agriculture, this needs to be promoted with necessary guidelines.***

- The VCU system in AICRP is not sufficient to test large number of entries from the private seed sector. Due to lack of Public-Private trust, facilities with the private sector are not utilised for the purpose.
- Unlike most developed economies, VCU and DUS testing are a) not compulsory, b) not conducted by autonomous agency (conflict of interests), c) conducted by different agencies, and d) takes long time.
- NPSD, 1988 and PPVFR, 2001 played catalytic roles in attracting investment in seed sector. However, some of the provisions need to be relooked. Ex: ***Registration of varieties/ parental lines imported under OGL for the purpose of multiplication and/or re-export to a third country.***
- Hybrid seed production, mainly of vegetables, offers potential to create good rural employment, but infringement of the parental lines of the hybrids is a big constraint due to non-compliance of PPVFR Act. Ex: ~70% tomato hybrid seed production of all hybrids take place in the suitable agro-climate of Ranebennur of district Haveri in Karnataka, leaving high risk of infringement of the parental lines. ***Steps needed to create awareness and effective enforcement of PPVFR Act to deter unlawful infringement of protected varieties as well as parental lines.*** Recent amendments allowing registration of the parental lines (independently) as varieties, is a welcome step.
- Lack of clarity and ambiguity in the policy w.r.t. the use of GM and GE technology for crop improvement needs to be looked into.
- Potato seed market is almost totally out of an effective regulatory system. ***Only less than 10% seed is marketed as certified, with no incentive for virus free TC material,*** if not of a notified variety. The bulk of “Seed” potato is actually marketed as “Table” potato, good for sowing, but not labelled, hence out of the ambit of Seeds Act. GOI and State Departments need to streamline the system. No incentive to produce CS/TL seed in potato.
- Rampant cases of infringement and unlawful multiplication of protected varieties of ornamentals, potatoes and other plant species which are propagated vegetatively, pose a big problem. Hence seed companies are reluctant to invest in new variety development in these species.
- Import of planting material of horticultural crops to India requires prolonged PEQ confinement under protected conditions (2-3 years), which hampers its commercial value. Procedures must be based on scientific data.
- ***Long delays in conducting PRA hampers seed business when the material is intended to be imported for further multiplication under controlled environment and exported to a third country. Needs a relook.***

- There are many pests and pathogens listed for ***PRA of seeds to be imported. This includes many which are known not to be transmitted through seeds. This needs to be examined and excluded in case of frequently imported spp.***
- Private sector along with breeders, farmers and scientists from public sector require access to genetic resources for improving the crops and ensuring sustainable food production, using conventional breeding practices which is exempted under section 2(f) of the NBA/BDA. However, the provisions of ITPGRFA need to be fully integrated with NBA/BDA regulating agricultural biodiversity and should be brought under the scope of work of the Ministry of Agriculture & Farmer's Welfare.

To discuss the above issues, a Stakeholders' Workshop was organised on 15 January 2024 in New Delhi, and one Round Table each in the Netherlands and India were held on 14 March and 20 March 2024, respectively, with participants from the Netherlands and India (Annexures 2-4). Deliberations from these were further incorporated in the study report.

X. Recommendations:

- The complexity of the Indian seed sector is large because of the size of the country, the diversity of crops and varieties that are grown in different parts of the country, its rich biodiversity to be conserved, and the majority of farmers being small land holders. The contribution of the Informal sector is still large (~35%), though the formal system (both public and private) is important and growing steadily. However, within the formal seed system, the share of the private sector is increasing, which shows the growing trust of farmers in the private sector. At the same time, the informal system is also being strengthened through farmers' producer organizations (FPOs), cooperatives and NGOs. The cutting edge technologies could benefit both farmers and seed industry, including the small players, and therefore, must be encouraged.
- There is ample opportunity for ***India-Netherlands partnership by a) Expanding the domestic seed production to make available quality seeds of improved varieties to farmers, and b) Expansion of overseas seed trade / exports, from 1% to 5% by 2030.***
- In order to improve the Ease of Doing Business (EoDB) we need to sensitize government offices for addressing some of the regulatory issues in a time bound manner and by holding regular public-private interphases.
- Periodic Round Tables must be organized by the concerned departments in collaboration with the National and International Seed Associations viz., FSII, NSAI, ISF to strengthen India's seed trade globally. ***A Round Table of the NPPOs and seed experts of the major seed exporting/importing countries with India may be organized to clarify many procedural issues.***
- Seed Bill which is pending for 20 years, must be finalized without further delay, keeping in view the current scenario ensuring that it benefits everyone.
- As the revision of some key regulatory policies and orders are in the process, it is expected that a ***'one nation one policy'*** will be implemented soon with harmonization

- of policies. Similarly, harmonization with international regulations and conventions (eg., UPOV, ITPGRFA) will help
- Vegetable seed imports are currently under open general licensing (OGL) system, which is proposed to be withdrawn under revised NPSD to encourage seed production within India. ***This will be detrimental to the seed trade. As the seed production plans are made well in advance by the seed importing companies, it is suggested that a window of at least 3 years may be allowed before revising this policy. This is particularly important in bringing the parental lines under licensing and producing the hybrid seed for export.***
- In the New Seed Policy stricter regulations are also needed for seed traders to bring more accountability and transparency.
- Truthfully Labeled seed, which is equivalent to self-certification, is recognized by the FAO as Quality Declared Seed (QDS). ***The importance of TL should be recognized by the Indian government and given due importance than simply introducing standards and over-regulating.*** For proper quality assurance attention is needed build a strong mechanism of testing involving such laboratories, and analysts, whose proficiency is recognized by international or high level professional accreditation. All ISTA member labs as well as NABL accredited STLs may be included in national system of QA.
- ***TL seeds must also be brought under the ambit of SATHI portal for better transparency and accountability. Collaboration with the Netherlands, having expertise in data management, will be effective in this area.***
- ***Wherever possible a system's approach between EU countries and India may be worked out under ISPM 38 (which does not require any additional declarations on the phytosanitary certificate between the two countries).*** Steps are needed to work on adopting EU Equivalence in seed quality assurance by considering the necessary provisions.
- There is ample scope for collaboration with the Netherlands and other EU countries in the areas of seed processing; applied seed technologies for enhancing the performance value under stress conditions; and in soft technologies as well as knowledge sharing and skill-based partnership. This will not only increase the market share of seed from India, but also create rural job opportunity. ***Collaboration for mutual benefit between India and the Netherlands in terms of seed production, DUS Testing, PRA and enhancement technologies with a focus on vegetables and flowers, and advanced data management need to be recognised.***

