

Early Generation Seed System Case Study

India Rice

August 2019



Table of Contents

India Rice Case Study

Executive Summary

1. Market Dynamics

2. Leadership

3. Research & Varietal Development

4. Demand Planning & Operations

5. Financial Sustainability

6. Enabling Environment

Appendix

Acronyms

| ABBREVIATIONS | DESCRIPTION |
|---------------|--|
| AICRIP | All India Coordinated Rice Improvement Project |
| AVT | Advance Varietal Trial |
| BS | Breeder seed |
| CS | Certified seed |
| DACFW | Department of Agriculture, Cooperation and Farmers Welfare |
| EGS | Early generation seed |
| FLD | Frontline demonstration |
| FS | Foundation seed |
| FSII | Federation of Seed Industries |
| GOI | Government of India |
| HYV | High yielding varieties |
| ICAR | Indian Council of Agricultural Research |
| ICPD | Integrated Cereals Development Programme in Rice based Cropping System Areas |
| IET | Initial Evaluation Trial |
| IIRR | Indian Institute of Rice Research |

| ABBREVIATIONS | DESCRIPTION |
|-------------------|---|
| IPRD | Integrated Program for Rice Development |
| IVT | Initial Varietal Trial |
| Kg/ha | Yield (Kilogram per hectare) |
| KVK | Krishi Vigyan Kendra |
| Mha | Million hectare |
| MMT | Million Metric Tons |
| MSP | Minimum Support Price |
| MV | Modern varieties |
| NARS | National Agriculture Research System |
| NFSM | National Food Security Mission |
| NIC | National Informatics Centre |
| NRRI/CRRRI | National Rice Research Institute (formerly Central Rice Research Institute) |
| NSAI | National Seeds Association of India |
| NSC | National Seed Corporation |
| NSRTC | National Seed Research and Training Centre |
| OPV | Open Pollinated Variety |



Executive Summary

Strong Federal and State Institutions Enable the Rice Seed System

VARIETAL DEVELOPMENT & SEED DEPLOYMENT



Varietal Development

Varietal development for India's rice is conducted through state agriculture universities (SAUs) and national institutes, with funding and strategic coordination from the Indian Council of Agricultural Research (ICAR). Private companies have also begun purifying and making proprietary selections of notified varieties within the open pollinated variety (OPV) segment in recent years.



Seed Multiplication

Breeder seed (BS) multiplication takes place at SAUs and ICAR research stations under the observation of the government of India (GOI). Foundation seed is multiplied at a state level by state seed corporations (SSC), the National Seed Corporation (NSC), and licenced private companies, which order and receive breeder seed allocations through a structured demand planning and production process.



Quality Seed Production

Certified seed (CS) and truthfully labeled (TL) seed production is done by 16 SSCs, ~5 farmer cooperatives, and more than 100 private companies. There are 26 state seed certification agencies (SSCAs) that provide seed quality assurance at a state level.

INDUSTRY ADVOCACY & MARKET TRENDS



Industry Advocacy

Conducive policy reforms and government support has spurred the seed industry's transformation with new seed policy (1988). Government support for the role of the private sector, combined with effective advocacy from the National Seeds Association of India (NSAI) and the Federation of Seed Industries of India (FSII) contribute to an enabling environment that supports seed companies' ability to develop profitable, diversified businesses.



Market Trends

Certified and truthfully labeled OPV seed production in India increased threefold between 2001 and 2017 in response to higher demand for quality rice seed. Proprietary OPV (private sector) is a fast-growing, new market segment (12% of area). Demand for hybrid rice (8% of area) has also increased significantly. Rice seed exports are small but expanding, with seed now exported to more than 10 countries.

SEED SYSTEM EVOLUTION

With the support of state governments, GOI has implemented various rice development programs since the 1950s, including:

Rice Seed Minikit

State-level Training on Rice Production Technology

Special Rice Development

Special Food grains Production Programme (SFPP)-Rice

Integrated Program for Rice Development (IPRD)

Integrated Cereals Development Programme in Rice based Cropping System Areas (ICDP-RICE)

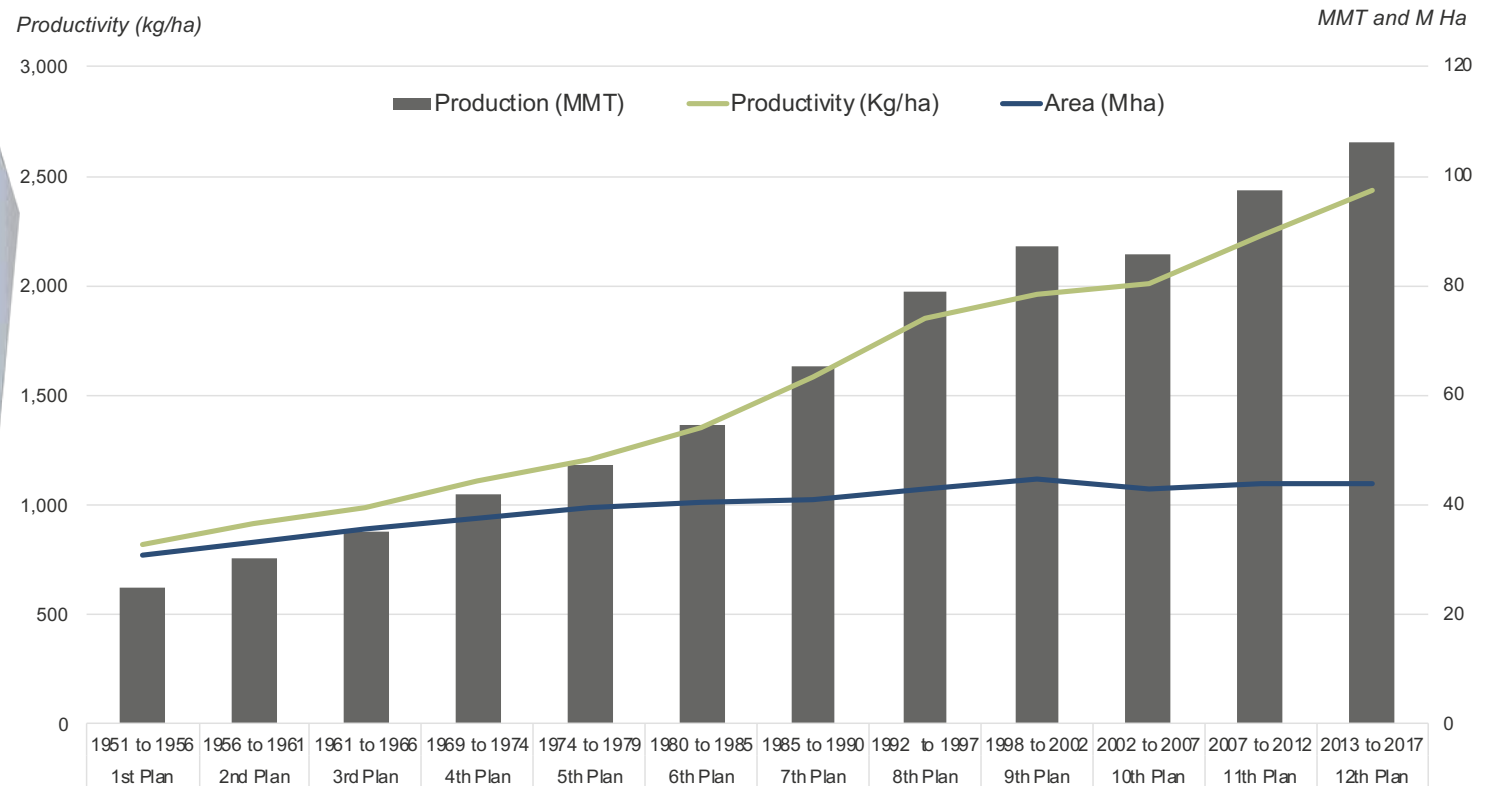
Promotion of Hybrid Rice

National Food Security Mission (NFSM)-Rice

Frontline Demonstration-Rice

India Rice: Planned & Targeted Growth

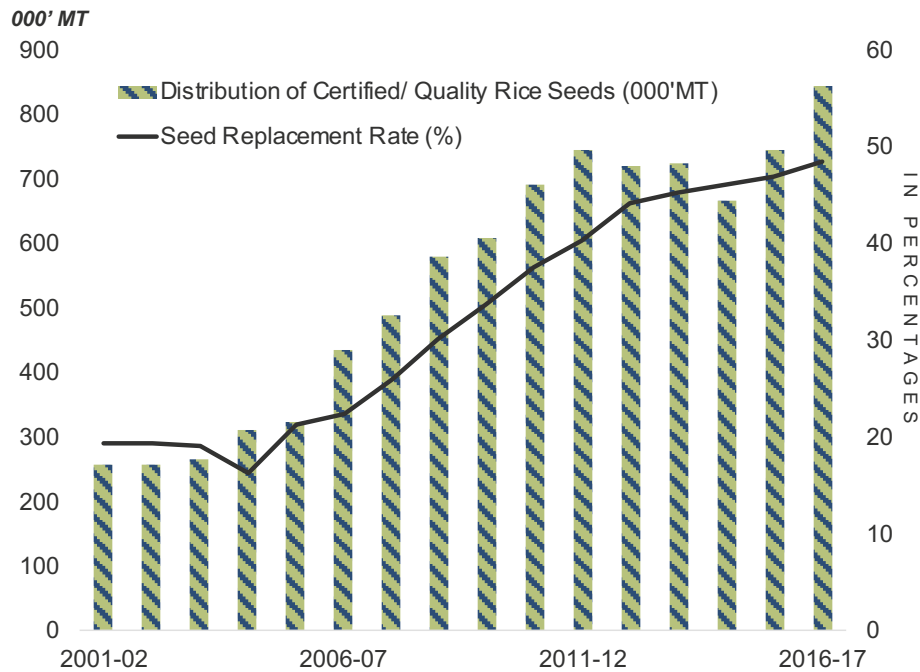
Sustained Period of Intentional, Structured Government Engagement



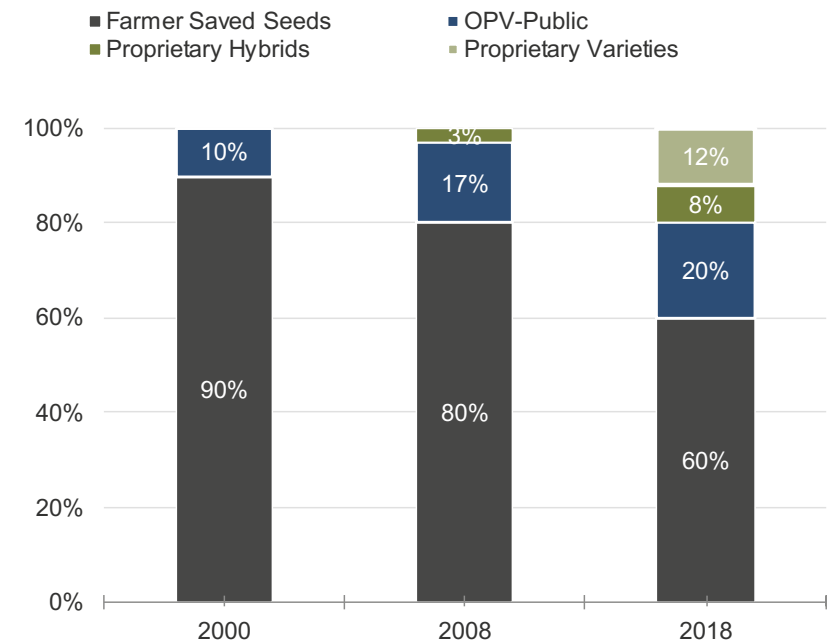
Source : Rice in India during Tenth plan , Directorate of Rice Development

Formal Seed System Expanding to Meet Demand for Improved Seed

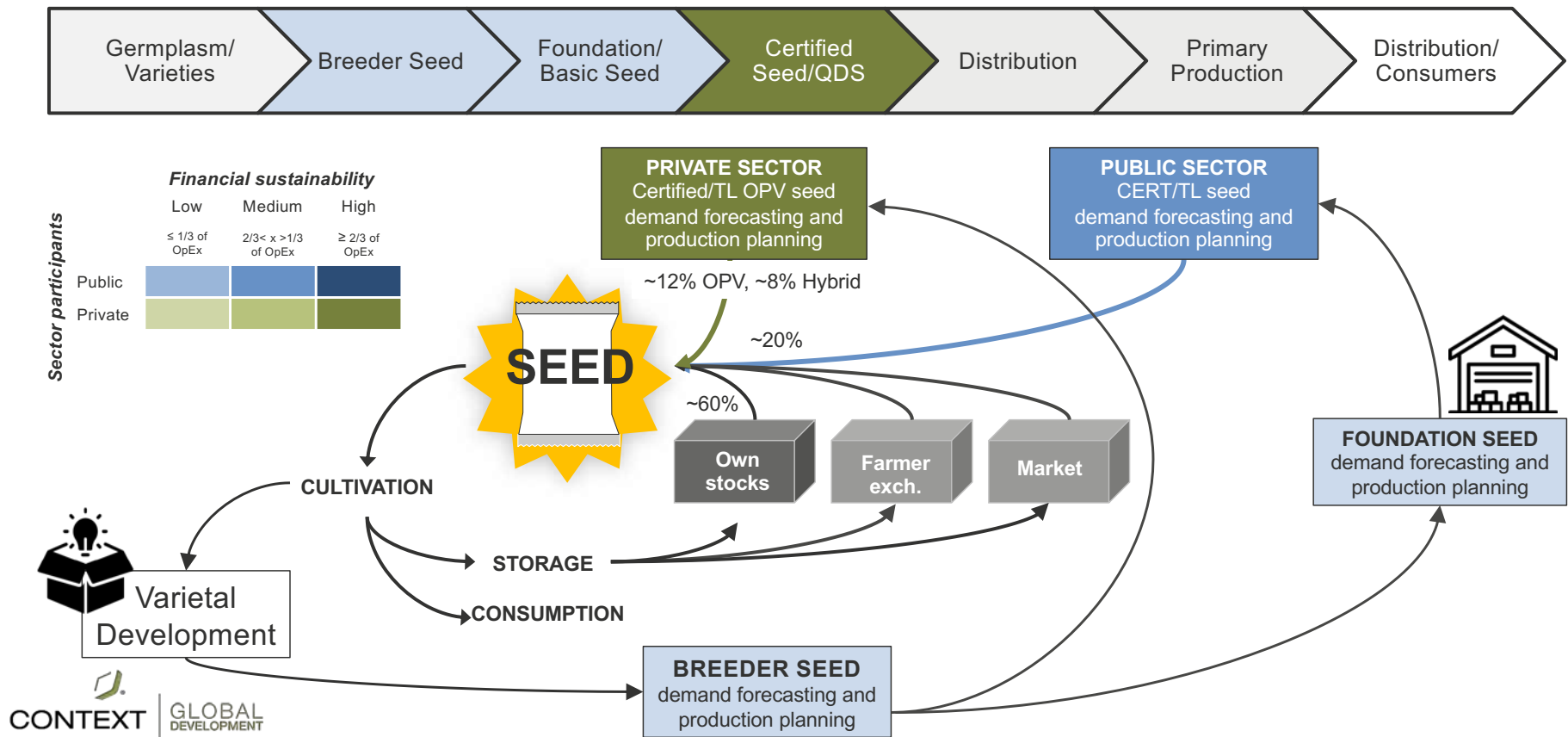
All India Rice Seed Distribution¹



Evolving Indian Rice Seed Market Structure²



Formalization Supported by Public Sector Varietal Development & Breeder Seed Deployment



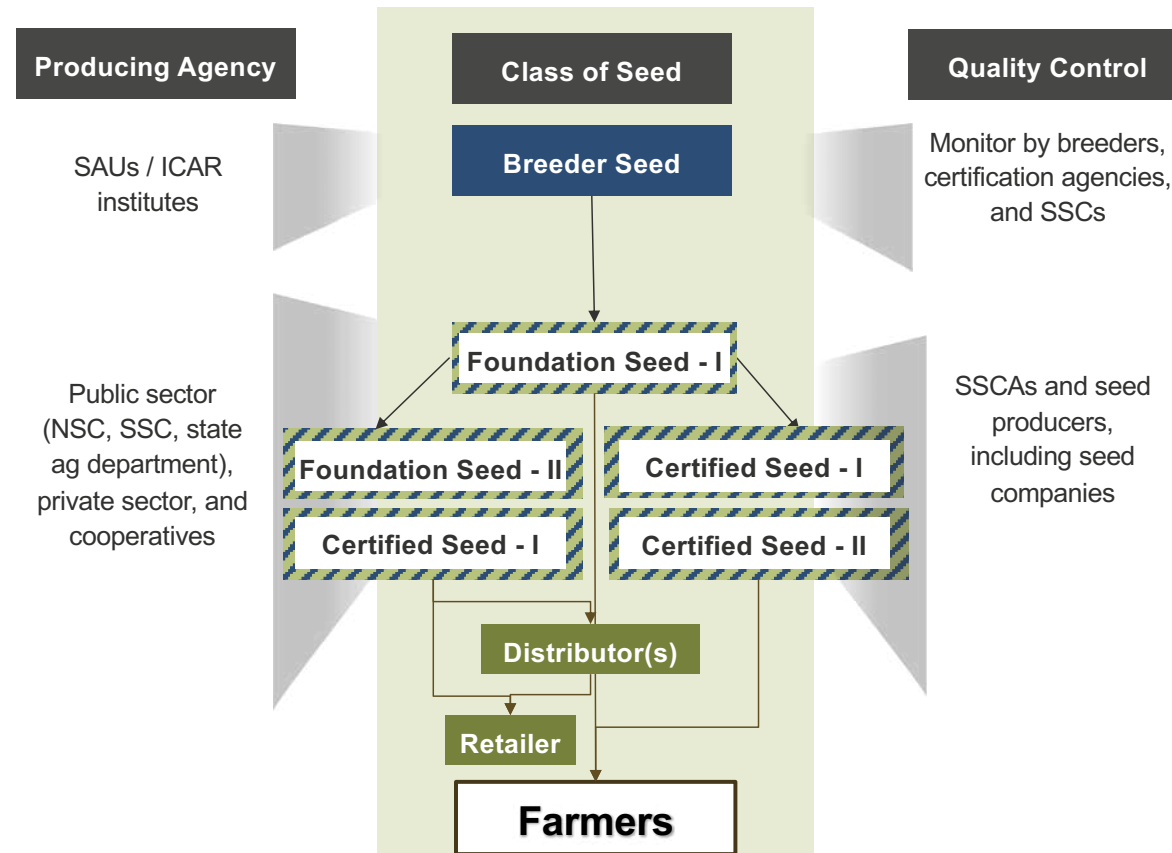
SEED SYSTEM STRUCTURE

Public Sector Plays Key Role in Production, Distribution, Seed Quality Assurance

Public R&D system has made significant contributions to the delivery of new modern varieties (MVs) and hybrids to farmers through transfer of technology (TOT) programs, such as on-farm verification trials, frontline demonstrations (FLDs), and the minikit program.

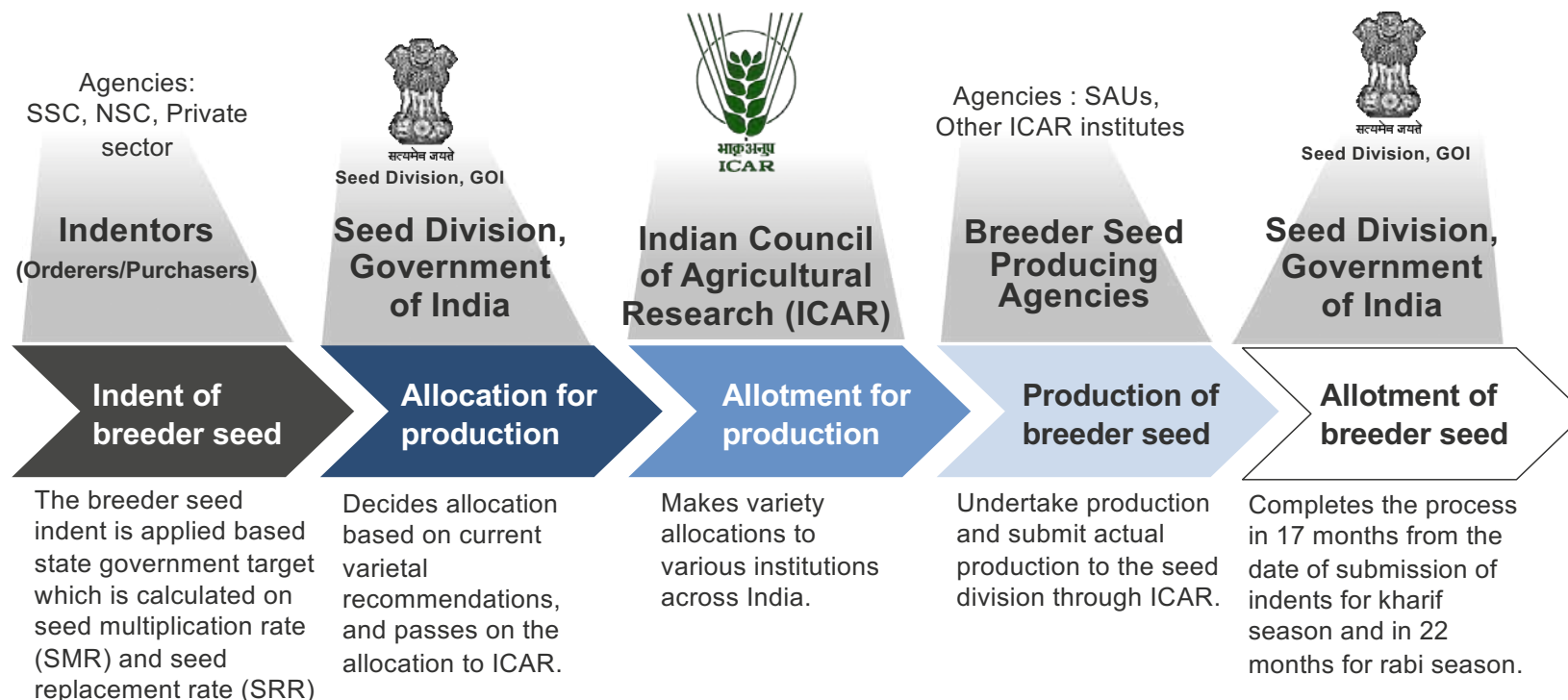
Lead farmers who participate in TOT programs have **become promoters and suppliers** of new **MV seeds** for fellow farmers.

Publicly bred MVs and other improved **germplasm** are **accessible by** the private sector, farmers' cooperatives, and NGOs.



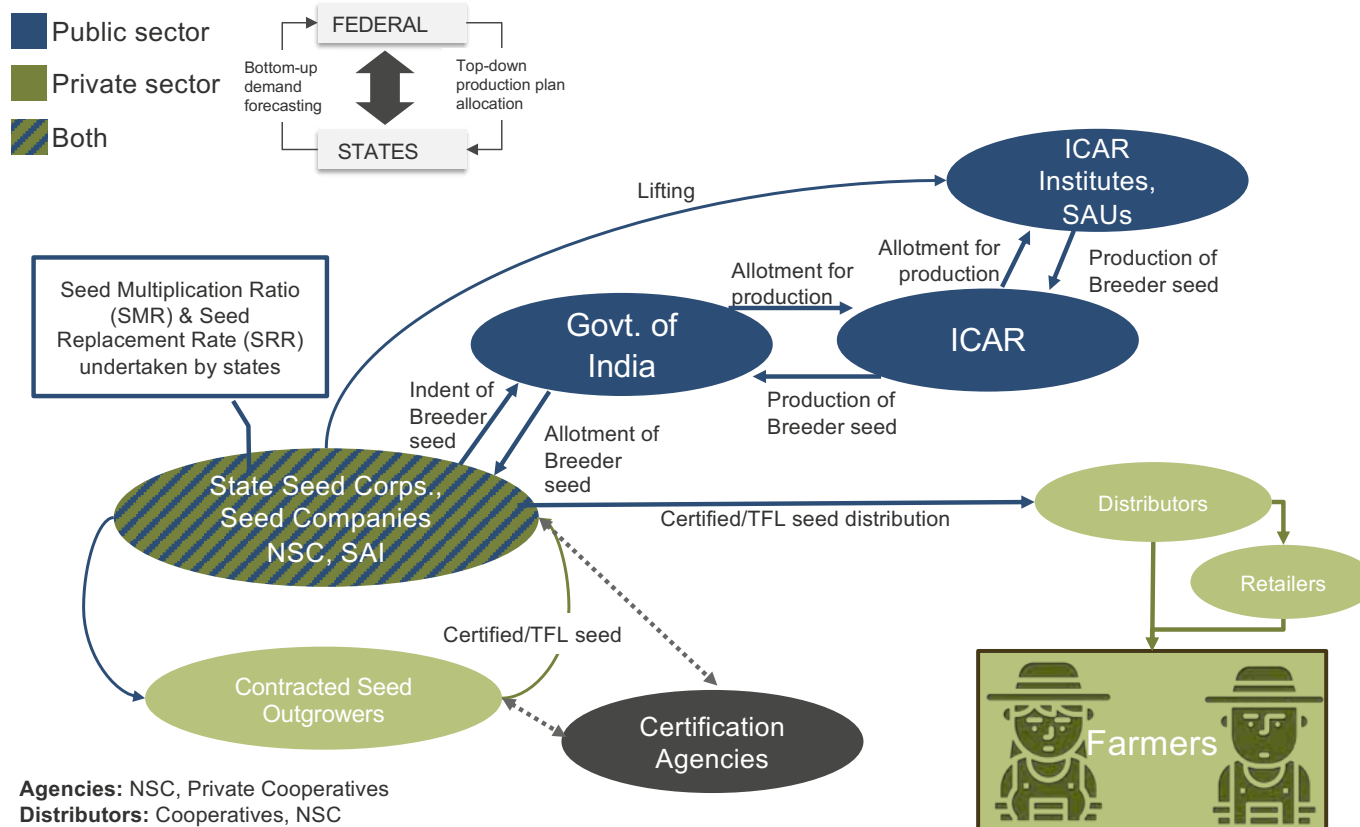
Source: Context expert analysis

Breeder Seed Demand Forecasting & Production Planning Is Well-Coordinated & Efficient



EGS DEMAND-SUPPLY PLANNING

Bottom-Up Demand Forecasting & Top-Down Production Planning Process



EGS demand and supply system

Research institutions (SAUs and ICAR) are responsible for producing and supplying breeder seed (BS) of notified crop varieties to both public and private seed companies.

These companies in turn produce foundation seed (FS) from which certified seed (CS) is produced and distributed to farmers.

Indents (orders) from various seed producing agencies are collected by State Departments of Agriculture (SDAs) and submitted to Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture, and GOI.

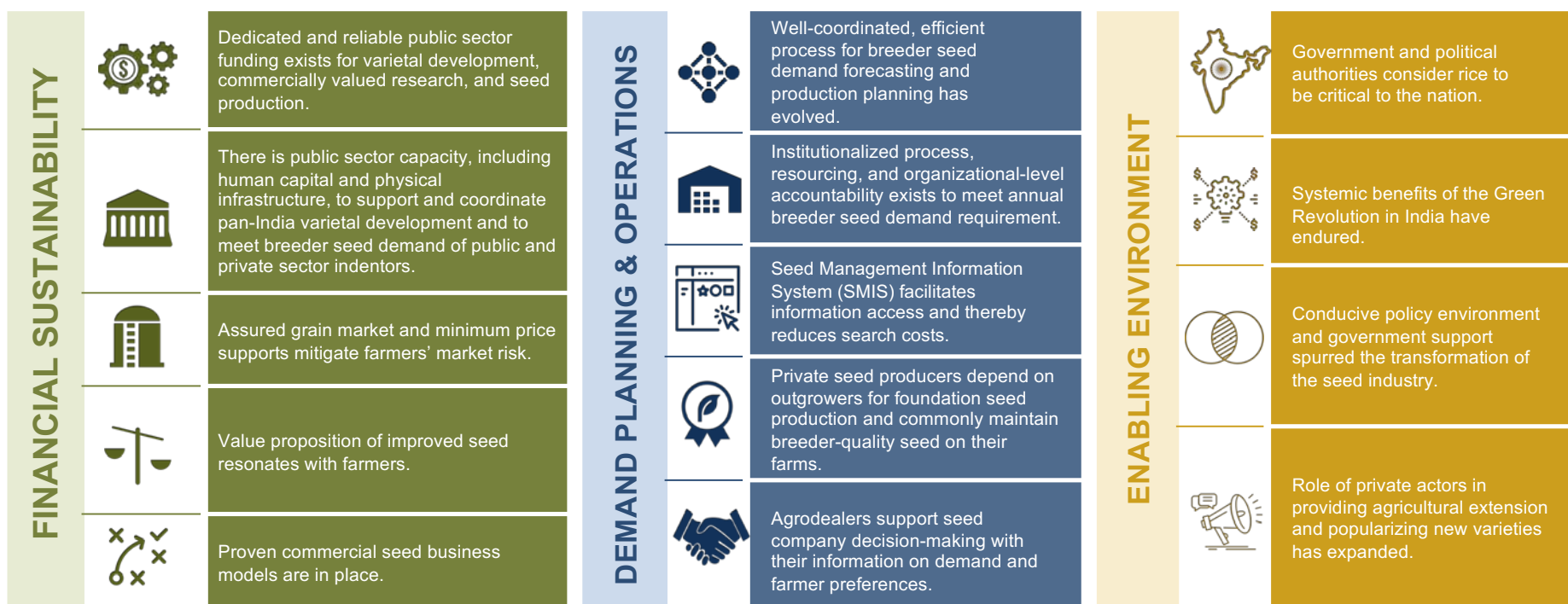
The DAC compiles all information on the crop and sends it to the crop project coordinator at ICAR who performs the final allocation of production responsibility to the appropriate SAU/ICAR institutions. Indents are compiled and forwarded to ICAR at least 18 months in advance. ICAR-DAC reviews BS production in the annual seed review meeting, and the actual production of BS by different research centers is suggested to DAC by ICAR.

On receipt of information from ICAR, available BS is allocated to the indenters further multiplication into CS/TL

Source: <https://seednet.gov.in/>

KEY SUCCESS FACTORS

Summary of EGS System Success Factors



KEY SUCCESS FACTORS

Financial Sustainability

Well-funded public sector focuses on making seed available, not cost recovery



Dedicated and reliable public sector funding exists for varietal development, commercially valued research, and seed production.

Continuous, centrally coordinated, locally researched varietal development is conducted by National Agriculture Research System (NARS)-ICAR, one of the world's most well-funded (USD 890 million annually to ICAR) and trained agriculture research systems (~7000 scientists) in the world. Of the USD 890 million, 200 million is allotted to the Crops division, which includes Rice. National Rice Research Institute (NRRI) is allotted 13 million USD, Indian Institute of Rice Research (IIRR) 4 million USD, and All India Coordinated Rice Improvement Project (AICRIP) 3 million USD).



There is public sector capacity to support and coordinate pan-India varietal development and meet the breeder seed demand of public and private sector indentors.

The seed industry has evolved with help of funds from the National Seed Projects to support public sector institutions and private seed companies (>500). The public sector is extensive and includes organizations including: NARS, comprising 60 ICAR research institutes, six bureaux, 15 national research centers, 19 project directorates, 78 all India Coordinated and network projects and eight agricultural technology application research Institutes, 60 SAUs, 641 krishi vigyan kendras (KVKs), NSC, New Delhi; 15 SSCs, and 24 SSCAs.



Assured grain market and minimum price supports mitigate farmers' market risk.

GOI provides a guaranteed market for farmers and sets minimum prices or Minimum Support Price (MSP) for rice. MSP is a market intervention by GOI to mitigate agricultural producers' exposure to commodity price volatility. GOI buys more than 30% of the total country production (~38 MMT) of rice for its own buffer stocks and for national food distribution programs.



Value proposition of improved seed resonates with farmers.

Demand for proprietary OPV and hybrid rice seed varieties is increasing because farmers recognize the incremental cost of purchasing seed is more than offset by the resulting higher yields. Private seed companies are delivering on their higher price, higher quality value proposition (i.e., varietal purity and high germination). Farmers can trial high-yielding varieties at a subsidized cost from SSCs before considering purchasing higher-priced commercial seed (OPVs and hybrids).



Proven commercial seed business models are in place.

Private sector is profitably serving growing demand for high-yielding proprietary OP and hybrid rice varieties by building trusted seed brands that consistently offer superior value to end users (farmers), distribution partners (agrodealers), and seed outgrowers. Private sector is able to sell TL seed and freely fix the retail price of seeds with adequate incentives to distribution partners. Market expansion has led to the emergence of a service industry meeting the operational needs of companies, including germplasm licensing/development, seed processing, cold storage, logistics, outgrower management., and seed distribution. Private companies collaborate via the structured advocacy of seed associations around areas of shared interest, but IP-related collaborations are rare.

KEY SUCCESS FACTORS

Demand Planning and Operations

Well-coordinated Process Closely Managed by GOI



Well-coordinated, efficient process for breeder seed demand forecasting and production planning has evolved.

Demand is tabulated using a bottom-up approach, wherein SDAs collect and submit indents (orders) from varying seed producing agencies and seed associations (on behalf of their membership) to the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, and Government of India (GOI). Production planning is done top-down, with the DAC compiling and submitting demand information to the crop project coordinator at the Indian Council of Agricultural Research (ICAR), which performs the final allocation of production responsibility to the appropriate ICAR institutions/SAUs.



Institutionalized process, resourcing, and organizational-level accountability exists to meet annual breeder seed demand requirement.

Intentional overproduction (i.e., buffer stocks) mitigates multipliers' risk of unmet supply of parental material. The institutions (ICAR & SAUs) producing EGS are well-established with extensive infrastructure (offices, equipment, and land) and are sufficiently staffed and funded through government grants.



Seed Management Information System (SMIS) facilitates information access and thereby reduces search costs.

SMIS, an integrated, multi-user, and menu-driven software package, can be used to generate various kinds of decision supportive information on breeder seed management, foundation and certified seed production, seed certification, seed law enforcement, progress report of seed testing laboratories, and database of notified varieties. SMIS is maintained and coordinated by GOI.



Private seed producers depend on outgrowers for foundation seed production and commonly maintain breeder-quality seed on their farms.

Private seed companies often maintain breeder-quality seed on their farms and depend on outgrowers for foundation seed production. For certified and quality seeds multiplication, which can require extensive outgrower networks, companies sometimes rely on independent contractors to serve as liaising agents between them and seed growers. These "organizers" can provide various service offerings, including aggregation, processing, and even seed packaging.



Agrodealers support seed company decision making with their information on demand and farmer preferences.

The interdependent relationship between companies and agrodealers encourages the formation of feedback loops that enable companies to make more informed investment and resource allocation decisions. Agrodealers have high expectations of their seed company suppliers to execute promotional activities and deliver high-quality products and after-sale services to farmers, which supports customer loyalty. Companies commonly offer sales bonuses, peer recognition, and trade credit terms to agrodealers.

KEY SUCCESS FACTORS

Enabling Environment

Conducive policy reforms and government support has spurred seed industry's transformation



Government and political authorities consider rice to be critical to the nation.

Funds, resources, schemes, grants, budgetary allocations, and monitoring system flow smoothly and continuously since rice is a priority concern for food security. Varietal development and breeder seed production is still predominately public sector managed and funded.



Systemic benefits of the Green Revolution in India have endured.

During the Green Revolution, the central government (with support from key donors) set in motion a series of reforms that contributed to the increased adoption of high-yielding varieties, chemical fertilizer, and tube-well irrigation (i.e., Green Revolution technologies).



Conducive policy environment and government support spurred the transformation of the seed industry.

Government support for the role of the private sector, combined with effective advocacy from the National Seeds Association of India (NSAI) and Federation of Seed Industries of India (FSII), contributes to an enabling policy environment that supports seed companies' ability to develop profitable, diversified businesses. The Seed Act (1966), Seed Rules (1968), and Seeds (Control) Order (1983) are the legal instruments to regulate the quality of seeds available in the market. The responsibility for seed law enforcement is vested with state governments. PVP Act additionally codifies farmers' rights and facilitates IP protection to seeds companies, spurring investments in R&D.



Role of private actors in providing agricultural extension and popularizing new varieties has expanded.

Private actors (i.e., agrodealers, sales and extension teams, and seed companies) are active in agricultural extension and popularizing new varieties. While the public extension system—along with commodity price policies and procurement support—are credited with the Green Revolution of the 1960s (K. Shebby, 2010), the public system plays a lesser role today, especially in areas where the private sector is actively marketing/demonstrating the utility of new varieties.

EGS Pain Points

Financial Sustainability

Generous public funding and subsidy programs have allowed state seed corporations to focus on fulfilling seed volume production requirements without needing to recoup operating costs through quality seed sales. As a result, parastatal seed corporations, which played an important role in spurring the evolution of the rice seed system are competing in the market with increasingly capacitated private seed companies at subsidized seed prices.

Demand Planning & Operations

Despite public sector funding for seed production, EGS producers (i.e., ICAR institutes and state agricultural universities) face infrastructural deficiencies (i.e., cold storage, seed processing, seed quality assurance testing equipment) that inhibit seed production efficiency and quality.

Enabling Environment

Public sector OPV seed production and deployment system is internally focused, insulated from market risk, and unable to satisfy growing farmer demand for high-quality, improved OPV, and hybrid rice seed varieties.

Quality assurance issues with parental seed from public institutions is leading to varietal deterioration. Private seed companies are making further selections or purifying their lines because public sector seed sometimes exhibits deterioration or genetic impurities. Companies may purchase low-priced government seed purely as a legal process but depend on their own seed for multiplication.



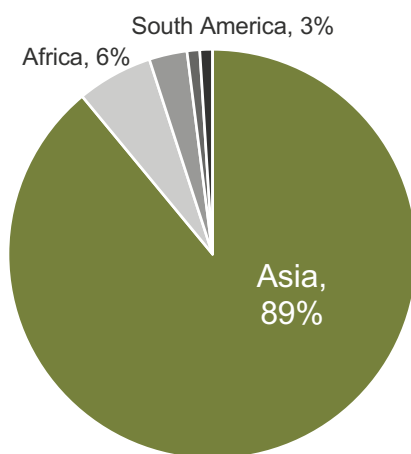
Market Dynamics



Rice in India & World

Rice Area in India Tops China, but Production/Yield Lags

Asia produces nearly 90% of the world's rice, led by China



| Country | Area (Mha) | Production (MMT) | Yield (Tons/ha) | % of Total Production |
|------------|------------|------------------|-----------------|-----------------------|
| India | 43.79 | 112.91 | 3.87 | 22% |
| China | 30.74 | 148.87 | 6.92 | 28% |
| Indonesia | 12.25 | 37.00 | 4.76 | 11% |
| Bangladesh | 11.27 | 32.65 | 4.35 | 6% |
| Thailand | 10.75 | 20.57 | 2.9 | 4% |
| Others | 54.15 | 143.01 | - | 29% |
| Total | 162.96 | 495.02 | 4.53 | 100% |

| Crop | 2017/18 in MMT |
|----------------|----------------|
| Rice | 112.91 |
| Wheat | 99.70 |
| Coarse Cereals | 46.99 |
| Pulses | 25.23 |

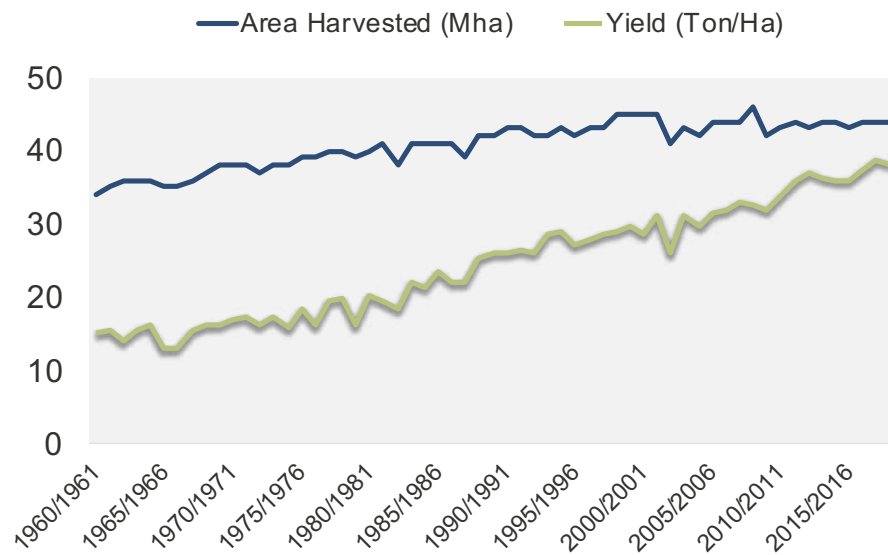
Rice occupies one-quarter of the total cropped area in India and contributes around 40% of the country's total food grain production.

Rice in India

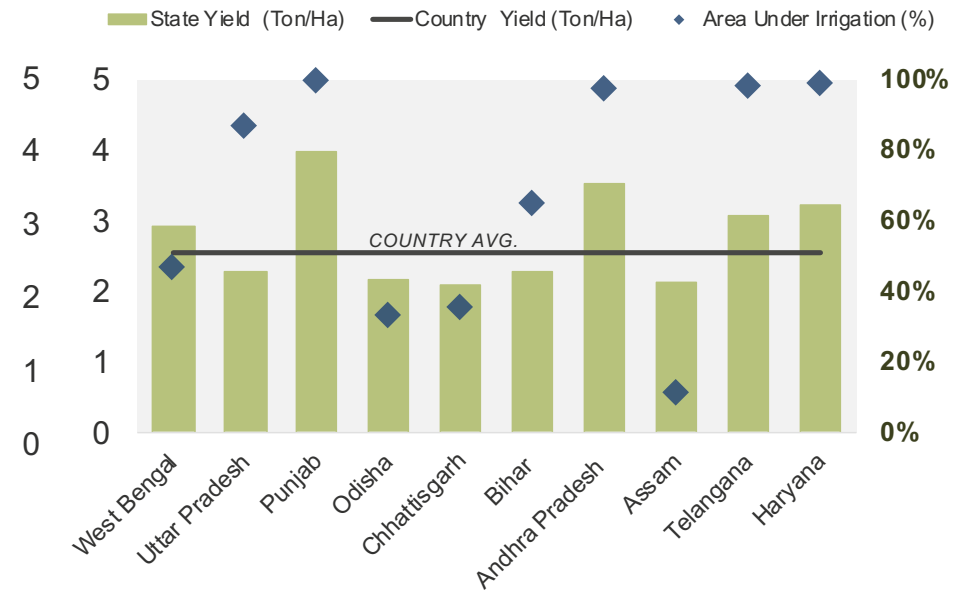
Steady Yield Increase in Last Half-Century (2% CAGR 1960 to 2016)

Green Revolution technologies (*high-yielding varieties, irrigation, and use of chemical fertilizers*) transformed India from a food-deficit country into a leading exporter

India Rice Harvested Area & Yield (1960 to 2016)



Key Producing States Yield Comparison



Rice Is Cultivated Across the Country

A Two-Season Crop

The kharif season (June-October) accounts for more than 87% of national production. Rabi season, which is concentrated in the south-coastal states, makes up the balance.

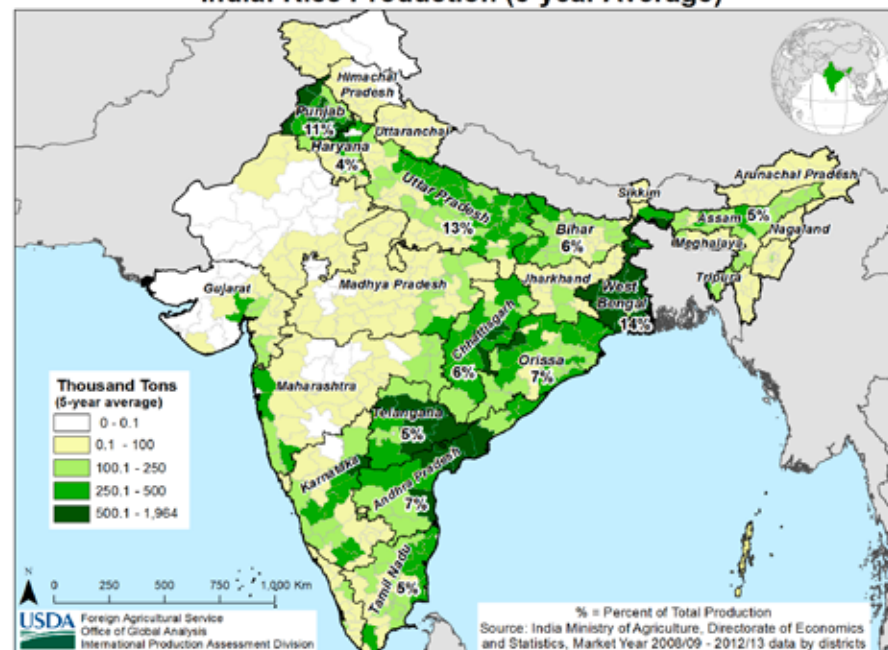
Major Producing State

| | Kharif | |
|----------------|--------|-------|
| | MMT | Share |
| West Bengal | 9.1 | 12% |
| Uttar Pradesh | 11.4 | 15% |
| Punjab | 9.1 | 12% |
| Chhattisgarh | 5.3 | 7% |
| Telangana | 3 | 4% |
| Andhra Pradesh | 3.8 | 5% |
| Haryana | 3 | 4% |

Rabi

| | MMT | Share |
|----------------|-----|-------|
| West Bengal | 4 | 30% |
| Uttar Pradesh | 0.4 | 3% |
| Punjab | 0 | 0% |
| Chhattisgarh | 0 | 0% |
| Telangana | 2 | 15% |
| Andhra Pradesh | 3 | 23% |
| Haryana | 0 | 0% |

India: Rice Production (5-year Average)



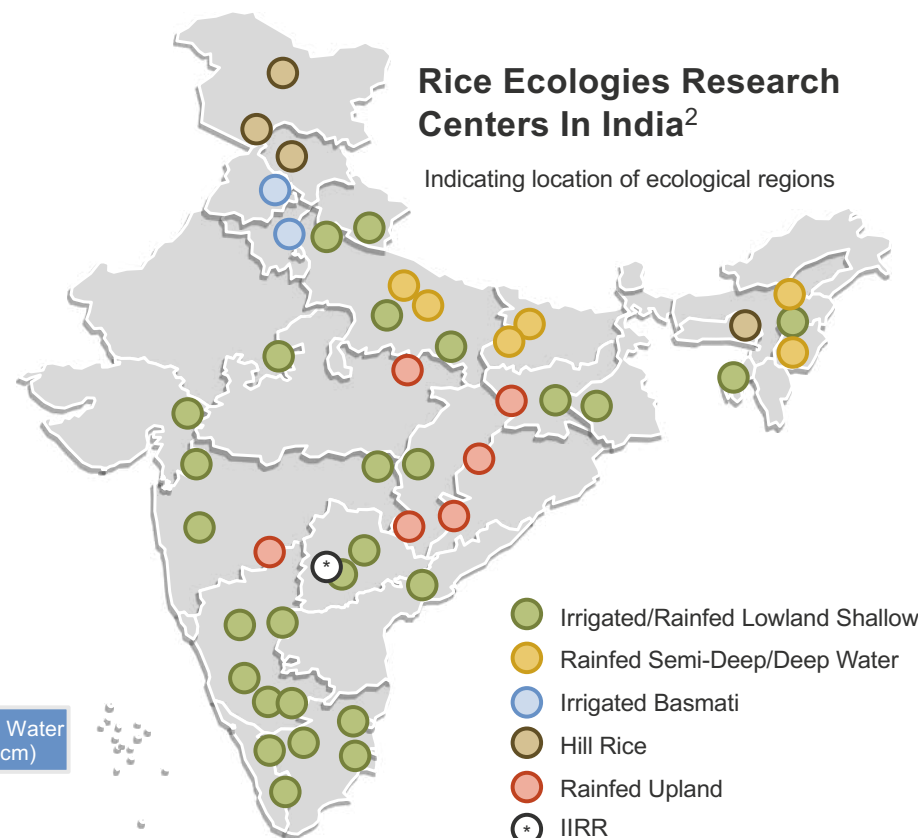
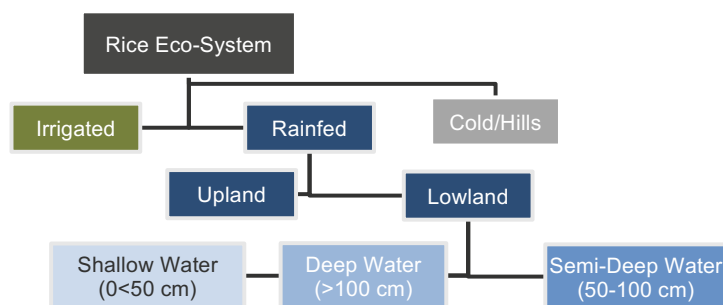
Rice Ecologies in India

Irrigated and Rainfed Lowland Most Important (>86%)

Distribution of area and production by ecosystem¹

| Ecosystem Classification | Area Share | Area (M.HA) |
|---------------------------|------------|-------------|
| Irrigated | 55% | 24.1 |
| Rainfed Lowland Shallow | 31% | 13.6 |
| Rainfed Upland | 9% | 3.9 |
| Rainfed Semi & Deep Water | 3% | 1.3 |
| Hills | 2% | 0.9 |

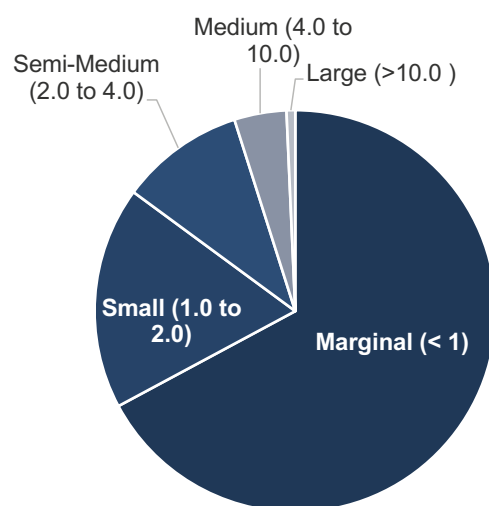
*Coastal saline is another classification category contributing 2% (subset of rainfed lowland and irrigated)



Predominance of Marginal & Small Farmers

85% of the farm size is less than 1.4 Ha

Farmer Segmentation by Farm Size



| Category of Holdings (in Hectares) | Marginal (< 1) | Small (1.0 to 2.0) | Semi-Medium (2.0 to 4.0) | Medium (4.0 to 10.0) | Large (>10.0) | |
|------------------------------------|-------------------|-----------------------|-----------------------------|-------------------------|-------------------|------|
| Category Share | 67.1% | 17.9% | 10.0% | 4.2% | 0.7% | 100% |
| Average Size of Holdings (Ha) | 0.4 | 1.4 | 2.7 | 5.8 | 17.4 | 1.15 |

Common rice based cropping patterns followed in India are:

Rice → Rice → Rice

Rice → Rice → Cereals (*other than rice*)

Rice → Rice → Pulses

Rice → Groundnut

Rice → Wheat

Rice → Wheat → Pulses

Rice → Toria → Wheat

Cropping patterns in different agroclimatic zones have evolved over time based on suitability of soil, profitability, availability of market and industrial infrastructure, and water availability.

Recent techniques such as relay cropping, intercropping, mixed cropping, minimum tillage, weed control, and use of fertilizers and pesticides have helped reduce the cost of cultivation and sustain high production levels.

Study States at a Glance

Telangana



Rice cultivated in kharif and rabi seasons

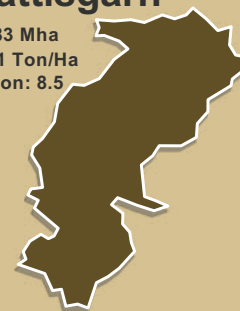
Known as the *seed bowl* of India

Highest SRR in India

Almost 99% irrigation coverage

Chhattisgarh

Area: 3.83 Mha
Yield: 2.1 Ton/Ha
Production: 8.5 MMT



Rice cultivated only in kharif season

Average yield lower than national yield

Around 36% of area is irrigated

Punjab-Haryana



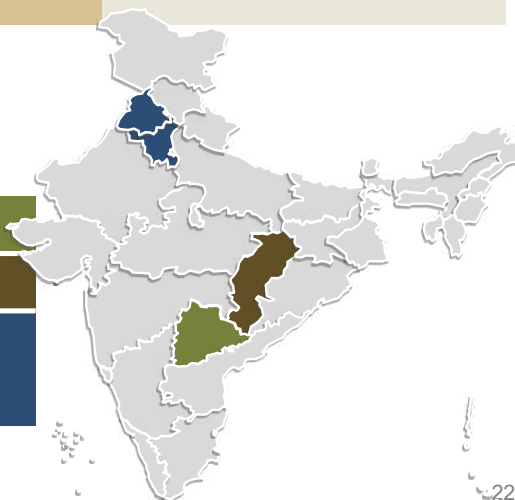
Rice cultivated only in kharif, rice-wheat cropping system

More than 90% of area is irrigated

It contributes 80% of India's basmati production

States' contribution to total rice production in India

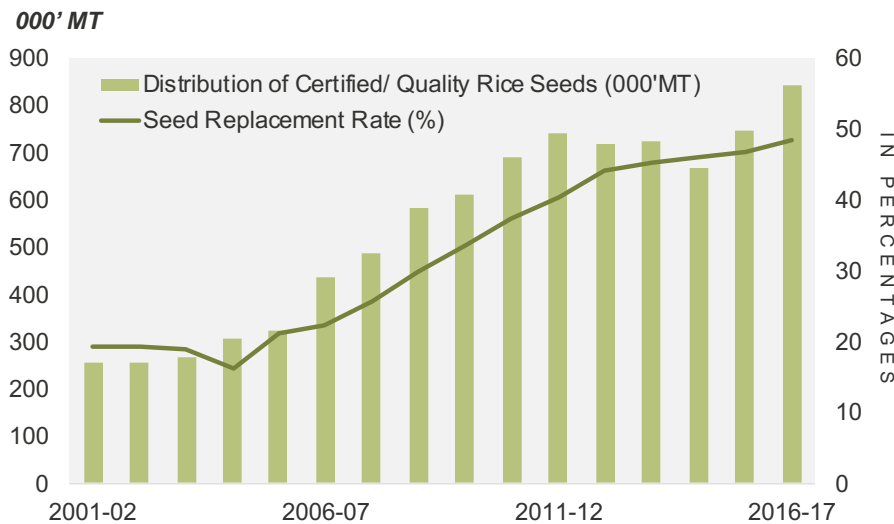
| | |
|--------------|----|
| Telangana | 2% |
| Chhattisgarh | 9% |
| Haryana | 3% |
| Punjab | 7% |



Trends in the Formal Rice Seed Distribution System

Quality seed distribution increased by more than 3X between 2003 and 2017 (845k MT)

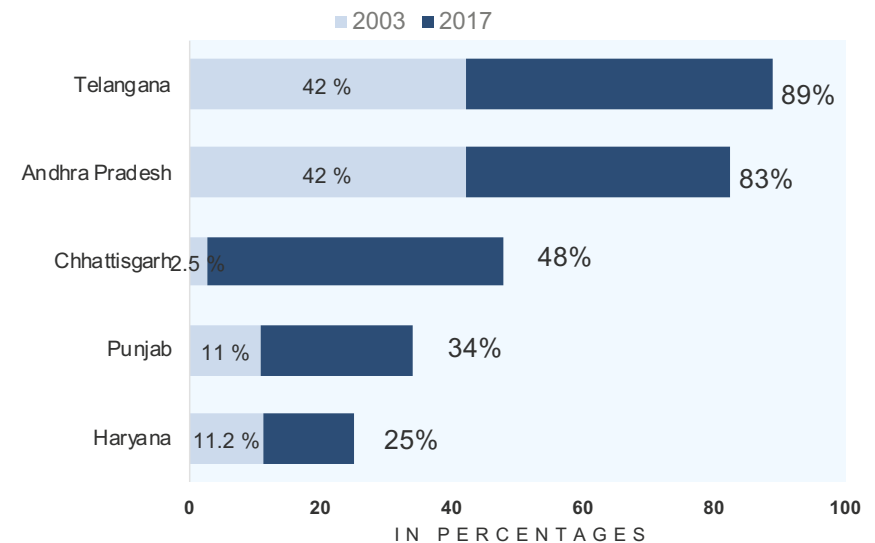
All India Rice Seed Distribution



Across India, the SRR increased from 19.2% to 48.5% (i.e., farmers are now sourcing seed from the formal market every two years).

* SRR ranges between 40% to 48% if informal seed distribution is considered

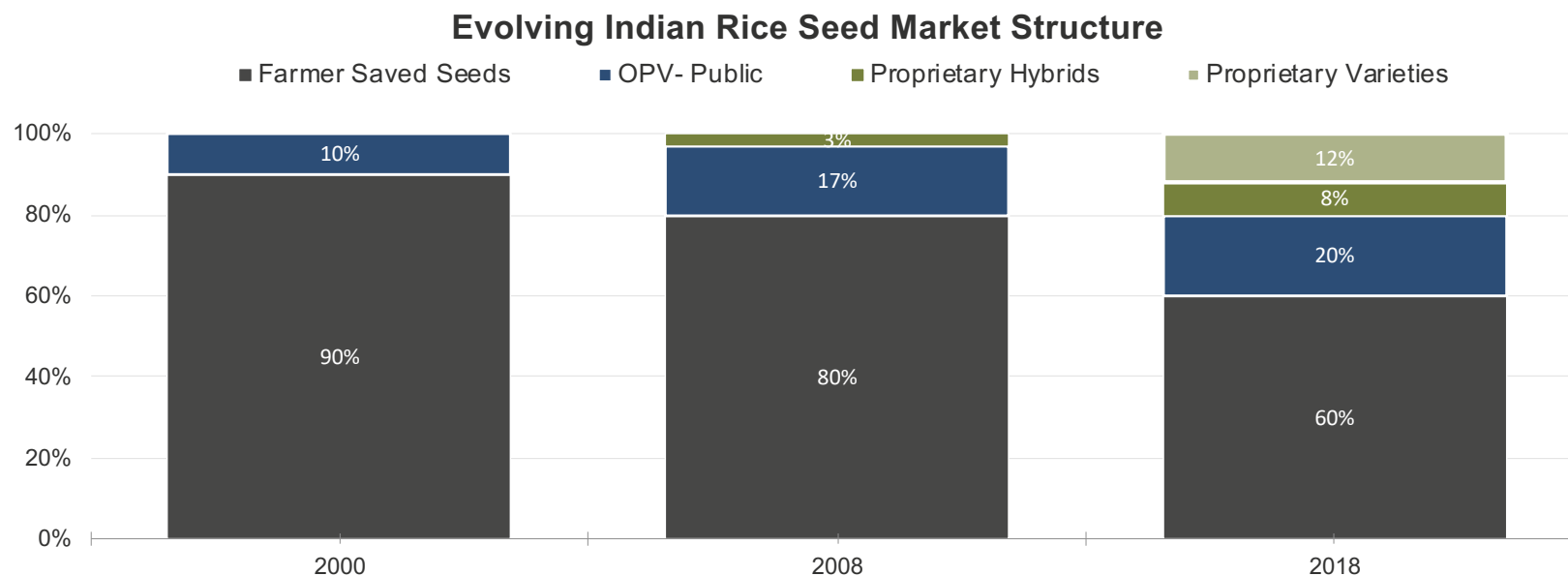
Study States: Change in SRR % (2003 to 2017)



In Chhattisgarh, the govt is pushing increased seed usage through subsidies. In Telangana and Andhra, rice farmers are overwhelmingly preferring to buy seeds.

Evolving Indian Rice Seed Market Structure

Emergence of a Proprietary OPV Segment

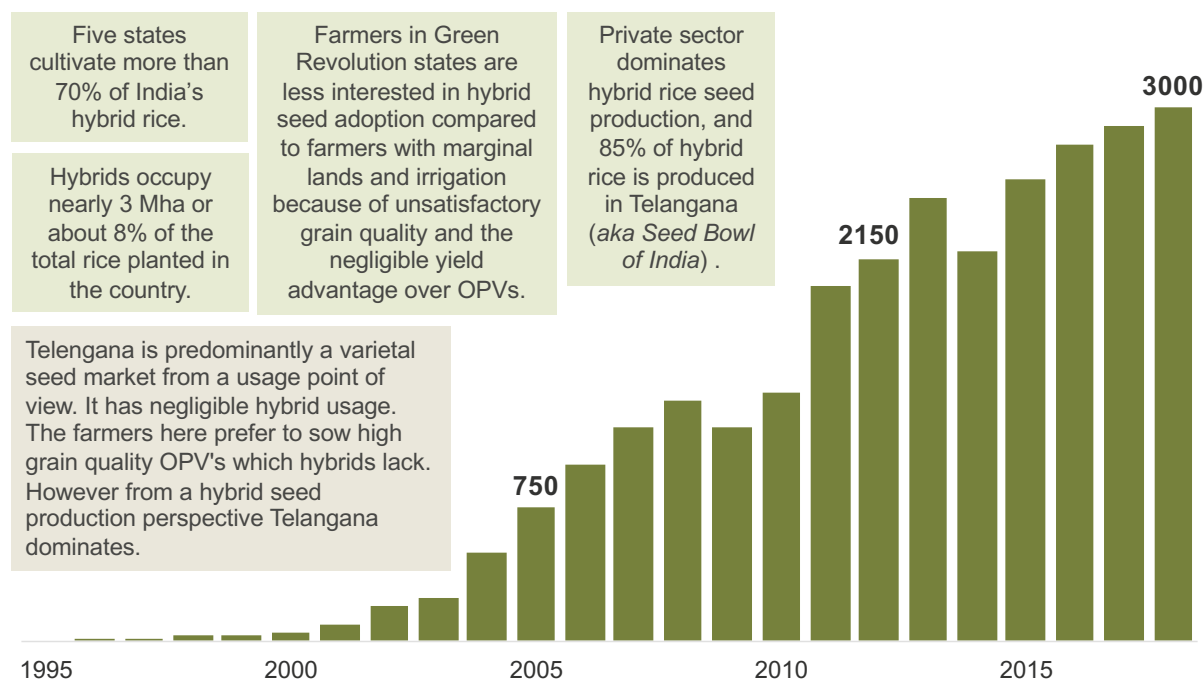


Over the past decade private companies have begun purifying and making proprietary selections from publicly developed, notified varieties. This new OPV segment has grown from nothing to an estimated 12% of area planted due to a number of factors including farmers' willingness to pay for higher quality seed and private sector marketing and distribution.

Hybrid segment, which was negligible in 2000, has grown to an estimated ~8% of seeded rice area in India

Hybrid Rice Market – Grain Quality Concerns and Low Yield Advantage Slows Adoption

Hybrid Rice Area Planted in India (000' Ha)



Major hybrid grain producing states

| State | Hectares | % of Total |
|----------------|--------------|-------------|
| Uttar Pradesh | 1,012 | 34% |
| Bihar | 425 | 14% |
| Jharkhand | 297 | 10% |
| Chhattisgarh | 256 | 9% |
| Haryana | 127 | 4% |
| Madhya Pradesh | 115 | 4% |
| Odisha | 101 | 3% |
| Gujarat | 91 | 3% |
| Punjab | 71 | 2% |
| Assam | 57 | 2% |
| Maharashtra | 42 | 1% |
| All others | 400 | 13% |
| Total | 2,993 | 100% |

Green Revolution states - Punjab, Haryana, Western UP, Telangana, Andhra Pradesh, Karnataka, Tamilnadu

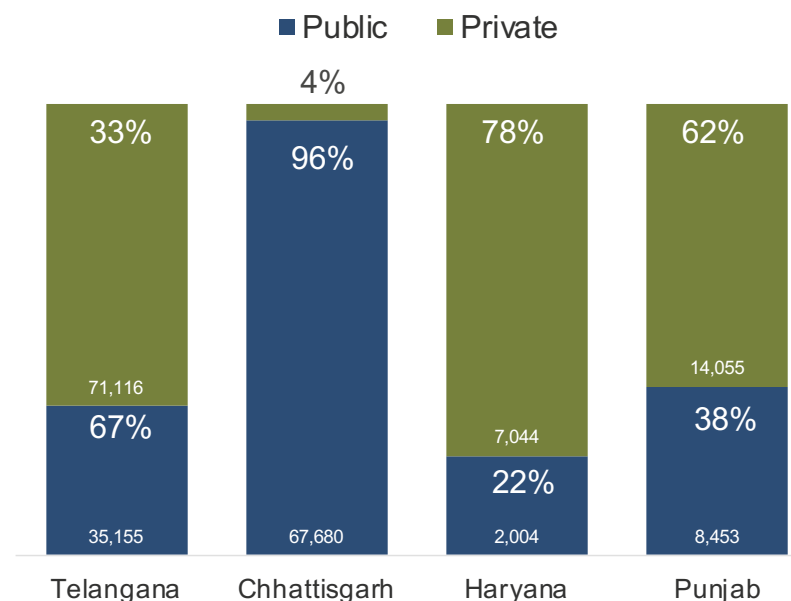
Seed Distribution in Study States

Private Sector Prevalent in Telangana, While Public Sector Leads in Chhattisgarh

State Seed Supply by Source Estimates 2018 (Tons)

| Seed supplier | Telangana | Chhattisgarh | Haryana | Punjab |
|----------------------------------|----------------|---------------|--------------|---------------|
| State Seed Corp. (SSC) | 31,600 | 59,440 | 1,199 | 2,205 |
| National Seed Corp. (NSC) | 1,330 | — | 417 | 1,975 |
| State Agricultural Univ. (SAU) | — | 194 | 195 | 1,360 |
| State Dept. of Agriculture (SDA) | 2,225 | — | — | — |
| Cooperatives | — | 8,046 | — | 72 |
| Others | — | — | 191 | 2,840 |
| Private | 71,115 | 2,625 | 7,043 | 14,055 |
| Total | 106,270 | 70,305 | 9,045 | 22,507 |

Public & Private Share (Tons)



Proprietary Rice Seed Market in India

Hybrid rice market share consolidated under Bayer and Pioneer, while the OPV segment is more fragmented

Proprietary hybrid rice market is consolidated, with Bayer and Pioneer (Corteva) at 60% combined market share.

PROPRIETARY HYBRIDS

| Company | Seed Sales (Tons) | Market Share (%) |
|-------------------|-------------------|------------------|
| Bayer | 16,000 | 37 |
| Pioneer | 10,000 | 23 |
| Dhanya | 4,000 | 9 |
| Seed Works | 3,000 | 7 |
| Advanta | 2,500 | 6 |
| Devgen | 2,000 | 5 |
| Mahyco | 2,000 | 5 |
| Indo American | 1,250 | 3 |
| J K Agri-Genetics | 1,250 | 3 |
| Unspecified | 1,200 | 3 |
| Nath | 600 | 1 |
| Total | 43,800 | 100 |

Proprietary OPV market is fragmented, with numerous local companies competing on brand and operational execution.

PROPRIETARY VARIETIES

| Company | Seed Sales (Tons) | Market Share (%) |
|--------------|-------------------|------------------|
| Nuziveedu | 18,000 | 17 |
| Kaveri | 10,000 | 9 |
| Ankur | 10,000 | 9 |
| Ganga Kaveri | 8,000 | 8 |
| Mahyco | 5,000 | 5 |
| JK | 5,000 | 5 |
| Unspecified | 50,000 | 47 |
| Total | 106,000 | 100 |

Basmati Rice in India

Premium Superfine, Long Grain, Aromatic Rice

Basmati is a special long grain aromatic rice cultivated in a specific geographical regions of the Indian subcontinent – it is India's highest valued agricultural export (GOI 16-17).

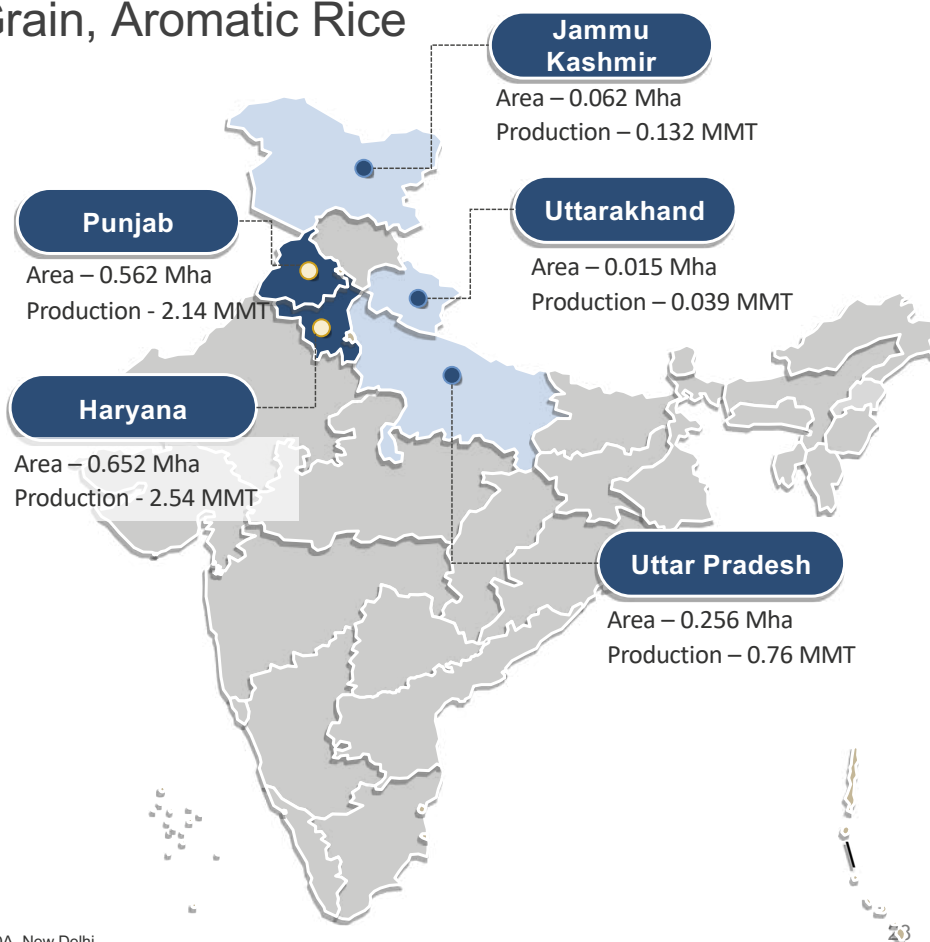
India produces more than **70%** of world's basmati.

Pakistan produces the the other **~30%**.

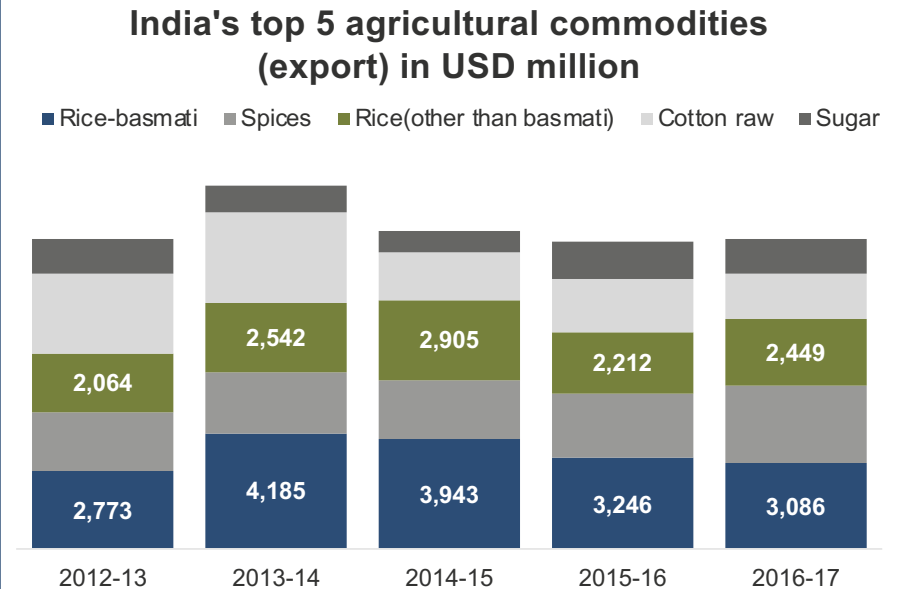
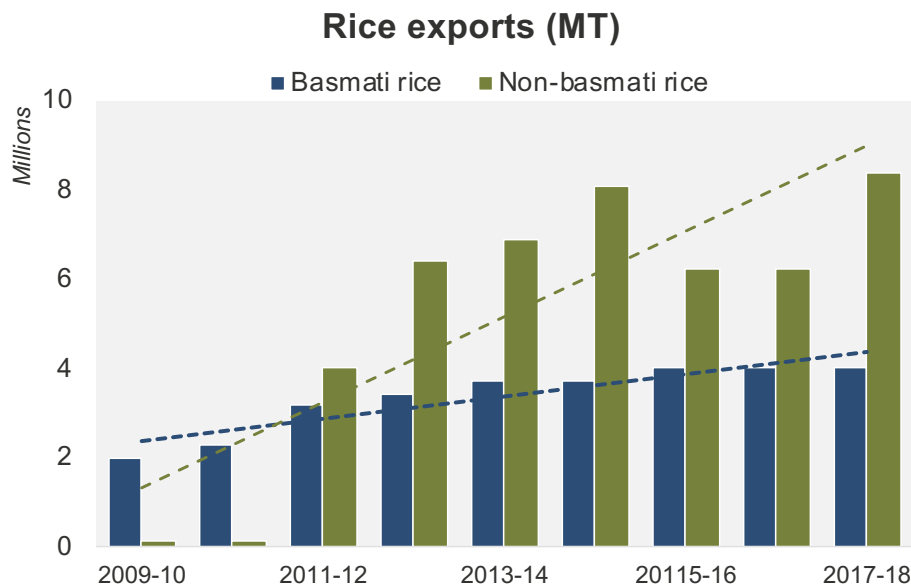
Basmati is primarily cultivated on irrigated lands in kharif season.

Area (%) occupied by basmati within each major cultivating state (2017):

| State | Haryana | Punjab | U. P. | U. K. | J. K. | H. P. | Delhi |
|-----------------------------------|---------|--------|-------|-------|-------|-------|-------|
| Basmati share within state | 33% | 24% | 14% | 7% | 99% | 42% | 16% |



Non-Basmati Rice Exports Have Grown Dramatically Since Export Ban Lifted



Export of non-basmati rice has surged over the past decade, after the government lifted its export ban. Non-basmati rice is essential to food security in India, unlike export-driven basmati rice, which the government does not regulate the same way.



Leadership



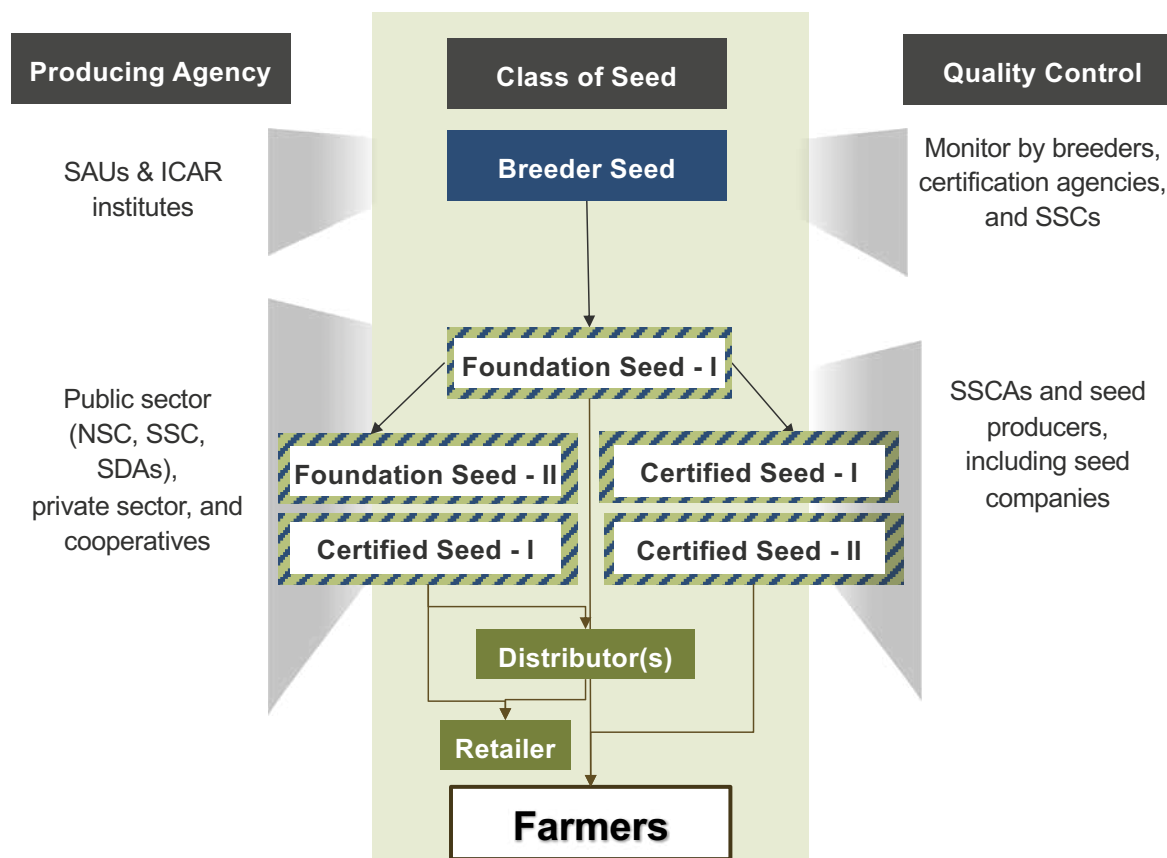
LEADERSHIP

Public Sector Plays Key Role in Production, Distribution, and Quality Assurance

Public R&D system has made significant contributions to the delivery of new modern varieties (MVs) and hybrids to farmers through transfer of technology (TOT) programs, such as on-farm verification trials, FLDs, and the minikit program.

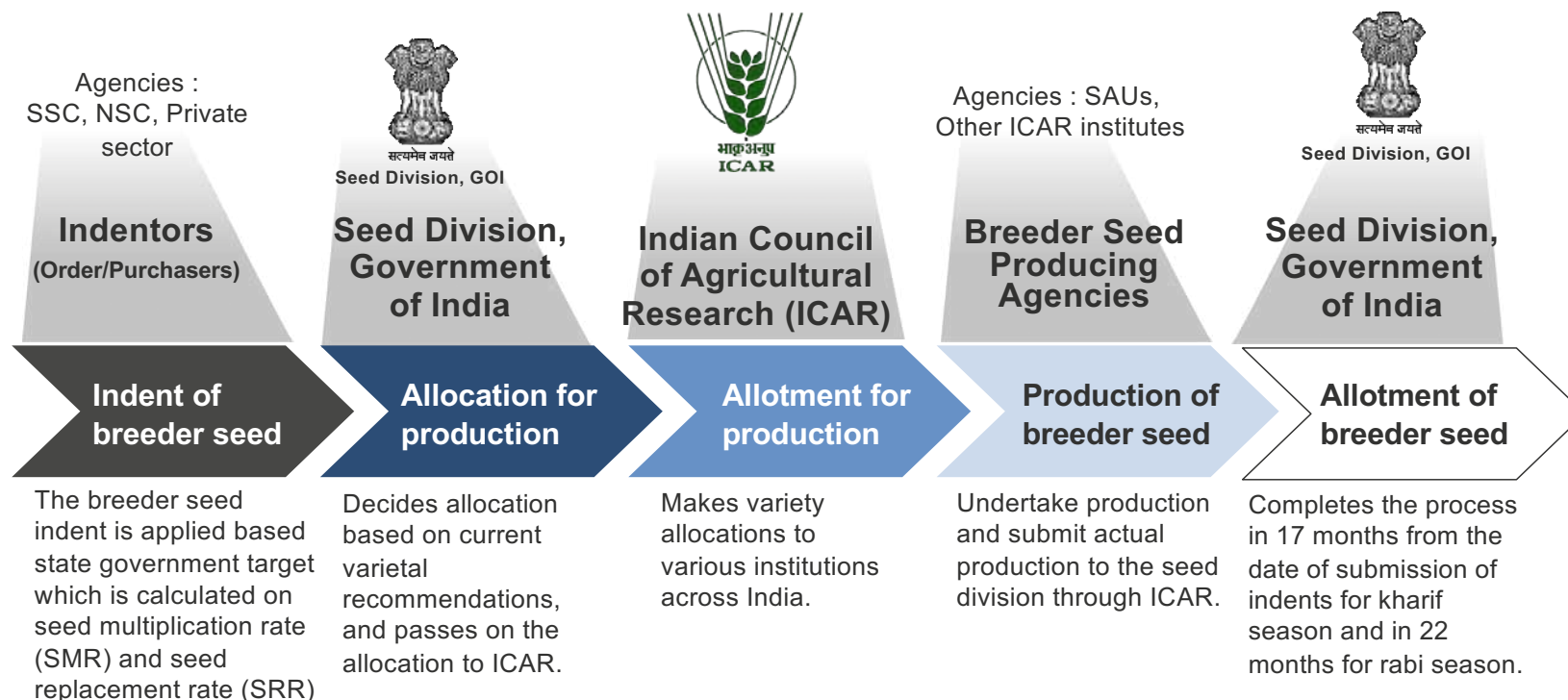
Lead farmers who participate in TOT programs have **become promoters and suppliers** of new **MV seeds** for fellow farmers.

Publicly bred MVs and other improved **germplasm are accessible by** the private sector, farmers' cooperatives, and NGOs.



Source: Context expert analysis

Breeder Seed Demand Forecasting & Production Planning Is Well-Coordinated & Efficient



India Breeder Seed Management System (Cont.)



Beyond breeder seed production, which is managed by the national seed system, numerous state-level multiplication stakeholders are involved, including:

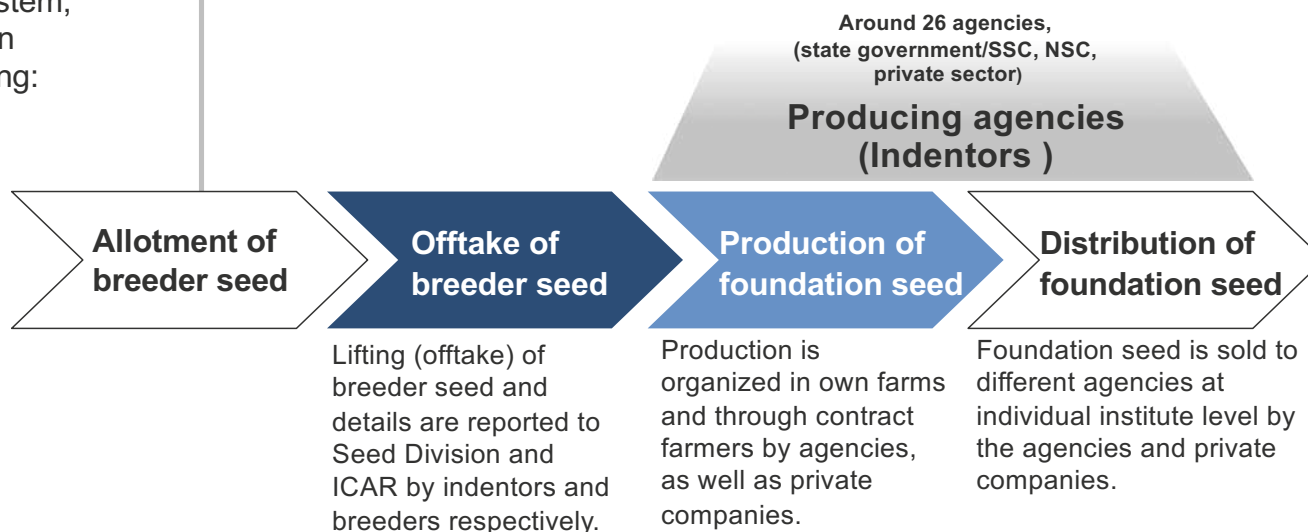
SSCs & SSCAs

SAUs

Private companies

Farmer cooperatives

Other approved seed producers



Seed Division, Government of India

Central Sector Scheme



Central Sector Scheme

1. Transport Subsidy on Movement of Seeds
2. Establishment and Maintenance of Seed Bank
3. Quality Control Arrangement on Seeds
4. Seed Village Programme
5. Assistance for Creation/Strengthening of Infrastructure Facilities in Public Sector
6. Application of Biotechnology in Agriculture
7. Assistance for Boosting Seed Production in Private Sector
8. Promotion of Hybrid Rice Seed Production
9. Assistance for Boosting Seed Export

Funding Sources



Grant from GOI



Seeds Division

DAC has implemented a country-wide Central Sector Scheme for the "Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds" since 2005-06 to ensure sufficient production and multiplication of high-yielding certified/quality seeds of all crops. It also aims to make the seeds available to farmers, including those in remote areas not easily accessible by rail or at affordable price.

Subordinate Offices: National Seed Research and Training Center (NSRTC), Varanasi

The NSRTC's prime objective is to have a separate national seed quality control laboratory which serves as a Central Seed Testing Laboratory (STL). STL maintains the uniformity in seed testing across all State Seed Testing Laboratories at the national level. It acts as laboratory for court-referred seed samples and is a member of the International Seed Testing Association (ISTA). In addition, CSTL monitors seeds in the market by purchasing samples from various selling points and testing them. Further, NSRTC organizes national training and workshops for professionals involved in seed development and quality control and for stakeholders in the seed industry.

Autonomous Bodies: Protection of Plant Varieties and Farmers' Rights Authority

In order to establish a system that protects and encourages development of new plant varieties, it was deemed necessary to recognize and protect farmers' contributions toward conserving, improving, and making available plant genetic resources. GOI enacted "The Protection of Plant Varieties and Farmers' Rights Act, 2001," which recognizes the contributions of both commercial plant breeders and farmers in plant breeding activity. It supports the socioeconomic interests of all stakeholders, including the private sector, public and research institutions, and resource-constrained farmers.

SeedNet Portal (<https://seednet.gov.in/>)

The National Informatics Centre has created the SeedNet India portal where all seed-related information is made available to farmers, research institutes, certifying agencies, seed testing organizations, etc. The information includes available varieties, new released varieties, seed supply and demand plan (indent and allocation), gazette notification, seed certification processes, present dealer, legal and admin framework, and more.

Source: <http://agricoop.nic.in/divisiontype/seeds>

Seed Division, Government of India (cont.)

Central Sector Scheme



GOVERNMENT OF INDIA MANDATE

Ensure supply of quality seeds to farmers

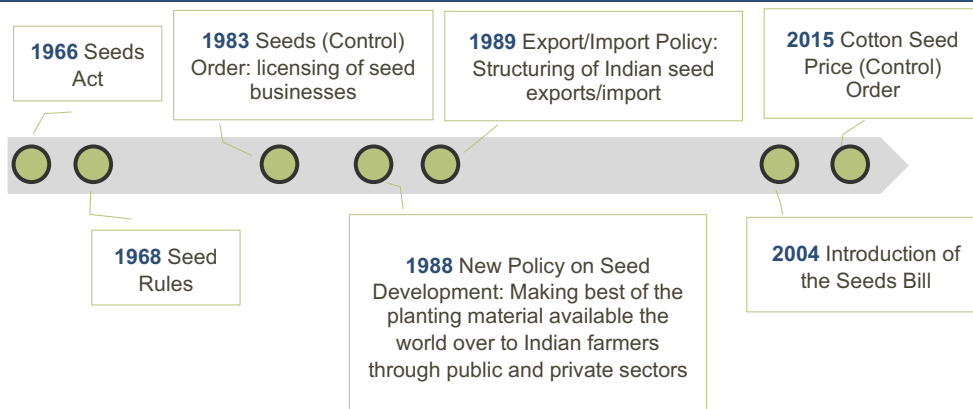
Maintain sustainability and farmer profitability by developing suitable infrastructure for seed quality control and seed development

Effectively implement and enforce the Seed Law

Develop and enforce seed quality standards

Strengthen seed certification and seed testing system

LEGAL INSTRUMENTS FOR SEED QUALITY REGULATION



SEED LAW ENFORCEMENT

Seed Law Enforcement – Seed inspectors are appointed by state governments (under section 13 of Seeds Act, 1966).

To ensure the quality of seeds, inspectors sample seeds and verify records or other material and seize if it does not meet Seeds Act provisions.

Seed testing takes place at Seed Testing Laboratories.

Seed certification is handled by the SSCAs.

Suitable instructions are issued to draw targeted seeds samples from the market before sowing season, per the provisions of the Seeds Act and Seed (Control) Order.

LEADERSHIP



Indian Council of Agricultural Research (ICAR)

Introduction to ICAR

ICAR is one of the largest national agricultural systems in the world. It plays a major role in promoting excellence in higher education in agriculture.

ICAR is an autonomous organization under the Department of Agricultural Research and Education (DARE), one of the departments of the Ministry of Agriculture and Farmers Welfare, GOI.

ICAR's headquarters is in New Delhi. There are 101 ICAR institutes and 71 agricultural universities spread across the country.

Funding Sources



- GOI grants
- Proceeds from the Agricultural Produce Cess Act
- Internally generated resources

Mission

ICAR spearheads national programs on agricultural research, higher education, and frontline demonstration (FLD) extension through a network of research institutes, agricultural universities, All India Coordinated Research Projects, and Krishi Vigyan Kendras (KVKs) to develop and demonstrate new technologies and to develop competent human resources for strengthening the country's agriculture across all dimensions.

ICAR Indian Institute of Rice Research (IIRR), Hyderabad

Established in 1965 as an All India Coordinated Rice Improvement Project (AICRIP) with 12 main centers, IIRR was elevated to directorate status in 1983 and to a full-fledged institute in 2015. Now there are 45 funded centers participating in AICRIP and more than 60 voluntary centers. IIRR has a sanctioned scientific cadre strength of 71 scientists. It is committed to maintaining its leadership and is responsive, vibrant and sensitive to the changing scenario and needs of its stakeholders.— ICAR-IIRR

ICAR National Rice Research Institute –NRRI. Cuttack (Formerly CRRI)

Established in 1946, NRRI has been pivotal in rice research in the country. It has developed 133 high-yielding rice varieties and several crop production, crop protection, and farm implement technologies. NRRI reports that varieties released by it are cultivated on 18-20% rice area within India and it has contributed significantly to the increase of rice production from about 20 million tons in 1950 to 112.8 million tons in 2017-18. During 2018-19, NRRI worked on 31 research projects under 7 research programs, 108 externally-aided projects, and 4 flagship projects. NRRI is one of the institutes of the ICAR under the Crop Science Division.

ICAR Indian Institute of Seed Science, Varanasi

The vision of this institute is to ensure quality seed security to farmers through technological intervention and sustainable agriculture, with the mission of enhancing genetic and physical seed characteristics for increased productivity, quality, and sustainability. Its mandate encompasses: basic, strategic, and anticipatory research in seed science and technology; coordination of seed production and seed technology research; and capacity-building in the field of seed production, testing, quality assurance, certification, and policy issues.

Source: <https://icar.org.in/>

Other National Bodies

Private & public companies play important roles too

| State-Level Players | All India Number |
|--|------------------|
| State Seeds Corporation (SSC) | 16 |
| State Seeds Certification Agencies (SSCAs) | 26 |
| State Agriculture Universities (SAUs) | >60 |
| Cooperatives | >5 |
| Private Seed Companies | >500 |

Source: <https://www.nscl.in/>

National Seeds Corporation Limited (NSC)

National Seeds Corporation Limited (NSC) is a public company incorporated in 1963 to undertake production of foundation and certified seeds. It is wholly owned by GOI under the administrative control of Ministry of Agriculture and Farmers Welfare.

NSC is assigned the lead role to develop the seed industry in the country. It undertakes production of certified seeds of nearly 600 varieties of 60 crops through its own farms and registered seed growers. NSC has 10 regional offices, 65 area offices, 44 seed processing plants, 7 air-conditioned seed storage facilities, 2 vegetable seed packing centers, 4 seed testing labs, and one DNA fingerprinting lab.

Seed marketing is carried out through three channels, namely sales through dealers/distributors, government (state/central) channels, and through its own sales counters. There are about 2,550 dealers of the corporation, accounting for more than 50% of sales.

NSC plays a key role in implementing of various GOI schemes, such as the National Mission on Oilseeds and Oil Palm (NMOOP), National Food Security Mission (NFSM), and Mission for Integrated Development of Horticulture (MIDH). It also provides technical support to the seed producing agencies, including SSCs, by training some personnel engaged in seed production in that organization. NSC is the nodal agency for the implementation of the Central Sector Scheme to create infrastructure facilities for the establishment of processing plants and storage facilities in different states within the private sector.

National Seed Association of India (NSAI) & Federation of Seed Industries of India (FSII)

National Seed Association (NSA) bodies represent the private seed industry of India, representing more than 90% of private sector sales. Its vision is to create "a dynamic, innovative, internationally competitive, research-based industry producing high performance, high quality seeds and planting materials which benefit farmers and significantly contribute to the sustainable growth of Indian Agriculture."

NSA bodies encourage investment in R&D to bring superior genetics and technologies to farmers, and they actively contribute to seed industry policy development with federal and state governments to ensure the creation of enabling environments that support global competitiveness.





NSA bodies arrange scientific seminars, trainings, and meetings. They also work towards globalizing the seed industry, harmonizing the regulatory environment, promoting export of seed, and encouraging investment in the industry.

Source: <https://icar.org.in/>

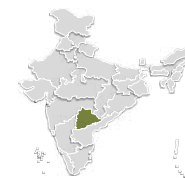
LEADERSHIP

Telangana State Organizational Value Chain



| ORGANIZATION | A | B | C | D | E | F | G |
|--------------------------|--|---|--|--|---|--|--|
| | Indian Council of Agricultural Research (ICAR) | AICRI Program under IIRR & other ICAR Inst. | PJTSAU, Hyderabad (SAU) | Telangana State Seed Organic Certification Authority | Telangana State Seeds Development Corporation | National Seeds Corporation Limited (NSC) | Private Sector |
| | भारतीय कृषि अनुसंधान परिषद Indian Council of Agricultural Research (Ministry of Agriculture and Farmers Welfare) | |  |  |  |  | COMMERCIAL SEED COMPANIES |
| VALUE CHAIN ROLE | <ul style="list-style-type: none"> – Spearhead national agriculture programs in the state – Varietal licensing | <ul style="list-style-type: none"> – Support varietal development for state agroecology – On-farm demonstration of research recommendations | <ul style="list-style-type: none"> – Varietal development and R&D – Breeder seed production and maintenance – Seed production | <ul style="list-style-type: none"> – Quality control: breeder, foundation, and certified seed certification – OECD certification | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Advocacy for private sector by associations – Foundation and certified seed production – Distribution of seeds |
| MAJOR FUNDING SOURCES | <ul style="list-style-type: none"> – GOI grants – Internally generated resources | <ul style="list-style-type: none"> – Budget allocated by ICAR – State fund to the regional research institution | <ul style="list-style-type: none"> – State government – ICAR grants – Internally generated resources | <ul style="list-style-type: none"> – State government grants and employee deputation – Certification fees | <ul style="list-style-type: none"> – State government – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Ministry of Agriculture and Farmers Welfare, GOI – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Private capital and income from the seed sales |
| FINANCIAL SUSTAINABILITY | PRIMARILY GOVT. GRANTS AND PARTLY INTERNALLY GENERATED INCOME FROM FEES & SALES | | | | PARTIALLY SUBSIDIZED AND SUPPORTED | | FINANCIALLY SUSTAINABLE |

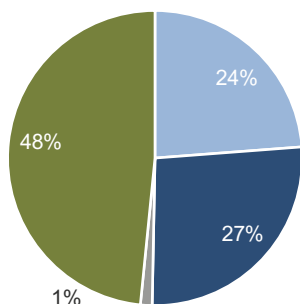
Telangana State-level Leadership



Quality Seed Production

Telangana Quality Seed Production Plan

■ DOA ■ SSC ■ NSC ■ PRIVATE



Funding Sources



- State government grants
- GOI grants
- Proceeds from Agricultural Produce Cess Act
- Internally generated resources

Professor Jayashankar Telangana State Agricultural University (PJTSAU), Telangana State

PJTSAU has nine constituent colleges with six devoted to agriculture, two to agricultural engineering and technology, and one to home science. In addition, there are 13 constituent polytechnics (11 in agriculture and one each in seed science and agricultural engineering). There are 16 agricultural research stations, including three regional stations, nine District Agricultural Advisory and Transfer of Technology Centers, eight KVKs, one Extension Education Institute, one Agricultural Information and Communication Center, one Agricultural Technology Information Center, and an Electronic Media Wing spread across the state with scientific support and administrative staff. Underway at PJTSAU are more than 29 ICAR research projects, seven GOI schemes, and three non-plan schemes funded by the state government.

Telangana State Seed Development Corporation (SSC)

The Telangana SSC main objectives are: 1) Assistance in breeder seed production; 2) Foundation seed production, certified seed production; 3) Seed processing packing, storage, marketing and distribution; 4) Seed supplies to different areas under contingency programs 5) Maintenance of seed bank of foundation seeds & certified seeds; 6) Collaboration in seed technology research coordination in seed import. Telangana SSC supplies seed to farmers through its own outlets, primary agricultural cooperative societies, dealers, etc. It has 16 processing plants in different districts. The entire infrastructure is funded by Grant in Aid from GOI Telangana state.

Telangana State Seed & Organic Certification Authority (TSSOCA)





The headquarters and zonal office of TSSOCA is in Hyderabad. Its five divisional offices covering the state are in Hyderabad, Warangal, Karimnagar, Nizamabad, and Gadwal. Its two notified seed testing laboratories are in Rajendranagar, and ARS, Karimnagar. Each division is a center for certified seed production of one or two crops: for example, rice paddy for Karimnagar, Warangal, and Hyderabad divisions; groundnut and bengal gram seed in Gadwal; and maize and pulses in Warangal division.

Source: <http://www.tssdcl.telangana.gov.in/>

LEADERSHIP

Chhattisgarh State Organizational Value Chain



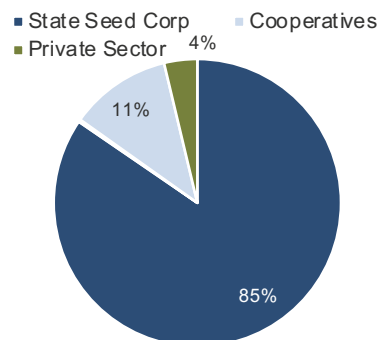
| ORGANIZATION | A | B | C | D | E | F | G |
|--------------------------|--|---|--|---|---|--|--|
| | Indian Council of Agricultural Research (ICAR) | AICRI Program under IIRR & other ICAR Inst. | IGKV, Raipur (SAU) | Chhattisgarh State Seed Certification Agency | The Chhattisgarh State Seeds Dev. Corp. | Cooperatives | Private sector representing the NSAI |
| | भारतीय कृषि अनुसंधान परिषद Indian Council of Agricultural Research (Ministry of Agriculture and Farmers Welfare) | |  |  |  | |  |
| VALUE CHAIN ROLE | <ul style="list-style-type: none"> – Spearhead national agriculture programs – Varietal licensing | <ul style="list-style-type: none"> – Varietal development – On-farm demonstration of research recommendations | <ul style="list-style-type: none"> – Varietal development – Breeder, foundation, and certified seed production | <ul style="list-style-type: none"> – Quality control: breeder, foundation, quality seed | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Advocacy for private seed players – Foundation and certified seed production – Distribution of seeds |
| MAJOR FUNDING SOURCES | <ul style="list-style-type: none"> – GOI grants – Internally generated resources | <ul style="list-style-type: none"> – ICAR allots budget – State fund to the regional research institution | <ul style="list-style-type: none"> – State government – ICAR budget – Internal resource generation | <ul style="list-style-type: none"> – State government – Profit from the certification | <ul style="list-style-type: none"> – State government – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Profit from the sale of certified seed |
| FINANCIAL SUSTAINABILITY | SUBSIDIZED BY THE PUBLIC SECTOR | | | | PARTIALLY SUBSIDIZED | | FINANCIALLY SUSTAINABLE |

Chhattisgarh State-Level Leadership



Quality Seed Production

Chhattisgarh Quality Seed Production Plan



Funding Sources



- State government grants
- GOI grants
- Proceeds from the Agricultural Produce Cess Act
- Internally generated resources

Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh State Agriculture University)

Indira Gandhi Krishi Vishwavidyalaya, is an autonomous nonprofit, research, and educational organization working to improve farmer livelihoods in Chhattisgarh. Education, research, and extension are the major activities coordinated through faculties and directorates of instruction, research, and extension. Grant in aid is received from ICAR, the state government, and international agencies. The university's major objectives are to: undertake basic, applied and adaptive research to evolve appropriate solutions and technologies; diversification of crops and farming systems; . collaboration with state, national, and international research institutions; imparting knowledge and education to people engaged in agriculture and allied fields; and developing educational and research networks in agriculture and allied fields. – Indira Gandhi Agricultural University

Chhattisgarh State Seeds Corporation (SSC)

The Chhattisgarh SSC is a public sector organization that produces and provides certified seed to farmers through 152 societies, seed processing centres, and state agricultural departments. It also produces foundation seed in 10 farm units/fields (328 ha) based on the demand of the agriculture department. It encourages agricultural mechanization and promotes organic farming in the state. Currently seven central-sponsored schemes and four state-sponsored schemes are active with Chhattisgarh's SSC. The corporation has 27 seed processing plants with 157,000 MT total capacity and it claims more than 80% share in the state certified seed supply plan. Certified rice seed production is estimated around 559,020 quintals in kharif 2018 of 30 different varieties.

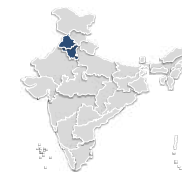
Chhattisgarh State Seed Certification Institute, Raipur






Major responsibilities of the institution include: registration of seed producing institutions and farmers who propagate seeds of different crop varieties notified by GOI; inspection of registered areas; registration of process centers for seed processing; inspection of seed processing centers and tagging of standard level seed; testing the quality of seeds in the seed test laboratory; and collection of notified varieties and their genetic properties.

Source: <http://agriportal.cg.nic.in/beejnigam/BeejHi/>

LEADERSHIP

Punjab State Organizational Value Chain



| ORGANIZATION | A | B | C | D | E | F | G |
|--------------------------|---|---|--|---|---|--|--|
| | Indian Council of Agricultural Research (ICAR) | AICRI Program under IIRR & other ICAR Inst. | Punjab Agri. University Ludhiana (SAU) | Punjab State Seed Certification Agency | Punjab State Seeds Dev. Corp. | National Seeds Corporation Limited (NSC) | Private sector representing the NSAI |
| | भारतीय कृषि अनुसंधान परिषद Indian Council of Agricultural Research (Ministry of Agriculture and Farmers Welfare) | |  |  |  |  |  |
| VALUE CHAIN ROLE | <ul style="list-style-type: none"> – Spearhead national agriculture programs – Varietal licensing | <ul style="list-style-type: none"> – Varietal development – On-farm demonstration of research recommendations | <ul style="list-style-type: none"> – Varietal development – Breeder, foundation, and certified seed production | <ul style="list-style-type: none"> – Quality control: breeder, foundation, quality seed | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Advocacy for private seed players – Foundation and certified seed production – Distribution of seeds |
| MAJOR FUNDING SOURCES | <ul style="list-style-type: none"> – GOI grants – Internally generated resources | <ul style="list-style-type: none"> – ICAR allots budget – State fund to the regional research institution | <ul style="list-style-type: none"> – State government – ICAR budget – Internal resource generation | <ul style="list-style-type: none"> – State government – Profit from the certification | <ul style="list-style-type: none"> – State government – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Ministry of Agriculture and Farmers Welfare, GOI – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Profit from the sale of certified seed |
| FINANCIAL SUSTAINABILITY | SUBSIDIZED BY THE PUBLIC SECTOR | | | | PARTIALLY SUBSIDIZED | | FINANCIALLY SUSTAINABLE |

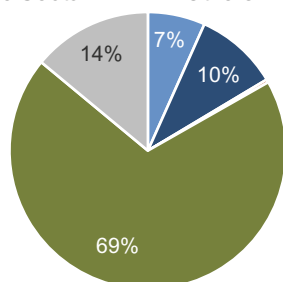
Punjab State-Level Leadership



Quality Seed Production

Punjab Quality Seed Production Plan

- State Agri Uni
- National Seed Corp
- Private Sector
- Others



Funding Sources



- State government grants
- GOI grants
- Proceeds from the Agricultural Produce Cess Act
- Internally generated resources

Punjab Agricultural University (PAU)

PAU is a leading state agricultural university for research, education, and extension in India. Having played a pivotal role in making the country self-sufficient in food grain production, it is known as the "Mother of the Green Revolution." PAU spans an area of 494 hectares at Ludhiana, with an off-campus area of 1793 hectares. The university now has four constituent colleges located at Naraingarh (Fatehgarh Sahib), Ladhawal (Ludhiana), Nabha (Patiala) and Birsikhanwala (Faridkot), which house eight regional research stations, three fruit research sub-stations, and five seed farms. The university has 18 KVKs. It also extends services to farmers through 14 Farmers' Advisory Service Centers. In 2017, it was ranked third by ICAR among all agricultural institutions/universities. The main rice research program of PAU is at Ludhiana with substations at Gurdaspur, Rauni (Patiala), and Kapurthala. Since inception, 35 varieties (24 non-basmati and 11 basmati) have been released by PAU, Ludhiana.

Punjab State Seeds Corporation Limited (SSC)

Punjab SSC was incorporated in 1976 with the objective of providing better quality seeds at reasonable price to farmers and developing a seed production infrastructure capable of responding rapidly to the fast changing demand of seeds of all kinds with least possible costs. The foundation seeds of different crops/varieties as recommended by PAU are procured by Punjab SSC and supplied to registered seed growers, as shareholders or contract growers for multiplication into certified seeds. Thus, the activities of Punjab SSC cover: the procurement of foundation seeds; supply of foundation seeds to growers; inspection of raw seeds of the standing crops; procurement of raw seeds at the seed processing plant level; grading, processing, and arranging for certification of seeds by Punjab SSCA; and packing, tagging, and transportation of seeds in marketable bags for sale to the farmers.

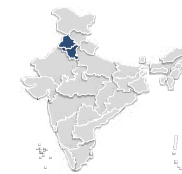
Punjab State Seed Certification Agency (SSCA)






Punjab SSCA was established in 1976 under the Seeds Act-1966 to fulfil the conditions as laid down in National Seeds Projects. The main function of the agency is to certify the seeds of crops/varieties notified GOI under section 5 of the Seeds Act-1966. The task of the agency is determined on the basis of area offered by the different seed producers/ organizations in a particular season/year and the agency has to depute its field staff according to the need after a thorough review before the start of season/year, so that the service of the staff is properly utilized.

Source: <https://icar.org.in/>

LEADERSHIP

Haryana State Organizational Value Chain



| ORGANIZATION | A | B | C | D | E | F | G |
|--------------------------|---|---|--|---|---|--|--|
| | Indian Council of Agricultural Research (ICAR) | AICRI Program under IIRR & other ICAR Inst. | Chaudhary Charan Singh Haryana University (SAU) | Haryana State Seed Certification Agency | Haryana State Seeds Dev. Corp. | National Seeds Corporation Limited (NSC) | Private sector representing the NSAI |
| | भारतीय कृषि अनुसंधान परिषद Indian Council of Agricultural Research (Ministry of Agriculture and Farmers Welfare) | |  |  |  |  |  |
| VALUE CHAIN ROLE | <ul style="list-style-type: none"> – Spearhead national agriculture programs – Varietal licensing | <ul style="list-style-type: none"> – Varietal development – On-farm demonstration of research recommendations | <ul style="list-style-type: none"> – Varietal development – Breeder, foundation, and certified seed production | <ul style="list-style-type: none"> – Quality control: breeder, foundation, quality seed | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Foundation and certified seed production – Distribution of seeds | <ul style="list-style-type: none"> – Advocacy for private seed players – Foundation and certified seed production – Distribution of seeds |
| MAJOR FUNDING SOURCE-S | <ul style="list-style-type: none"> – GOI grants – Internally generated resources | <ul style="list-style-type: none"> – ICAR allots budget – State fund to the regional research institution | <ul style="list-style-type: none"> – State government – ICAR budget – Internally generated resources | <ul style="list-style-type: none"> – State government – Profit from the certification | <ul style="list-style-type: none"> – State government – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Ministry of Agriculture and Farmers Welfare, GOI – Profit from the sale of certified seed | <ul style="list-style-type: none"> – Profit from the sale of certified seed |
| FINANCIAL SUSTAINABILITY | SUBSIDIZED BY THE PUBLIC SECTOR | | | | PARTIALLY SUBSIDIZED | | FINANCIALLY SUSTAINABLE |

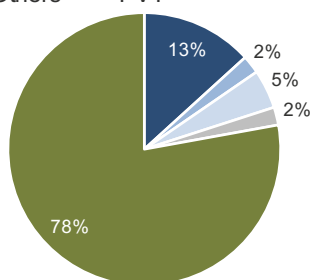
Haryana State-Level Leadership



Quality Seed Production

Haryana Quality Seed Production Plan

■ SSC ■ SAUs ■ NSC
■ Others ■ PVT



Funding Sources



- State government grants
- GOI grants
- Proceeds from the Agricultural Produce Cess Act
- Internally generated resources

Chaudhary Charan Singh Haryana Agricultural University, Hisar

The Haryana Agricultural University was established in 1970 and spans 7,219 acres at Hisar and 1,426 acres at outstations. The university has the following six constituent colleges: College of Agricultural Engineering and Technology, Hisar; College of Agriculture, Hisar; College of Agriculture, Kaul; College of Bawal; College of Basic Sciences & Humanities, Hisar; and Indira Chakravarty College of Home Science.

The university publishes the most research papers among agricultural universities in India. It has research facilities spread throughout the state, including eight KVKs; 12 Krishi Gyan Kendras (agricultural knowledge centers); regional research stations at Bawal (Rewari), Rohtak, Uchani, Kaul, Buria, Ambala, and Balsamand (Hisar); a training institute at Nilokheri Karnal; and six disease investigation labs

Haryana Seeds Development Corporation Limited (SSC)

The Haryana SSC was established in 1974 under the Companies Act (1956) with the objective of organizing production and distribution of certified seeds to farmers at reasonable rates. It is funded by the state government, National Seeds Corporation Limited, and shareholder seed growers of the corporation. It has six seed processing plants in Umri, Hisar, Sirsa, Yamuna Nagar, Tohana, and Pataudi, and one marketing center in Bhiwani. It also has a cotton ginning and bale pressing factory at Hisar. The Haryana SSC markets certified seeds through its own network of 74 sale counters, institutional agencies like Haryana Agricultural Marketing Federation Co-operative Limited (HAFED), Haryana Agro Industries Corporation Limited (HAIC), and mini banks.

Haryana State Seed Certification Agency, Panchkula

The Haryana State Seed Certification Agency was incorporated in 1974 to provide quality seeds of wheat, paddy, gram, pulses, oil seeds and vegetables at reasonable prices to the farmers in Haryana. The agency has six processing plants with a total processing capacity of 29000 MT graded. In 2018-19, HSSC cultivated certified seeds in 8440 Ha and produced 2434 MT foundation seed & 18664 MT. certified seed.



Research & Varietal Development



Indian Rice Varietal Development: A Journey

All India Coordinated Rice Improvement Project (AICRIP) has 47 fully funded centers, 100 participating centers (SAUs and SDAs) across all rice-growing states.

Website link:
<http://www.aicrip-intranet.in/>

60 state agricultural universities in rice-growing states are also involved in breeding as a part of AICRIP or independently motivated.

By 1950, ICAR established 82 research stations dedicated to rice research in 14 states. Releases 445 OP varieties using a pure line methods

In the 1950s and 1960s NRRI tested many exotic rice varieties and selected the most suitable germplasm. NRRI & ICAR were successful in identifying high yielding varieties (HYVs) that were responsive to fertilizers

AICRIP was established in 1965 and worked closely with IRRI to initiate work on the interracial hybridization program of semi-dwarf Taiwanese types/derivatives and indica types. Over the following decade, India rice breeding programs become increasingly productive. AICRIP develops f Taichung (Native) - 1 from the semi-dwarf mutant and achieves remarkable success. Landmark varieties Padma and Jaya emerge from this program

In the 1970s, India achieves self-sufficiency in rice production. To date, AICRIP has evaluated 24,900 entries and released 1,000 OPV varieties and 68 hybrids

All India Coordinated Rice Improvement Program (AICRIP)

The Largest Research Network Working on a Single Crop

AICRIP coordinates multi-disciplinary and multi-location testing of varietal improvement, crop protection, and crop management technologies in India. IIRR is the nodal agency that facilitates planning, supply, and exchange of improved germplasm and experimental material for evaluation, trial data collection, compilation, analysis, and documentation. Trials are monitored by IIRR & NRRI (the other principal ICAR Rice Institute) at various centres across India.

There are about 300 scientists at 47 funded cooperating research centers and about 100 voluntary centers affiliated to various SAUs, SDAs, ICAR institutions and private sector organizations carrying out rice improvement programs. An overview of work by the three important departments :

1.Crop Improvement

Plant Breeding Program: The coordinated breeding program tests promising breeding material (varieties, hybrids, etc.) to identify the most stable, high-yielding, or superior genotypes suited for different agro-climatic conditions by assessing their consistent performance over three years.

2.Crop Production

Agronomy: The coordinated agronomy program conducts trials on nutrient management, yield enhancement, input use efficiency, and conservation agriculture management and provides data to support breeding material for varietal release.

Plant Physiology :The coordinated physiology program identifies suitable donors for major abiotic stresses and evaluates rice genotypes for nitrogen use efficiency.

Soil Science :Addressing issues related to sustaining productivity of soil and crop systems on long-term basis, yield gap assessment and site specific nutrient management.

3.Crop Protection

Entomology: The coordinated entomology program identifies the donors and breeding lines for resistance to major insect pests at multi-locations

Plant Pathology : Under the rice pathology programme of AICRIP more than 1000 accessions of germplasm and advanced breeding lines are evaluated annually against major rice diseases across 52 locations throughout the country.

All India Coordinated Rice Improvement Program (AICRIP)

AICRIP Adjusts Programs and Trials Based on Market Needs



During the initial phase

Emphasis was on achieving higher yields through improved plant type largely for irrigated areas. This led to the development of short statured HYVs. These new revolutionary HVYs heralded "Green Revolution" in India

1980s

Yield stability and quality improvement received heightened attention in this decade. This led to the development of varieties possessing major biotic stress tolerance. A prototype of semi-dwarf basmati rice varieties was developed

1990s

Efforts in the 90s were focused on developing suitable hybrid rice technologies with at least 10% yield advantages over OPVs in various locations to validate superiority. For promoting regular rice exports (non-basmati) targeted different export markets

2000s

The focus in this period included soil stress trials for problem soil areas; aerobic trials to develop genotypes for water limited environments; and hill trials for incorporating cold tolerance

In recent times

Emphasis is on in the development of near isogenic lines for quick evaluation of marker assisted selection, deriving products introgressed with genes for biotic and abiotic stresses, and, finally addressing nutritional security by enriching the grains with micronutrients like zinc, iron, and protein

National Procedure for Varietal Testing and Release

Three-tier system tested over decades



Rice Breeding and National Evaluation System

The varietal testing program follows a three-tier system involving one year of Initial Varietal Trial (IVT) which constitutes the first level of testing after assigning the Initial Evaluation Trial (IET) number to every nominated entry developed by different cooperating centers. The subsequent two years consist of Advance Varietal Trials (AVT-1 and AVT-2) to identify elite lines with consistently superior performance over the best checks.

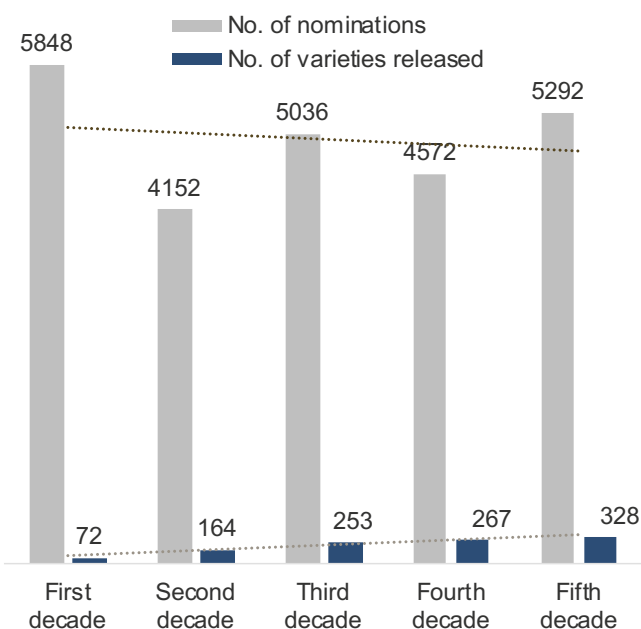
Simultaneously, these nominated lines are screened for resistance to major pests and diseases at hot spot locations, and they are also screened under controlled conditions for disease and insect pressure. Additionally, all promising entries are assessed for grain quality and agronomic performance.

Finally, the top-performing elite lines possessing desirable quality features and required level of stress resistance/tolerance are identified by the Variety Identification Committee in the All India Rice Workshop and then approved for release and notification by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for commercial cultivation.

Depth & Breadth of Varietal Development in India

Nine States Contribute, Led by Andhra Pradesh and Odisha

Nominations tested and varieties released through AICRIP (from 1970s)



Nominations and varietal release by state (1965-2014)

ENTRIES

| IET nominations by state | | |
|--------------------------|------------------|------------|
| States | No. of Genotypes | % of Total |
| Andhra Pradesh | 7218 | 29% |
| Odisha | 4149 | 17% |
| Uttar Pradesh | 1478 | 6% |
| Tamil Nadu | 1256 | 5% |
| West Bengal | 1229 | 5% |
| Uttarkhand | 1164 | 5% |
| Chhattisgarh | 1018 | 4% |
| Maharashtra | 794 | 3% |
| Haryana | 634 | 3% |
| Delhi | 571 | 2% |
| Punjab | 416 | 2% |
| Other states | 4946 | 20% |
| Total | 24900 | 100% |

VARIETIES RELEASED

| No. of varieties released | | |
|---------------------------|------------------|------------|
| States | No. of Varieties | % of Total |
| Andhra Pradesh | 115 | 11% |
| Odisha | 124 | 12% |
| Uttar Pradesh | 48 | 5% |
| Tamil Nadu | 70 | 7% |
| West Bengal | 50 | 5% |
| Maharashtra | 60 | 6% |
| Punjab | 22 | 2% |
| Kerala | 62 | 6% |
| Karnataka | 48 | 5% |
| Bihar | 37 | 4% |
| Assam | 33 | 3% |
| Gujarat | 31 | 3% |
| Union Territory | 25 | 2% |
| Other states | 139 | 14% |
| CVRC | 147 | 15% |
| Total | 1011 | 100% |


Source: <http://www.aicrip-intranet.in/Default.aspx>

Rice Varieties & Market Segments

| Maturity segment | Duration | % Area cultivated | Key states | Reference varieties |
|--------------------|--------------|-------------------|--|--|
| Extra Early | 95-109 days | 7% | JH, CG, MH, GJ, MP, TN | ADT-43, Sahbhagi dhan, NDR- 118 ADT-45 |
| Early Maturity | 110-119 days | 13% | UP, MP, JH, CG, OD, MH, WB GJ, HR, PB, WB, BH, AP, TS | MTU-1010, IR-64, Shatabdi, IR- 36, Gontra Bidhan |
| Mid Early Maturity | 120-129 days | 21% | UP, JH, CG, PB, HR, BH, OD, MP, GJ, TG | Lalat, Naveen, Gurjari |
| Medium Maturity | 130-140 days | 23% | UP, BH, PB, HR, CG, MP, JH, OD | Pusa-1121, MTU-1001, Sarju-52, NDR-359, Mahamaya, HMT |
| Late Maturity | >140 days | 35% | UP, BH, CG, OD, AP, TS, WB, AS | MTU-7029, BPT-5204, Ranjeet, Pusa-44, Swarna Sub-1, Pratikshya |

| Grain type | Reference varieties | End Use |
|--------------------------|---|---|
| Extra Long Slender (ELS) | Pusa-1121, Pusa Basmati-1 | Premium rice, aromatic, mainly consumed in North India, used for special occasions, Biryani |
| Bold Grain | Mahamaya, Jaya, Gurjari, Lalat, IR-64, Sarju-52 | Preferred in a few states for eating, making flaked and puffed rice |
| Medium Slender | BPT-5204, JGL-1798, JGL-384, Imp White Ponni | Good cooking quality, used widely across many states |
| Short Slender | HMT | Good cooking quality, used widely across many states |

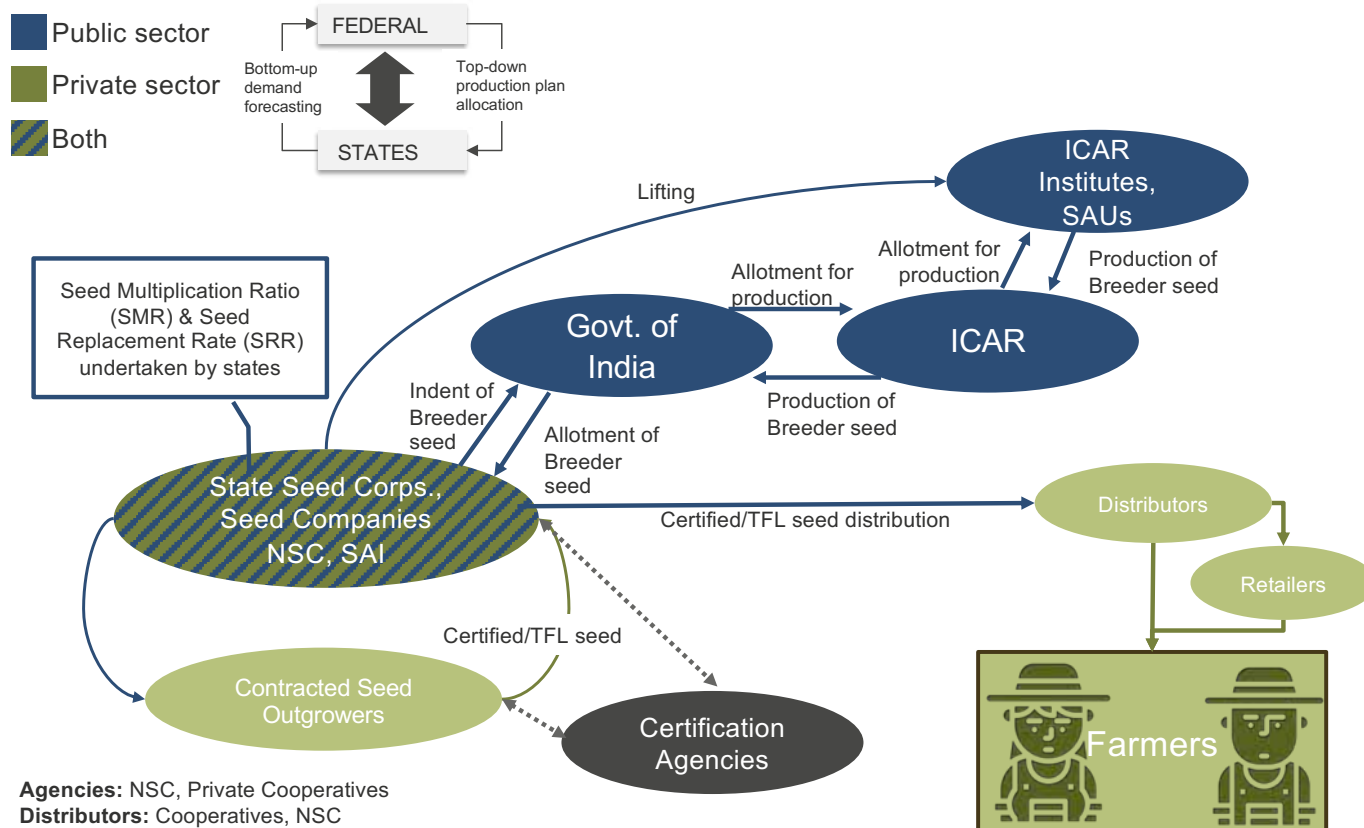
Source: AICRIP & Context expert analysis



Demand Planning and Operations

EGS DEMAND PLANNING & OPERATIONS

Bottom-Up Demand Forecasting & Top-Down Production Planning Process



EGS demand and supply system

Research institutions (SAUs and ICAR) are responsible for producing and supplying breeder seed (BS) of notified crop varieties to both public and private seed companies.

These companies in turn produce foundation seed (FS) from which certified seed (CS) is produced and distributed to farmers.

Indents (orders) from various seed producing agencies are collected by State Departments of Agriculture (SDAs) and submitted to Department of Agriculture, Cooperation and Farmers Welfare (DACFW), Ministry of Agriculture, and GOI.

The DAC compiles all information on the crop and sends it to the crop project coordinator at ICAR, who performs the final allocation of production responsibility to the appropriate SAU/ICAR institutions. Indents are compiled and forwarded to ICAR at least 18 months in advance. ICAR-DAC reviews BS production in the annual seed review meeting, and the actual production of BS by different research centers is suggested to DAC by ICAR.

On receipt of information from ICAR, the available BS is allocated to the indenters as per lead down policies for further multiplication to CS

Source: <https://seednet.gov.in/>

Calendar of Operations for Breeder Seed Production & Distribution

| Key Breeder Seed Activities | Production season | |
|---|--|--|
| | Kharif | Rabi |
| Placement of indent of breeder seed with SDA Director and state public seed producing agencies. | December 15 of prior year | May 31 of current year |
| Communication of screened and compiled indents by SDA Director to Seed Division of Ministry of Agriculture, GOI. National Seed Association of India forwards the indents of private parties to Seed Division as well. Central Agencies such as NSC, etc. place their indents directly with Seed Division. | January, first week | June 7 |
| Communication of compiled indents to ICAR headquarters by Seed Development Section of Ministry of Agriculture, GOI. | February 28 | July 15 |
| Communication of Breeder Seed Production Plan in BSP-1 by Project Coordinator (Crop) to Seed Development Section and ADG (Seeds), ICAR. | May 15 | October 15 |
| Communication of BSP-2 by concerned breeders to Seed Development Section and ADG (Seeds), ICAR. | After 15 days of planting of breeder seed crop | After 15 days of planting of breeder seed crop |

Source: <https://seednet.gov.in/>

Communications Plan for Breeder Seed Production & Distribution

| Schedule of Demand/Supply Communications | Production season | |
|--|--|--|
| | Kharif | Rabi |
| Communication of BSP-3 by concerned breeder to Seed Development Section, Ministry of Agriculture, GOI, and ADG (Seeds), ICAR. | After 15 days of actual inspection of breeder seed crop by Joint Monitoring team | After 15 days of actual inspection of breeder seed crop by Joint Monitoring team |
| Communication of final production figures of breeder seed by ICAR in BSP-5 to Seed Development Section. | February 15 | July 15 |
| Communication of allocation of breeder seed by Seed Development Section to Director of Agriculture and concerned indentors. | March 31 | September 15 |
| Communication of details for collection of breeder seed against GOI allotment to Ministry of Agriculture by Director of Agriculture in the Performa 'A' enclosed with supply plan. | After 15 days of cut-off-date | After 15 days of cut-off-date |
| Communication of details of supply of seed to allottees by the breeder to Ministry of Agriculture and ICAR in Performa 'B' enclosed with supply plan. | After 15 days of cut-off-date | After 15 days of cut-off-date |

Source: <https://seednet.gov.in/>

Seed Supply Channels to Farmers

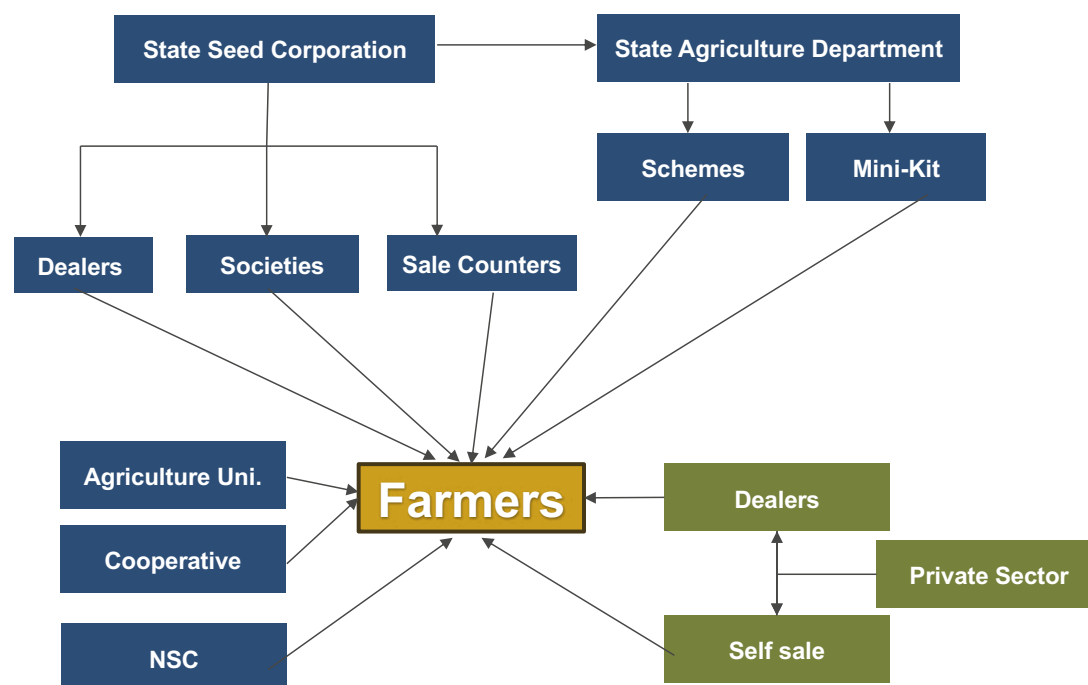
Seed Distribution and Marketing

Three formal marketing channels exist for the distribution of publicly produced CS:

1. **SSCs and NSC** have their **own marketing network** with many sales centers nationwide. Farmers purchase TL/CS from different these outlets.
2. **Licensed private seed dealers.** These deal with or sell seeds of any company producing seed, be it from the private or public sector
3. **SDAs** under various government-funded development programs (mostly subsidized seed distribution).

The **private sector** normally decides the **retail price of seeds** with adequate incentive to seed dealers. (Except for BT cotton, where price is regulated, Indian seed market operates as a free market). As trade margins are usually less for publicly produced CS, **seed dealers prefer** to sell **private-sector seed**.

In practice, seed dealers charge a **higher price** to farmers **during periods of scarcity** because of profit motive and the absence of adequate regulatory mechanisms.



Seed Management Information System (SMIS) Plays Central Role for Coordination and Information Flow



SMIS is an integrated, multi-user, menu-driven software package that can be used to generate various kinds of decision supportive information pertaining to breeder seed management, foundation and certified seed production, seed certification, seed law enforcement, progress report of seed testing laboratories, and a database of notified varieties.



Its primary functions are to:

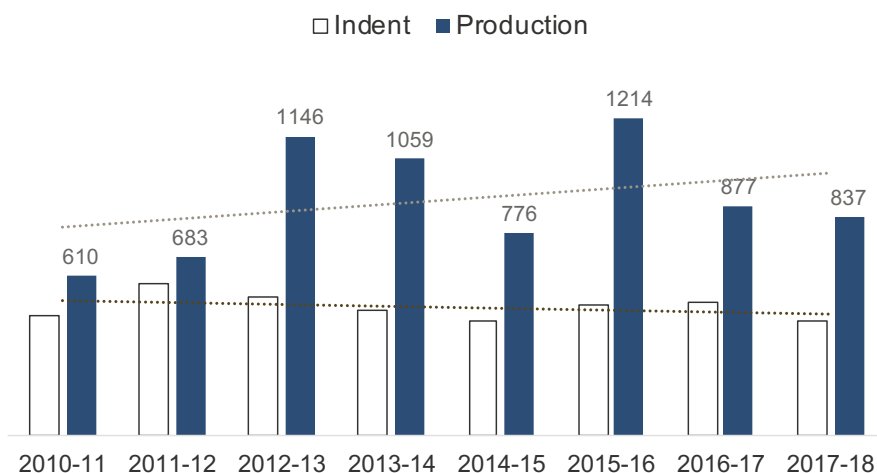
- Maintain databases and monitor the performance of various agencies involved in seed production (breeder / foundation / certified)
- Distribution of seeds (breeder / foundation / certified)
- Certification of seeds (foundation / certified)
- Testing and law enforcement of seeds
- Provide timely responses to ad-hoc queries

Source: <https://seednet.gov.in/>

All India Breeder Seed Production

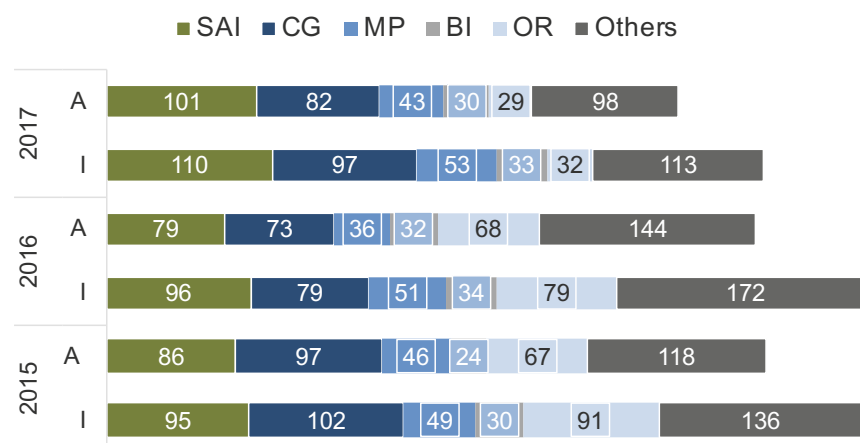
Breeder Seed Supply Always Exceeds Demand (Indent)

Rice Breeder Seed Indent and Production (MT)



Breeder seed indent from 2007-08 to 2017-18 shows breeder seed production is always higher than demand. Sometimes a few varieties are not produced, but in the case of many varieties, production is in excess.

Breeder Seed Indentors and Allocation (MT)



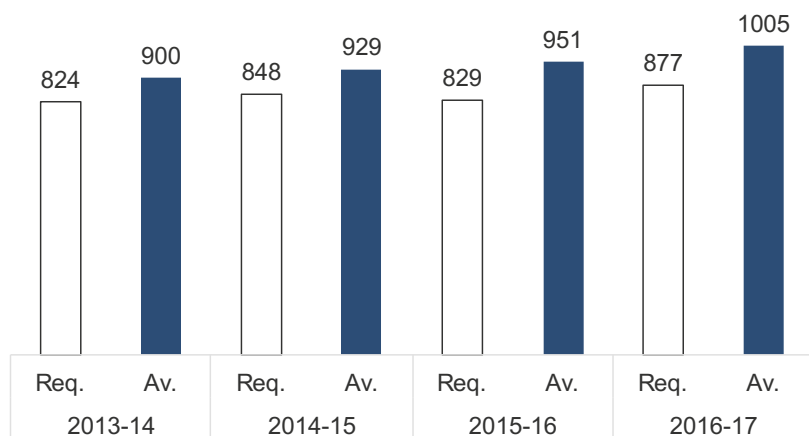
The National Seed Association of India (NSAI) which represents private companies and the state of Chhattisgarh are the main indentors, accounting for more than a 40% share

State Abbreviations : CG – Chhattisgarh, MP – Madhya Pradesh, BI – Bihar, OR - Orissa

All India Certified/Quality Seed Production

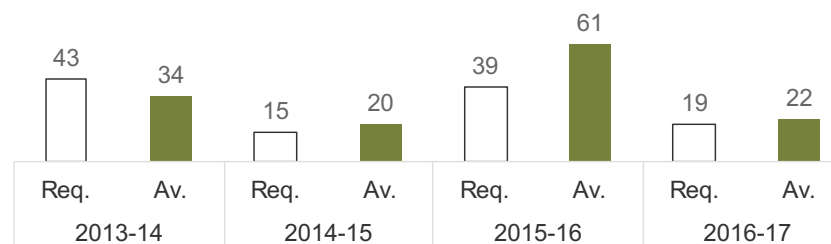
Excess production aligns with government focus on food security

**Requirement and Availability of Certified/ Quality
PADDY SEEDS (KMT)**



Due to GOI's strong public production mandate in order to meet food and food security requirements, certified/quality seed production is always 10% higher than requirement.

**Requirement and Availability of
HYBRID SEEDS (KMT)**

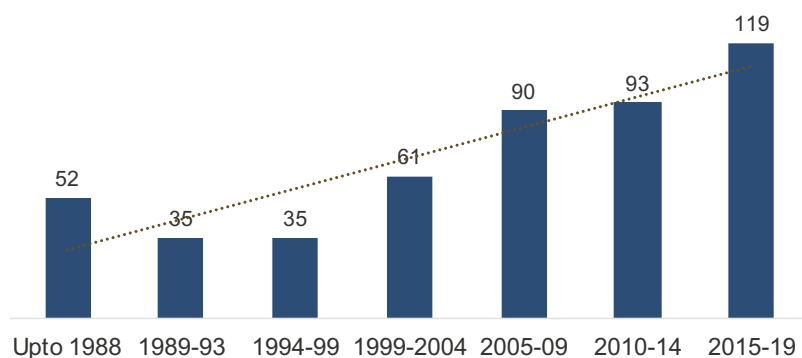


The official data of hybrid seed production also shows a surplus. However, some hybrid production is exported, which this data does not reflect.

Analysis of Breeder Seed Indent for Year 2020

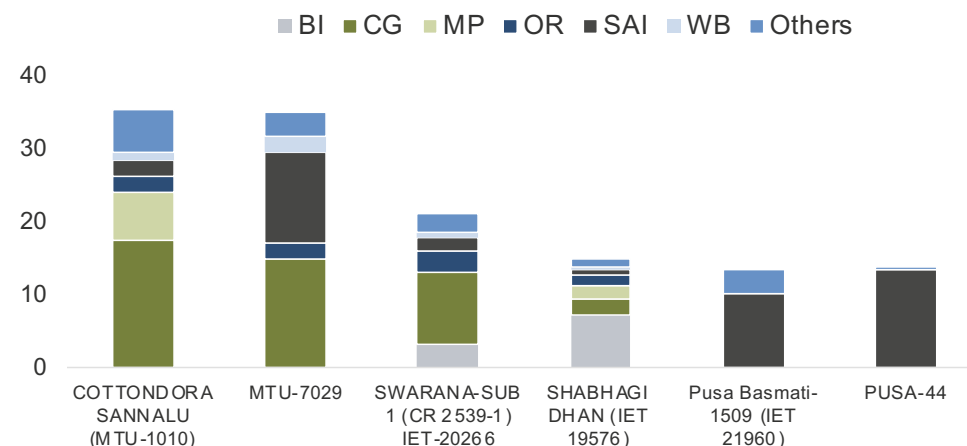
Breeder Seed Demand is Increasing Over Time

Notified Variety Breeder Seed Demand (MT)



Out of 305 varieties, the top six (MTU-1010, MTU-7029, SWARANA-SUB, SHABHAGI DHAN, Pusa Basmati-1509, and PUSA-44) account for 28% of total breeder seed. These varieties were all released between 1985 and 2011.

Top 6 Breeder Seed Varieties Indent (MT) 2020

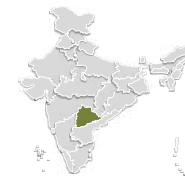





New Varieties released after 2015 are sold at higher prices but are yet to pick up meaningful commercial traction (119 MT Sold)

For basmati variety, NSAI is the main player

State Abbreviations : BI – Bihar, CG – Chhattisgarh, MP – Madhya Pradesh, OR – Orissa, SAI – National Seed Association of India, WB – West Bengal

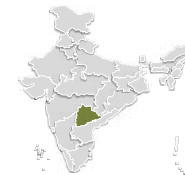
Telangana EGS Deployment Actors & Volumes



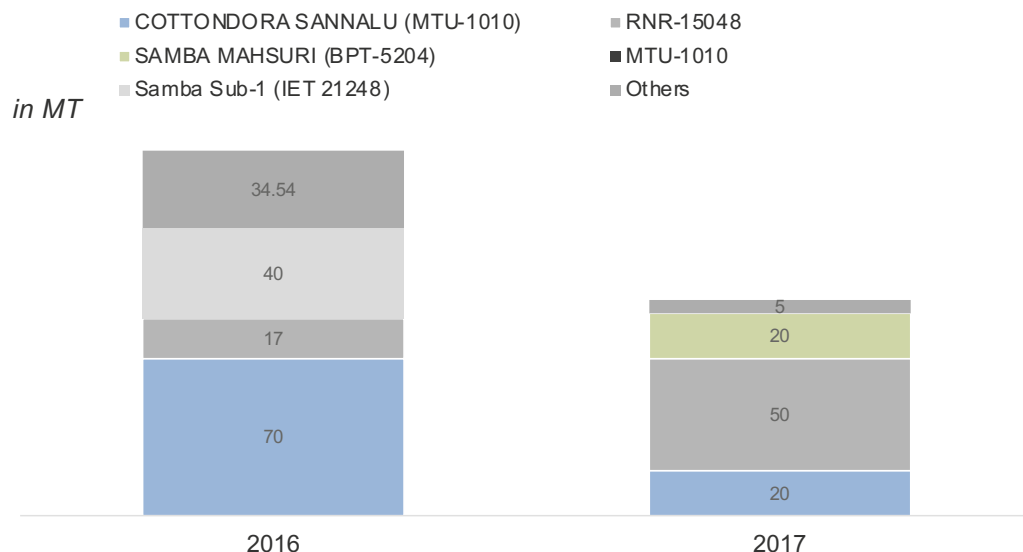
| | Breeder Seed | Foundation Seed | Quality Seed |
|------------------------|--|--|--|
| Who | 1. IIRR, Hyderabad 2. ICAR - Indian Institute of Seed Science, UP 3. PJTSAU 4. Acharya N.G.Ranga Agricultural University, Hyderabad | 1. Telangana SSC 2. NSC 3. Private companies 4. SAUs | 1. Telanana SSC 2. NSC 3. Private companies 4. SAU 5. Cooperatives |
| Sector | Public | Public & Private | Public & Private |
| Seed production |  9.5 MT |  1,064 MT |  106,404 MT |
| Capital sources | For public: GOI grants, internal resource generation, ICAR-allotted budget, state funds for regional research institution | | |

Source: <https://seednet.gov.in/>

Telangana Breeder Seed Production & Quality Assurance by Agency



Breeder Seed Production by Variety, Telangana (MT)

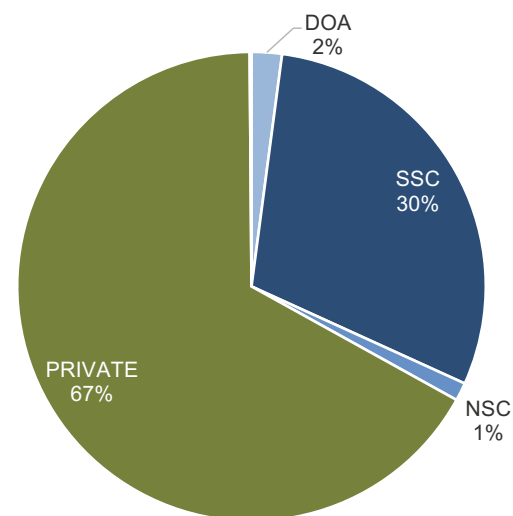


Total number of active varieties is 25 ; most are medium duration.

BPT-5204, MTU-1010, and RNR-15048 are important, high demand varieties, which were notified in 1989, 2000, and 2016 respectively. The private sector is also active in these varieties

Source : <https://seednet.gov.in/>




Telangana Quality Seed Production Plan



The main breeder seed producers are SAU regional agricultural stations. Main quality seed (CS & TL) seed production is done by the private sector

Chhattisgarh EGS Deployment Actors & Volumes

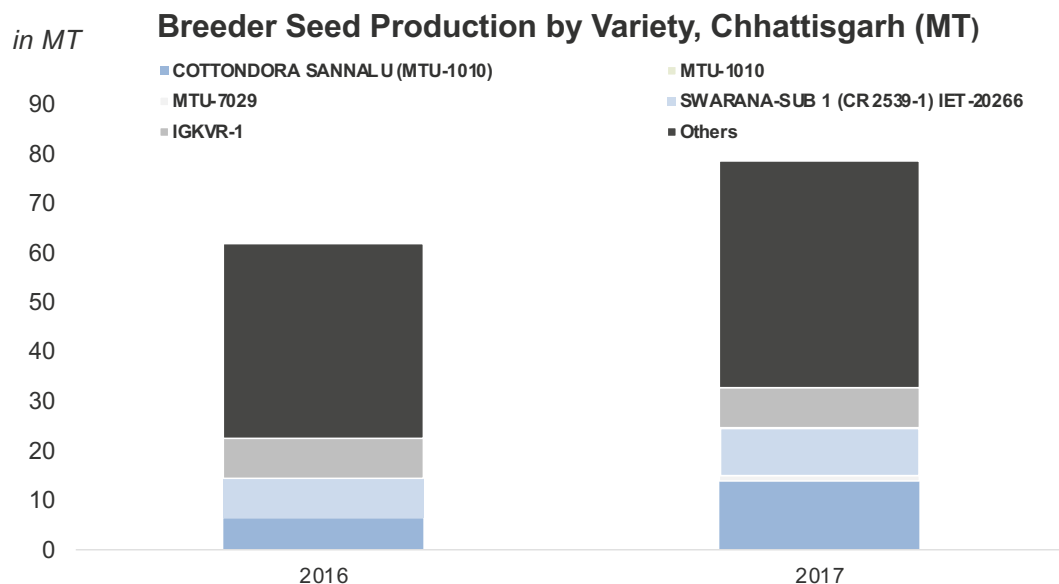


| | Breeder Seed | Foundation Seed | Quality Seed |
|-----------------|--|--|--|
| Who | 1. Indira Gandhi Krishi Vishwavidyalaya-Raipur 2. Regional agricultural research station-Maruteru 3. Acharya N.G.Ranga Agricultural University-Guntur 4. NRRI-Cuttack, Odisha 5. IIRI, Hyderabad 6. Zonal agriculture reserch station - Sindewahi, Mah 7. Division of Seed Science and Technology, New Delhi | 1. Chhattisgarh SSC 2. SAUs 3. Private sector 4. Cooperatives | |
| Sector |  Public |  Public & Private |  Public & Private |
| Seed production | 78.6 MT | 703 MT | 70,305 MT |

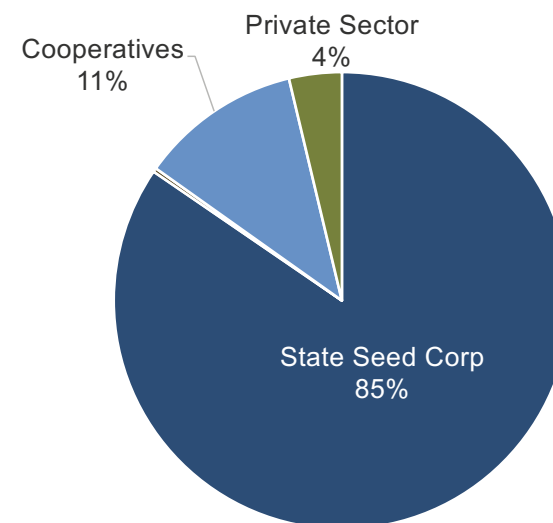
For public: GOI grants, internal resource generation, ICAR-allotted budget, state funds for regional research institution

Source: <https://seednet.gov.in/>

Chhattisgarh Breeder Seed Production & Quality Assurance by Agency



Chhattisgarh Quality Seed Production Plan

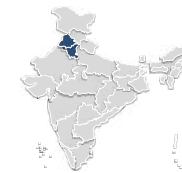





Total number of active varieties is 51.

MTU-7029, MTU-1010, SWARANA-SUB 1 (CR 2539-1) IET-20266 are the high demand varieties notified in 1985, 2000, and 2009 respectively

The main breeder seed producers are Maruteru, AP, and SAU. Over 85% of quality seed is produced by SSC

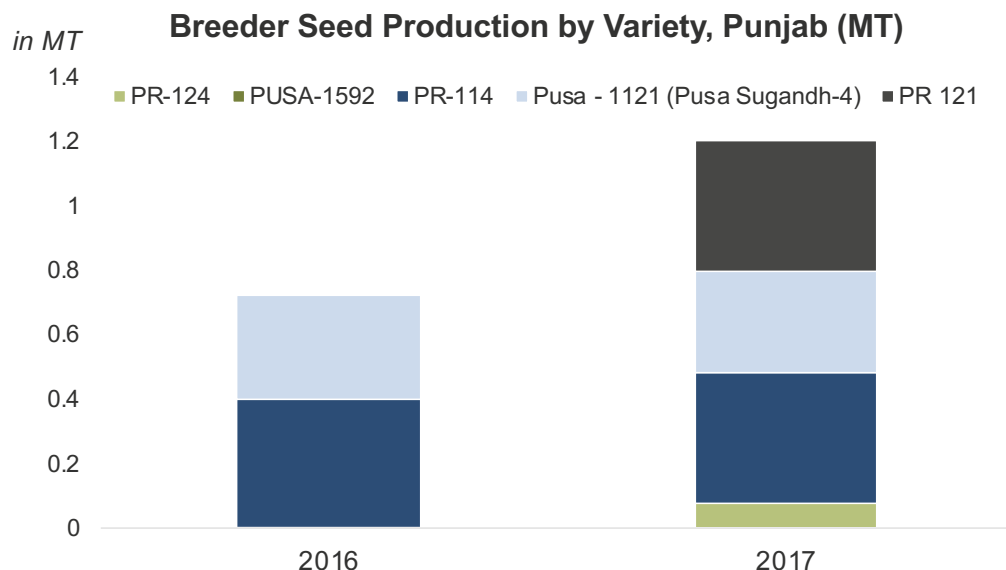
Punjab EGS Deployment Actors & Volumes



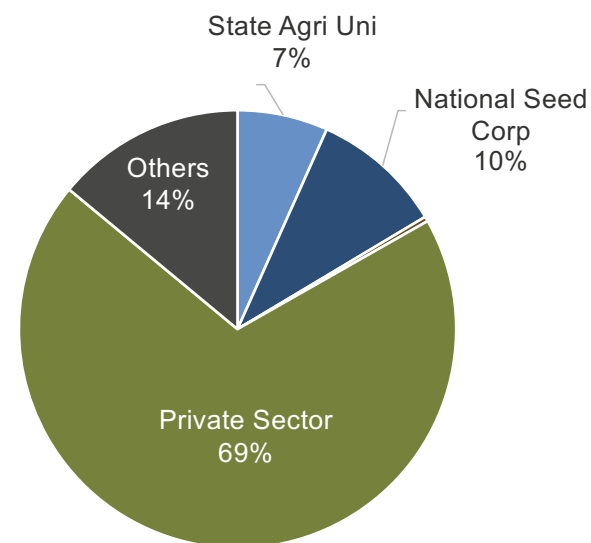
| | Breeder Seed | Foundation Seed | Quality Seed |
|-----------------|--|---|---|
| Who | 1. Indian Agricultural Research Institute- Regional Station, Karnal 2. Punjab Agriculture University- Punjab 3. Division of Seed Science and Technology, New Delhi 4. Central Soil Salinity Research Institute-Karnal, Haryana 5. Basmati Export Development Foundation, New Delhi | 1. Punjab SSC 2. National Seed Corporation 3. Punjab Agriculture University-Punjab 4. Private sector | |
| Sector |  Public |  Public & Private |  Public & Private |
| Seed production | 0.2 MT | 140 MT | 14,000 MT |
| Capital Sources | For public: GOI grants, internal resource generation, ICAR-allotted budget, state funds for regional research institution | | |

Source: <https://seednet.gov.in/>

Punjab Breeder Seed Production & Quality Assurance by Agency



Punjab Quality Seed Production Plan



Total number of active varieties is 15.

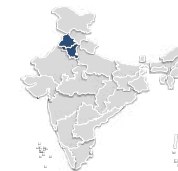
PR-114 and PR- 124 notified in 2001 and 2014, respectively are in high demand.




The main breeder seed producers are PAU & ICAR-IARI, RS-Karnal, Haryana. Private sector produces over 70% of quality seed

Source: <https://seednet.gov.in/>

* Both OP and Basmati Variety are included⁶⁹

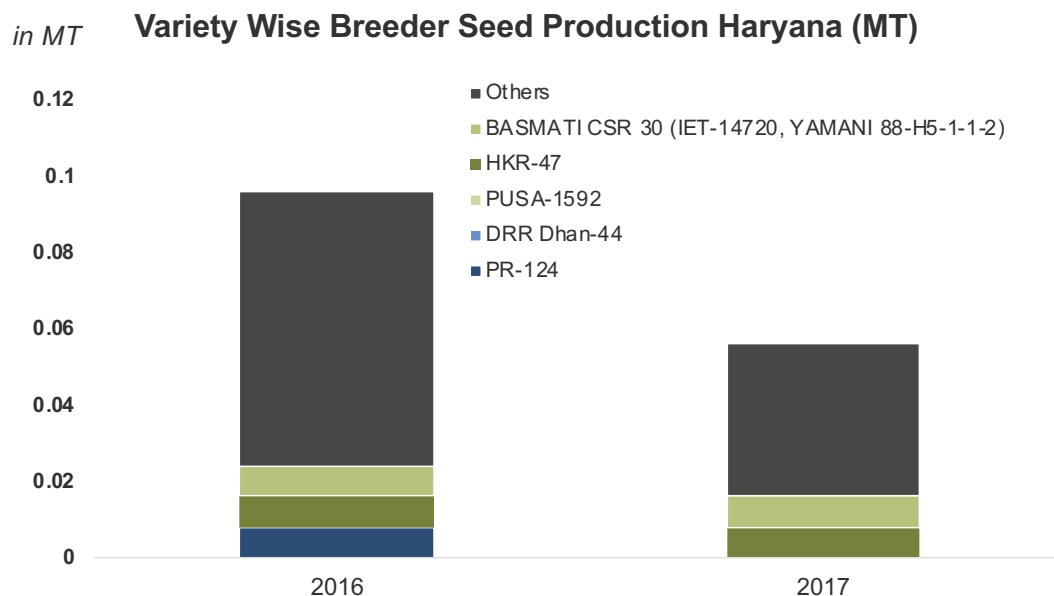
Haryana EGS Deployment Actors & Volumes



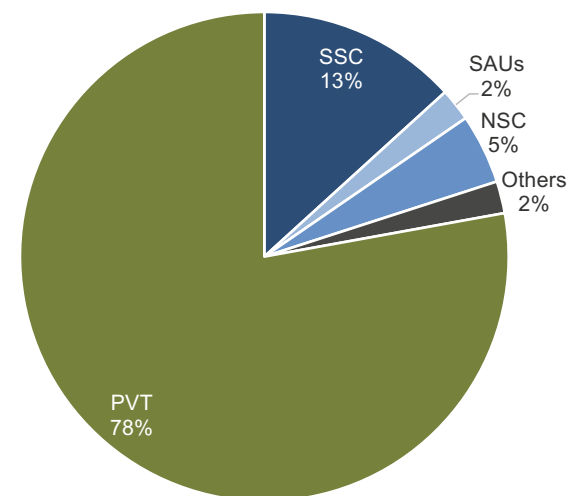
| | Breeder Seed | Foundation Seed | Quality Seed |
|-----------------|---|--|--|
| Who | 1. Punjab Agriculture University-Ludhiana 2. Indian Agricultural Research Institute- Regional Station, Karnal 3. Haryana Agriculture University, Haryana 4. Basmati Export Development Foundation, New Delhi 5. G. B. Pant University of Agriculture and Technology 6. IIRR-Hydrabad | ← 1. Haryana SSC 2. NSC 3. Haryana Agriculture University(HAU) 4. Private sector → | |
| Sector |  Public |  Public & Private |  Public & Private |
| Seed production | 0.06 MT | 90 MT | 9,048 MT |
| Capital Sources | For public: GOI grants, internal resource generation, ICAR-allotted budget, state funds for regional research institution | | |

Source: <https://seednet.gov.in/>

Haryana Breeder Seed Production & Quality Assurance by Agency



Haryana Quality Seed Production Plan



Total number of active varieties is 17

HKR-47, PR-114, PR-124, and BASMATI CSR 30 (IET-14720, YAMANI 88-H5-1-1-2) are the varieties in highest demand

Chief breeder seed producers are PAU & HAU and ICAR-IARI, RS-Karnal, Haryana. ~80% quality seed is produced by private sector

Source: <https://seednet.gov.in/>

* Both OP and Basmati Variety are included



Financial Sustainability

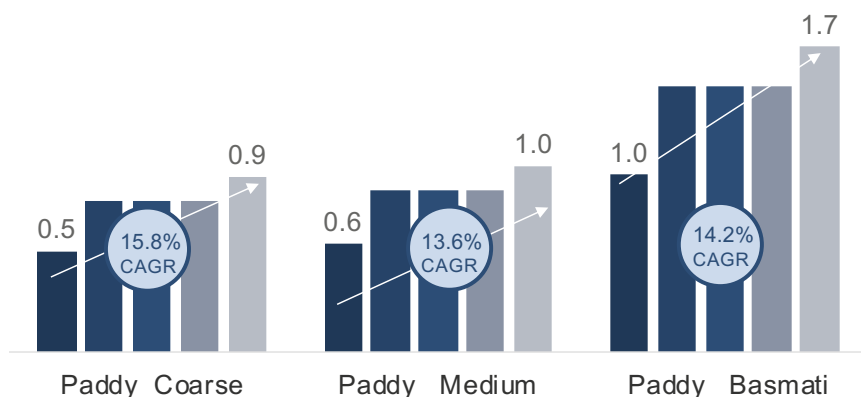
Breeder Seed Price Decided by Govt. Panel

OPV Prices Growing >13%, Hybrids > 21% CAGR

Breeder seed selling price across India is decided at the annual Seed Review Meeting. Though govt regulated price growth is healthy, reflecting robust growth & demand for rice seeds

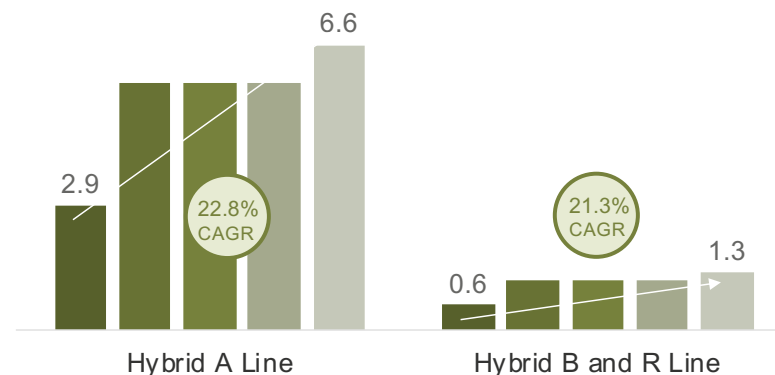
OPV Breeder Seed Selling Price (USD/Kg)

■ 2014-15 ■ 2015-16 ■ 2016-17 ■ 2017-18 ■ 2018-19



Hybrid Breeder Seed Selling Price (USD/kg)

■ 2014-15 ■ 2015-16 ■ 2016-17 ■ 2017-18 ■ 2018-19



Breeder seed prices are classified into five categories: Paddy Coarse, Paddy Medium, Paddy Basmati, Hybrid A Line, and Hybrid B & R Line

Revenue and Cost of Production Comparison by Quality Seed Product Type

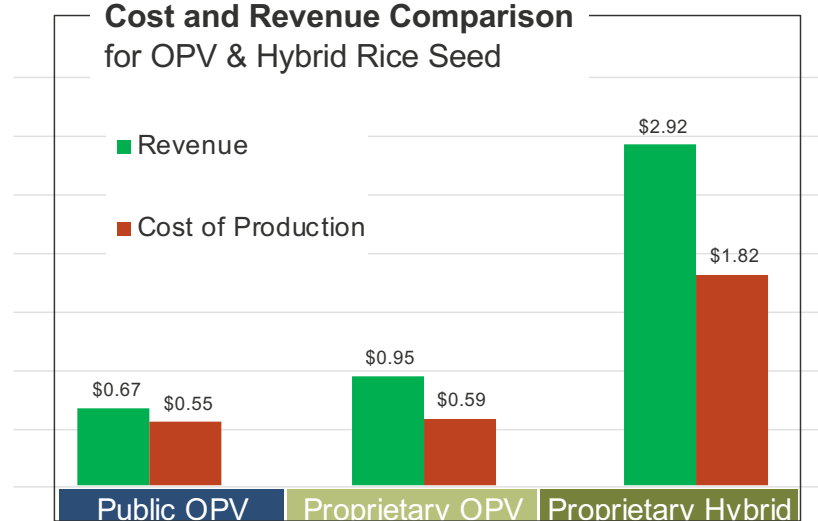
Takeaways

Hybrid seed production can be comparatively profitable, but requires higher levels of resourcing (infrastructure, human capital, and working capital) than proprietary OPV seed production.

Public organizations pay more to outgrowers because profit is not a driving motivation.

Private companies differentiate themselves from SSCs through prompt service, seed grower advances, and prompt payments.

Cost and Revenue Comparison for OPV & Hybrid Rice Seed

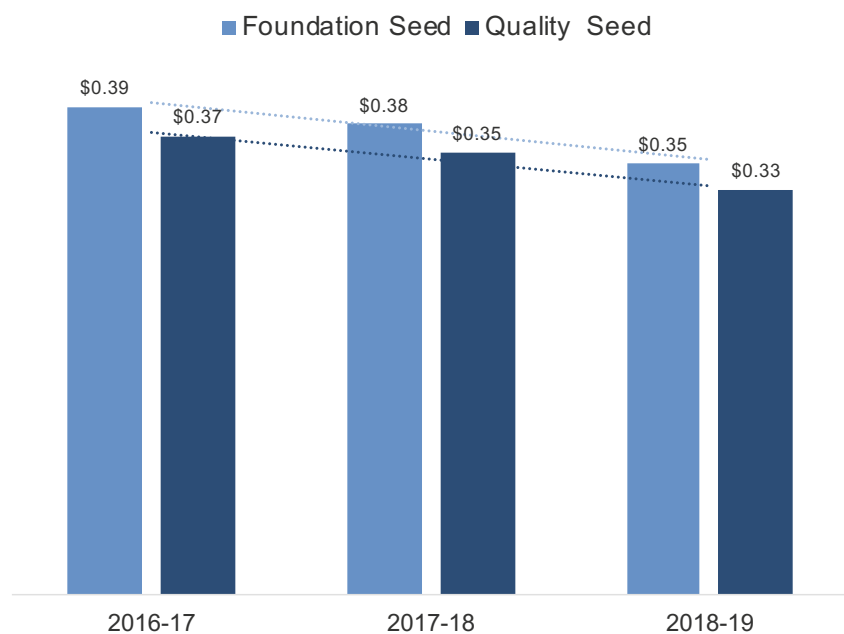


| | Public OPV | Proprietary OPV | Proprietary Hybrid |
|-----------------------------|------------|-----------------|--------------------|
| Revenue | \$ 0.67 | \$ 0.95 | \$ 2.92 |
| Cost of Production | \$ 0.55 | \$ 0.59 | \$ 1.82 |
| Seed procurement cost | \$ 0.38 | \$ 0.29 | \$ 1.00 |
| Seed processing | \$ 0.02 | \$ 0.02 | \$ 0.06 |
| Seed storage | \$ 0.02 | \$ 0.03 | \$ 0.06 |
| Transport cost | \$ 0.03 | \$ 0.06 | \$ 0.09 |
| Distributor margin | \$ 0.10 | \$ 0.19 | \$ 0.61 |
| Other cost | \$ 0.08 | \$ 0.05 | \$ 0.14 |
| Company Gross Margin | \$ 0.12 | \$ 0.36 | \$ 1.10 |

Source: Industry Experts

Procurement Price Fixation for OPV Foundation & Quality Seeds

Public Bred Seed Avg. Procurement Prices – Telangana (USD/kg)



Procurement price is the price of seeds procured from out growers for raw seed. The SSC and SDA are involved in setting these prices annually.

The formula for calculating the price that public organizations (i.e., SSCs) use for foundation seed and quality seed (certified and truthfully labelled) varies by state, but can be generalized as:

$$\text{Foundation seed price} = \text{grain price}^1 \times (1 + 30\text{-}35\%)$$

$$\text{Quality seed price} = \text{grain price} \times (1 + 20\text{-}25\%)$$

In the publicly bred segment, prices are governed by SSC/NSC, and private company prices are also influenced by SSC prices – they are however free to set their own prices.

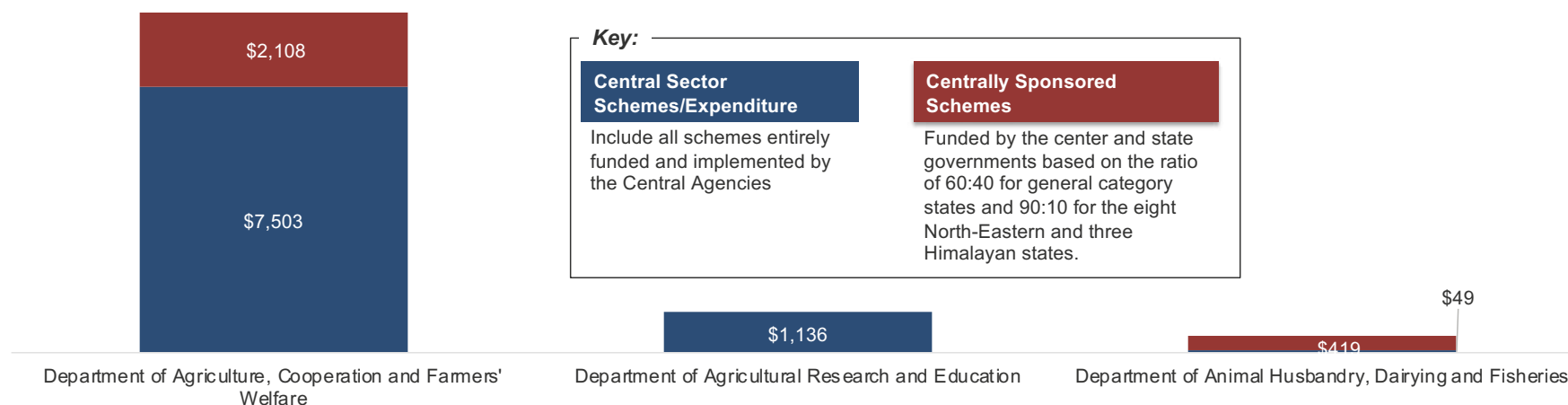
In the proprietary seed segment, the seed procurement price is usually 10 to 20% less than the public procurement price.

Ministry of Agriculture (GOI) Budget

Two departments of the Ministry of Agriculture fund the rice seed sector:

1. Department of Agriculture, Cooperation and Farmers Welfare (DACFW) - Implements programs and schemes relating to crop husbandry, and manages agriculture inputs including seeds.
2. Department of Agricultural Research and Education (DARE) - Manages agriculture universities, and promotes research in the sector through ICAR which operates as an autonomous organization overseen by DARE.

Overall Budget Estimates* by Funding Scheme Source and Department 2018-2019 (in USD Million)



Source: <https://www.indiabudget.gov.in/>

Overview of GOI Schemes/Programs for Rice

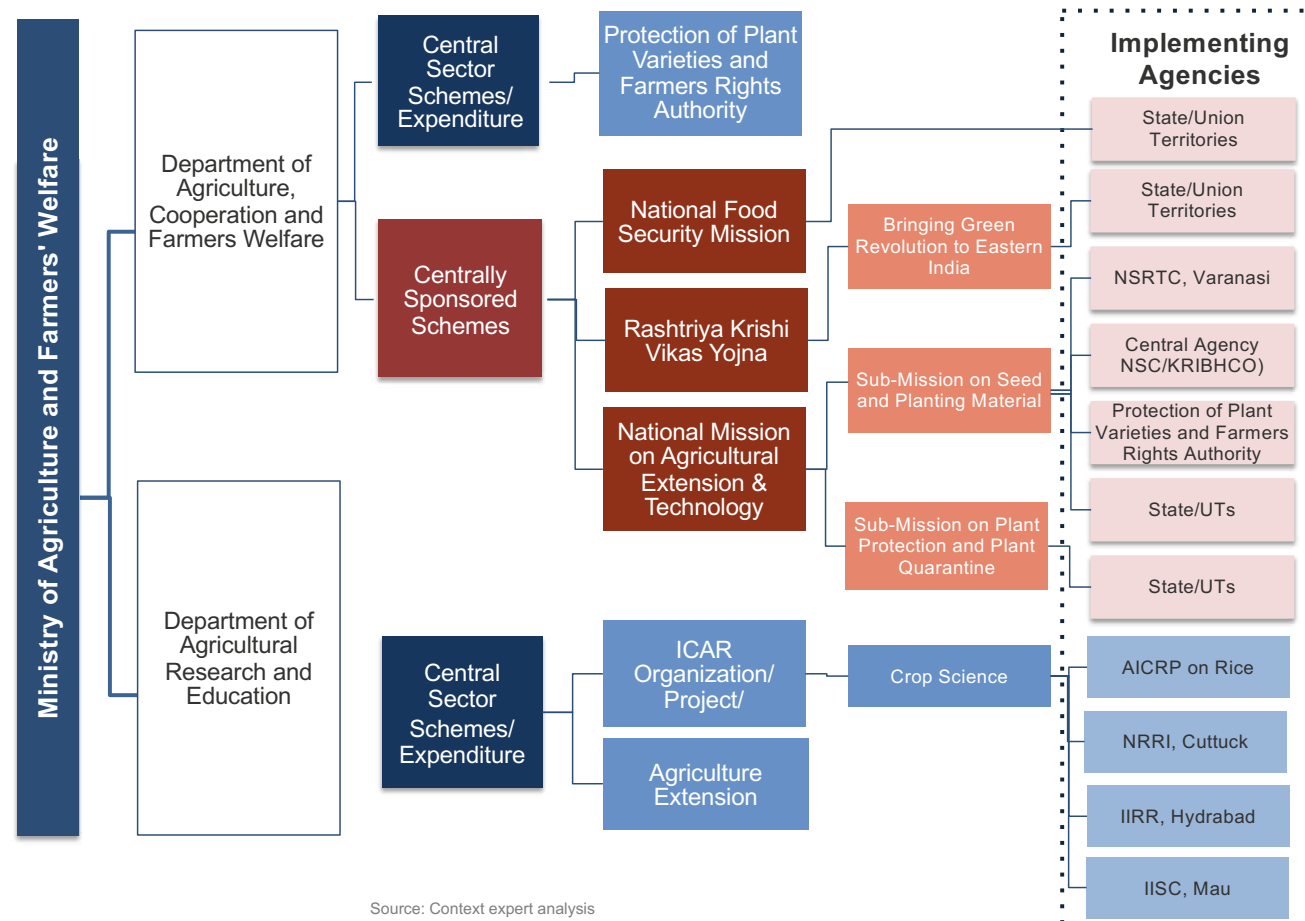
More than 15 central schemes/programs are active, including these key four schemes:

National Mission on Agricultural Extension and Technology = Sub-Mission on Seeds & Planting Material

Crop Science through ICAR

Rashtriya Krishi Vikas Yojna (Bringing Green Revolution in Eastern India)

Protection of Plant Varieties and Farmers Rights Authority



Source: Context expert analysis

Government of India Budget for Rice Research

(in \$ millions)

| Budget Line Items for Key Rice Institute Budgets | Total ICAR | All Crop Science Division | NRRI, Cuttack | IIRR, Hyderabad | AICRP on Rice | CRP on Rice Biofortificati | IIISC, Mau |
|--|--------------|---------------------------|---------------|-----------------|---------------|----------------------------|------------|
| Capital (Grants for CapEx) | \$111 | \$14 | \$1 | \$0 | \$0 | \$0 | \$0 |
| Total OpEx (Direct Salary Expense + Other OnFX) | \$785 | \$196 | \$11 | \$4 | \$3 | \$1 | \$1 |
| Direct Salary Expense (Grant) | \$428 | \$115 | \$4 | \$3 | \$2 | \$0 | \$0 |
| Other Operating Expenses (Grant) | \$356 | \$81 | \$7 | \$1 | \$1 | \$1 | \$1 |
| <i>Pension & Other Retirement Benefits</i> | \$140 | \$40 | \$6 | \$0 | \$0 | \$0 | \$0 |
| <i>Traveling Allowance</i> | \$9 | \$2 | \$0 | \$0 | \$0 | \$0 | \$0 |
| <i>Research & Operational Expenses</i> | \$87 | \$17 | \$1 | \$0 | \$0 | \$1 | \$1 |
| <i>Administrative Expenses</i> | \$82 | \$19 | \$1 | \$0 | \$0 | \$0 | \$0 |
| <i>Miscellaneous Expenses</i> | \$37 | \$2 | \$0 | \$0 | \$0 | \$0 | \$0 |
| Grand Total (Capital + Revenue) | \$896 | \$209 | \$13 | \$4 | \$3 | \$1 | \$1 |

CRP is Consortia Research Platform
IIISC is Indian Institute of Seed Science

Source: ICAR Crop Science Division 2018-19 – Key Rice Institute Budget (USD Million)

The IIRR normally doesn't report/publish seed sales revenue as a head. In 2017/18, a press release reported = 0.01 million USD revenue that accrued from seed sales that accrued to a revolving fund (for production of quality seed in research farms / outgrowers for sale to seed companies and government seed agencies), 0.26 million USD for testing of varieties and hybrids, contractual services for the evaluation of breeding lines for quality, diseases, insects and also assessing the efficacy of new molecules/ chemicals.

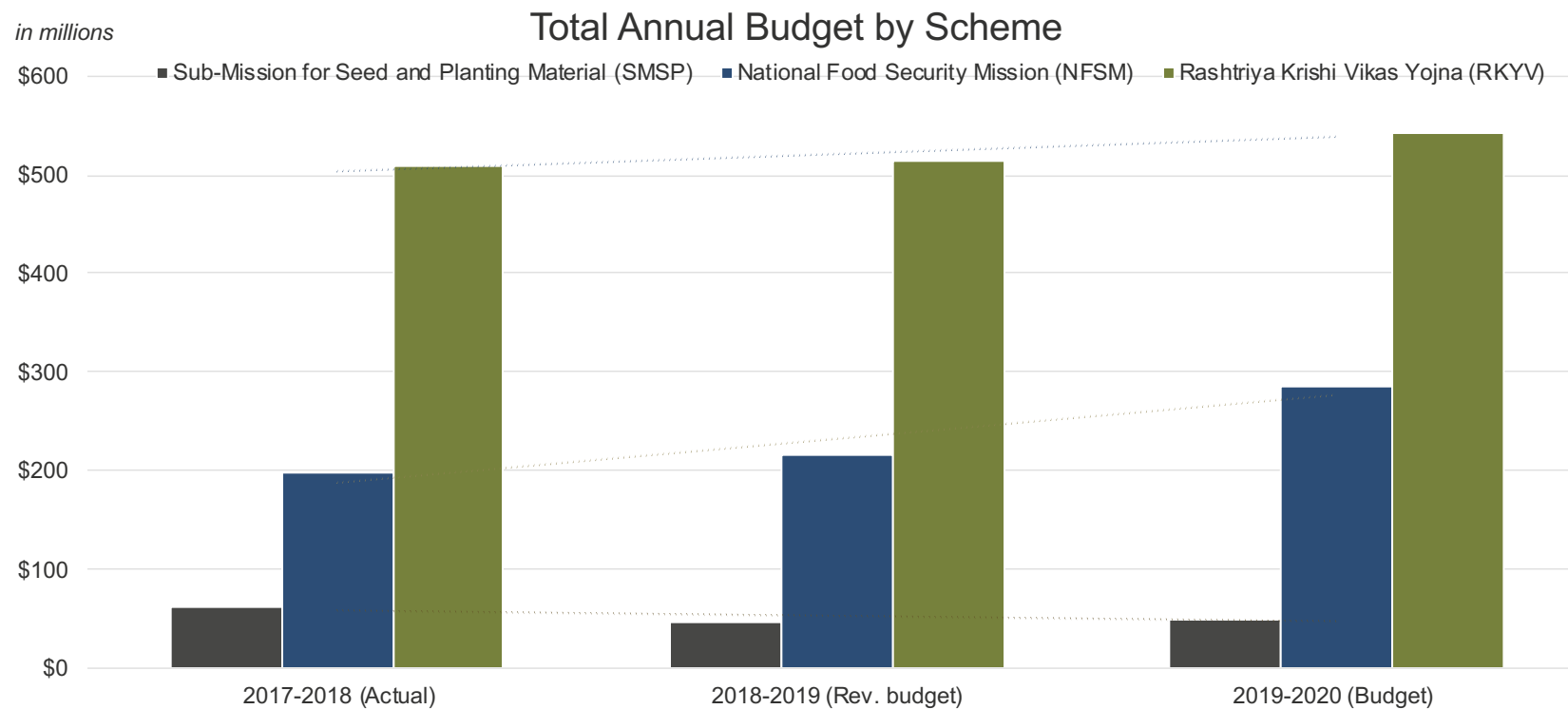
Grants Provided to States via Three Key Schemes

Budget allocated to states via three key schemes (USD millions)

| | Sub-Mission for Seed and Planting Material (SMSP) | | | National Food Security Mission (NFSM) | | | Rashtriya Krishi Vikas Yojna (RKVY) (Green Revolution in E. States) | | |
|-------------------|---|-------------|-------------|---------------------------------------|-------------|-------------|--|-------------|-------------|
| | 2014-15 | 2015-16 | 2016-17 | 2012-13 | 2013-14 | 2014-15 | 2012-13 | 2013-14 | 2014-15 |
| All States | 26.6 | 20.9 | 29.4 | 32.9 | 32.3 | 13.2 | 82.6 | 66.4 | 76.4 |
| Telangana | 0.56 | 1.39 | 1.3 | 0 | 0 | 0.5 | 0 | 0 | 5.3 |
| Haryana | 0 | 0 | 0 | 0.5 | 0.3 | 0 | 1.6 | 3.4 | 0 |
| Chhattisgarh | 2.6 | 0.5 | 0.9 | 2.1 | 2.6 | 0.1 | 2 | 1.6 | 4.7 |
| Punjab | 0.4 | 0.5 | 0.1 | 1.5 | 1.7 | 0 | 0 | 0 | 0 |

SMSP is focused on the seed sector, and NFSM and RKVY are general scheme agriculture developments.

Total Annual Budget Under Each Scheme



Source: <https://www.indiabudget.gov.in/>

Financial Assistance to States Under Sub-Mission for Seed and Planting Material (SMSP)

The following three primary schemes under SMSP are among 26 SMSP interventions offering financial assistance to states:

1 Seed Village Program (GOI share 60%+ / state share 40%)

Implementing agencies: SDA, SSC, NSC, SAU, ICAR institutes, KVKs, central agricultural universities/institutes, etc.

2 Seed Storage Facilities & Processing Facilities (100% GOI)

Implementing agencies: SDA, SSCs, NSC, SAUs, ICAR institutes, KVKs, central agricultural universities/institutes, Self Help Groups, Farmer Producer Organizations, etc.

3 Transport Subsidy on Movement of Seeds (100% GOI)

Implementing agencies: SDAs of all North-Eastern states (including Sikkim and J&K, Himachal Pradesh, Uttarakhand and West Bengal), SSCs including NSC State Marketing Federation, Agro Industries Corporation, and other agencies designated by the state government.

State wise money released under SMSP (USD Million)

| Geography | 2014-15 | 2015-16 | 2016-17 | % of Total |
|-----------------------------|--------------|--------------|--------------|-------------|
| Telangana | 0.56 | 1.39 | 1.29 | 4% |
| Haryana | 0 | 0.02 | 0.01 | 0% |
| Chhattisgarh | 2.55 | 0.47 | 0.85 | 3% |
| Punjab | 0.39 | 0.47 | 0.09 | 0% |
| Central Agency NSC/KRIBHCO) | 2.31 | 2.39 | 4.16 | 14% |
| NSRTC, Varanasi | 0.35 | 0.31 | 0.26 | 1% |
| PPVFRA | 2.29 | 2.26 | 2.82 | 10% |
| All other states | 18.12 | 13.55 | 19.95 | 68% |
| Total | 26.57 | 20.86 | 29.43 | 100% |

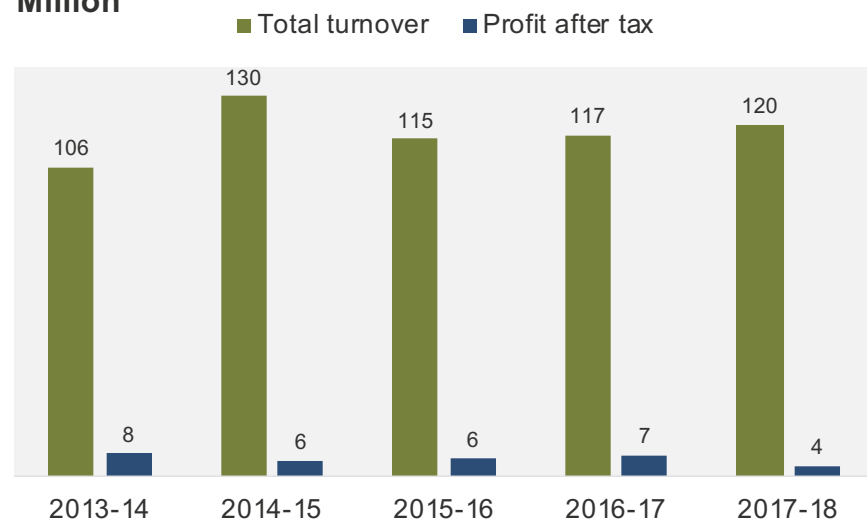
Source: <http://agricoop.nic.in>

GOI Scale of Assistance for Seed Production and Distribution Schemes Implemented by States

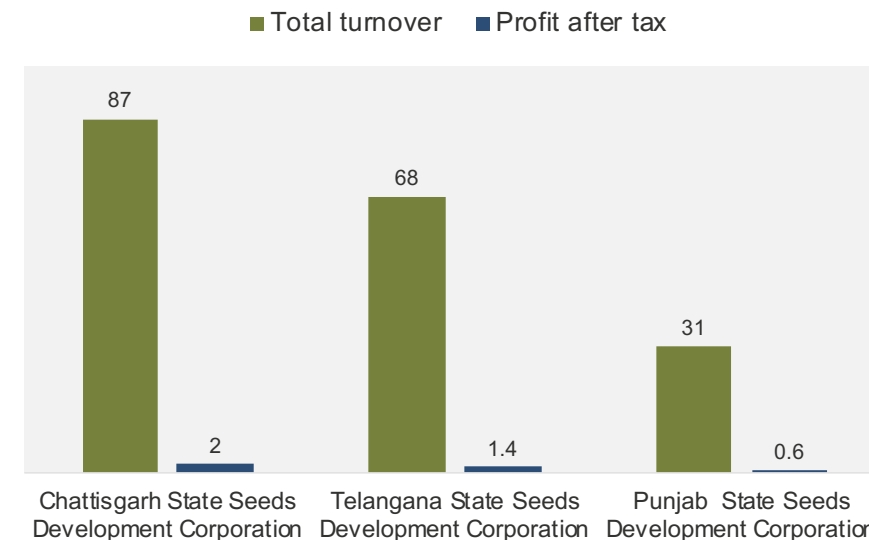
| Scheme/Component | Crop | Scale of Assistance |
|---|---|--|
| National Food Security Mission (NFSM) | Rice | <ul style="list-style-type: none"> – 71 USD per 100 kg or 50% of seeds cost, whichever is less, for certified hybrid seed distribution. – 0.15 USD per kg or 50% of the cost, whichever is less, for certified seed distribution for HYVs less than 10 years old. |
| Bringing Green Revolution in Eastern India (BGREI) | Rice and wheat | <ul style="list-style-type: none"> – Rice seed distribution: same assistance as NFSM above – Seed production assistance: 14.2 USD per 100 kg for HYVs of paddy and wheat and 71 USD per 100 kg. for paddy hybrid varieties less than 10 years old varieties, beginning in 2015-16. Out of this, 75% amount of subsidy is for farmers and 25% to help seed producing agencies cover costs, including certification. |
| Rashtriya Krishi Vikas Yojna (RKVY) | All crops | <ul style="list-style-type: none"> – All activities, including seed infrastructure. |
| National Mission on Agricultural Extension and Technology (NMAET)- Sub-Mission on Seeds & Planting Material (SMSP) | Seed Village Program All agricultural crops (60% GOI and 40% state share) | <ul style="list-style-type: none"> – Seed distribution: Financial assistance for foundation / certified seeds at 50% cost of the seeds for cereal crops and 60% for oilseeds, pulses, green manure, and fodder crops is provided for one acre of area per farmer for production of quality seeds. – Farmer training: Assistance to train farmers on seed production and seed technology @ 214 USD for a group of 50-150 farmers. – Seed-treating/dressing drums: Financial assistance for treating seeds @ 50 USD per seed-treating drum of 20kg capacity and 71 USD drum of 40kg capacity. – Storage bins: To encourage farmers to develop adequate storage capacity, financial assistance is provided to farmers for purchasing seed storage bins. |

Financial Highlights of NSC & SSC

National State Seeds Development Corporation in USD Million



State Seed Corporations in USD Millions



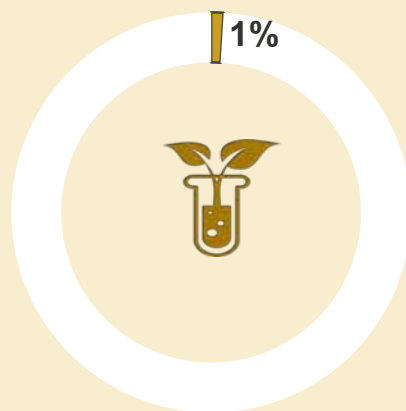
By and large, the published profits through seed sales by public seed organizations are not financially sustaining. After-tax figures do not fully reflect organizations' operating costs.

Sources: <http://agricoop.nic.in> ; <http://www.tssdcl.telangana.gov.in> ; <http://agriportal.cg.nic.in/beeinagam> ; <https://pssca.punjab.gov.in/>

Financial Sustainability by EGS Value Chain Step

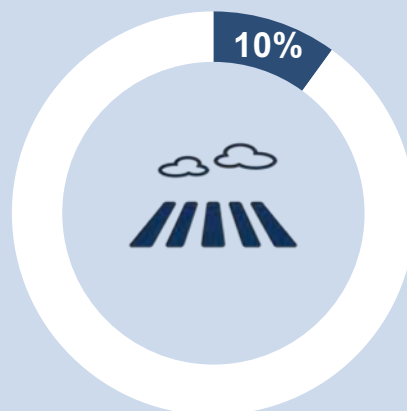
Government Funds Varietal Development and Breeder Seed Production

Varietal Development



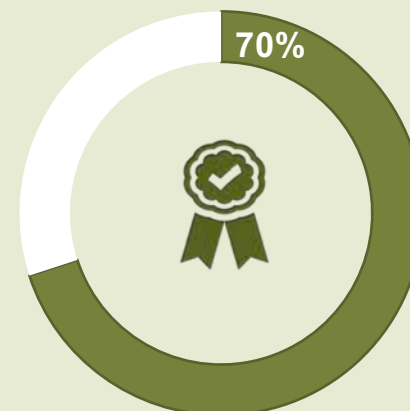
Public sector almost exclusively funds varietal development

Breeder Seed Demand Forecasting & Production



Variable by state, but the public sector subsidizes an estimated 90% of seed multiplication costs

Certified Seed Demand Forecasting & Production



Public sector recovers an estimated 70% of its operating costs, while the private sector cost recovery is 100%



Enabling Environment

SEED SYSTEM EVOLUTION

With the support of state governments, GOI has implemented various rice development programs since the 1950s, including:

Rice Seed Minikit

State-level Training on Rice Production Technology

Special Rice Development

SFPP-Rice

IPRD

ICDP-Rice

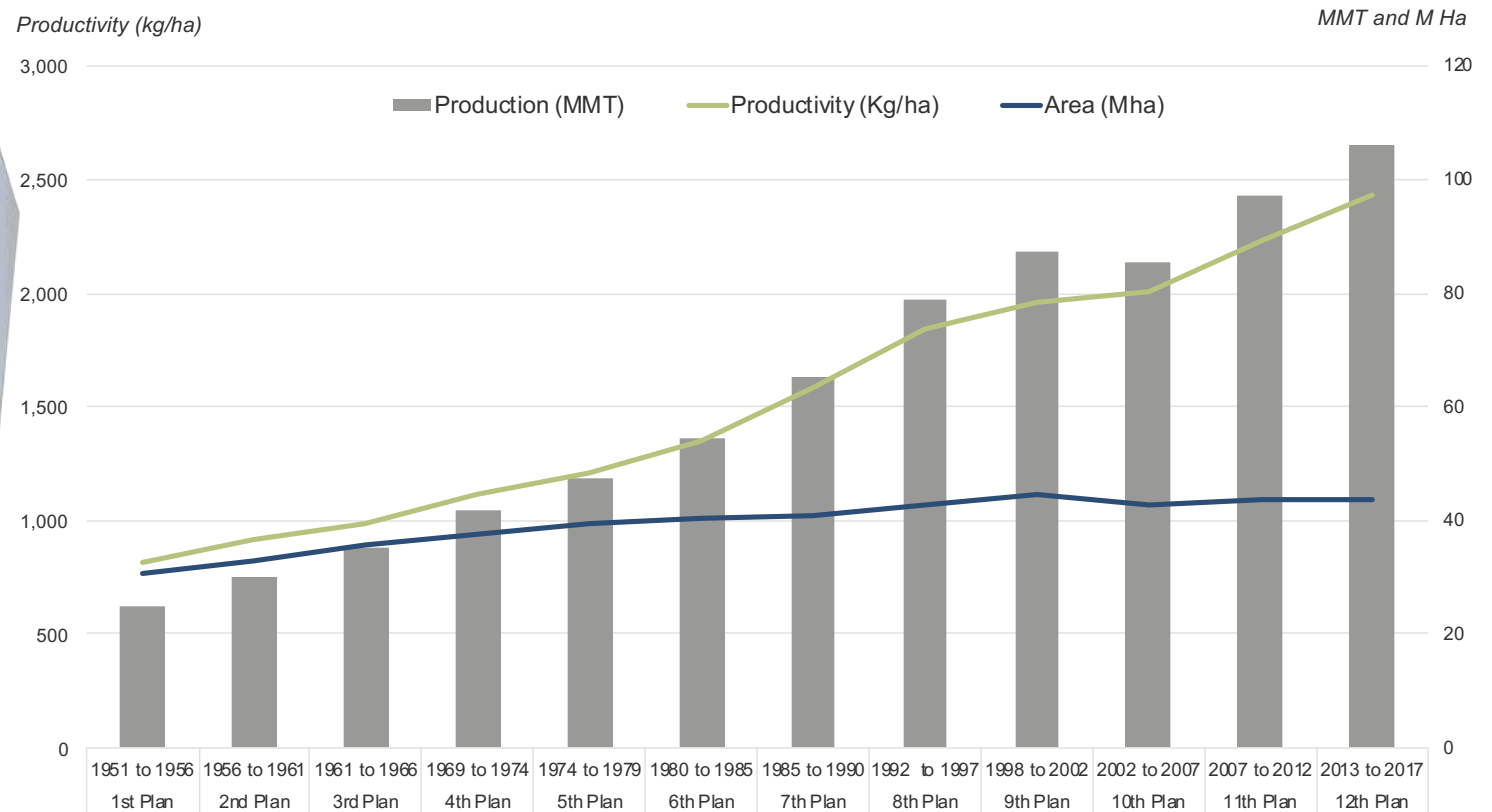
Promotion of Hybrid Rice

National Food Security Mission-Rice

Frontline Demonstration-Rice

India Rice: Planned & Targeted Growth

Sustained Period of Intentional, Structured Government Engagement



Source : Rice in India during tenth plan , directorate of rice development

India Rice EGS System Timeline

Before 1950

- 1928 – Report of Royal Commission on Agriculture (First major milestone in the history of seed sector development)
- 1945 – Famine Enquiry Commission (Emphasised need for multiplication and distribution of quality seed of improved varieties)
- 1950 – Seed farms were established in Community Development Blocks (Department of Agriculture started them to multiply foundation seed)

1950-1970

- 1946 – Establishment of NRRI, Cuttack
- 1952 – Grow-More Food Program Committee
- 1961 – First hybrid maize was released
- 1963 – National Seeds Corporation Ltd was established
- 1966 – Enactment of Seed Act (To regulate quality of seed)
- 1965 – Establishment ICAR-IIRR, Hyderabad
- 1967 – Seed Review Team (set up to examine the seed situation and make recommendations)
- 1969 – Terai Development Corporation Pantnagar (a SSC) established and became an ideal organization for cooperation with by other states
- 1969 – State Farms Corporation of India (Production of certified seed on 38,325 ha on 14 farms)

1971-1990

- 1971 – Report of National Commission on Agriculture (Stressed the need for maintaining purity of seed)
- 1976 – National Seed Project Phase I (Launched in first four states - Punjab, Haryana, Maharashtra, and Andhra Pradesh with the establishment of state seed corporation on their territory)
- 1978 – National Seed Project Phase II (Launched in five states - Karnataka, Rajasthan, Uttar Pradesh, Bihar and Orissa with the establishment of state seed corporation on their territory)
- 1990 – National Seed Project Phase III (Launched in four states - Assam, West Bengal, Madhya Pradesh, and Gujarat with the establishment of state seed corporation)
- 1987 – Expert Group on Seed (To review entire seed sector and to make recommendations)

1990 onward

- 1991 – New Industrial Policy (Opened doors for foreign investors in Indian seed industry)
- 2001/2003 – PPV & FR Act / PPV & FR Act Rules (To protect plant breeders and farmers rights)
- 2002 – National Seed Policy (To develop seed industry)
- 2004 – Establishment of Directorate of Seed Research, Mau, UP (To undertake research and coordination on seed production)
- 2008 – Joining of OECD seed schemes (To facilitate seed trade in international market)
- 2009 – 14 Export and Import Policy (New EXIM) (Liberalized export of seeds and planting materials with few exceptions)
- 2010 – Seed Bill 2004,
- 2011 – Modified policy on Seed Development / Modified policy on Seed Sector

Structured, Public Sector Interventions Led by the Seed Division within the Government of India



Source: <http://seednet.gov.in>

| # | Name of the component | Details of the component |
|---|--|---|
| 1 | Transport Subsidy on Movement of Seeds | This component covers North-Eastern states, including Sikkim, Himachal Pradesh, Jammu, Kashmir, Uttarkhand, and West Bengal. It provides for (a) 100% reimbursement of difference between rail and road transportation cost for the movement of seeds produced outside the state and (b) the actual cost, restricted to maximum limit of Rs.60 per quintal whichever is less for the movement of seed within the state from state capital / district headquarters to sale outlets/sale counters. |
| 2 | Establishment & Maintenance of Seed Bank | In order to ensure that seeds are available to the farmers at the time of natural calamities like floods, droughts, etc. Under this component, grants-in-aid are released to NSC, State Farms Corporation of India, and SSC. |
| 3 | Quality Control Arrangement on Seeds | This component deals with arrangement to regulate the quality of seeds under the Seeds Act. This component also deals with the strengthening of National Seed Research and Training Center at Varanasi (Uttar Pradesh). |
| 4 | Seed Village Program | To upgrade the quality of farmer-saved seed, which is about 80-85% of the total seed used for crop production program, financial assistance is provided for distribution of foundation/certified seeds at 50% cost of the seed of crops for production of certified/quality seeds only and for training on seed production and technology to the farmers. |
| 5 | Assistance for Creation/ Strengthening of Infrastructure Facilities in Public Sector | In order to establish/strengthen infrastructure facilities for production and distribution of quality seeds, assistance for creating facilities of seed cleaning, grading, processing, packing, and seed storage is provided. Assistance is provided at the standard rate of Rs.22.25 lakh per seed processing plant of 1000 MTs (including construction of building and machinery/equipment) or multiples thereof. For construction of seed storage warehouse, assistance is provided at the standard rate of Rs.25 lakh per seed warehouse of 1000 MT capacity and multiples thereof. |
| 6 | Application of Biotechnology in Agriculture. | This component is being implemented for providing financial assistance for post-release monitoring of transgenic crops through SAUs, SDAs, KVKs, public awareness campaign through SAUs, scientific organizations/institutes, and for promotion of tissue culture through SAUs/specialized institutions/seed corporations. |
| 7 | Assistance for Boosting Seed Production in Private Sector | Under this component, credit linked back-ended capital subsidy is provided at the rate of 25% of the project cost subject to a maximum limit of Rs.25.00 lakh per unit on seed infrastructure development. Private companies, individual entrepreneurs, self-help groups, seed cooperatives, and partnership firms are eligible for subsidy. |
| 8 | Promoting for Hybrid Rice Seed Production | Under this component, assistance is provided for production as well as distribution of hybrid rice seeds. Production subsidy @ Rs.20/- per kg. and distribution subsidy @Rs.25/- per kg. are given to beneficiaries. |
| 9 | Assistance for Boosting Seed Export | Under this component, assistance is meant for obtaining the membership of international organizations like International Seed Testing Association and to participate in the Organization for Economic Cooperation and Development schemes for the development of Indian seed industry and promotion of export of seeds. |

Schemes Promoting Rice Production Targeted at Overall Rice Production (incl. Seeds)

1. Special Rice Development Program's objective was to substantially increase productivity in low productivity areas by improving the supply of inputs like quality seeds, fertilizers, pesticides, plant protection equipment, farm implements and technology, as well as improving the irrigation, drainage, and development of infrastructure facilities. The funding was provided on a 50:50 sharing basis between GOI and the state government.
2. The Special Food Grains Production Programme (SFPP) -Rice's objective was to achieve minimum food production of 166 MT during 1988-89 and 175 MT for the terminal year 1989-90 of the 7th Five Year Plan. It was implemented in 106 potential districts in 13 states and was 100% funded by GOI.
3. Integrated Program for Rice Development (IPRD): SRPP and SFPP-Rice were merged and unified under IPRD, which was implemented from 1990-1991 and expanded coverage to more states. The funding pattern under the scheme was modified to 75:25 to be shared between GOI and state governments. From the year 1991-92, the scheme was further extended to five additional states. Thus, the scheme was implemented in 23 states.
4. Under IPRD, state governments could choose the most suitable components out of the approved components, namely distribution of certified seeds, micro-nutrients (zinc sulphate), herbicides, pesticides, PP equipment, seed treating chemicals, farm implements, supply to power tiller to small and marginal farmers. Based on the state's specific rice production constraints, the state government allocated funds, with an overall limit of 0.25 USD million per district. Field demonstrations and training programs for farmers and farm laborers were also included under the scheme for effective transfer of crop production technology.
5. ICDP-Rice: The objective of the modified scheme is to increase the overall productivity of cereals as a whole under specific crop-based systems (rice, coarse cereals, and wheat) .
6. Rice Seed Minikit Program: In addition to supplying certified HYVs of rice seed to farmers, the program distributed seed minikits of recently released, location-specific HYVs to farmers at nominal cost. A total number of 33,00,000 seed minikits of 419 location-specific rice HYVs were distributed in different rice growing states during the 9th Five Year Plan.
7. National Food Security Mission (NFSM)-Rice: During the 11th Five Year Plan, NFSM-Rice was implemented in 144 districts of 16 states. From the year 2012-13 onward, it has been implemented in 194 districts of 25 states. Interventions include cluster demonstrations on improved package of practices, demonstrations on cropping system, seed distribution of hybrid rice and HYVs, cono-weeder, manual sprayer, power sprayer, drum seeder, pump set (up to 10 HP), seed drill, multi-crop planter, zero till multi crop planter, power weeder, water carrying pipes, rotavator, paddy thresher/multi-crop thresher, laser land leveller, self-propelled paddy transplanter, plant protection chemical and biopesticides, weedicides, micro-nutrients, lime and liming material, cropping system based training of farmers, local initiatives and project management team and other initiatives like demonstration by NGOs in remote areas, assistance for custom hiring. From the year 2015-16, it has been implemented on a 60:40 sharing pattern between GOI and most state government except for the 90:10 sharing pattern between GOI and North-Eastern and three Hill states.
8. Frontline Demonstration-Rice: The FLDs on rice are an approved NFSM component, conducted by the ICAR/SAUs system, focusing on the latest notified/released varieties and a full package of practices on selected farmers' fields to demonstrate the potentiality of the technologies to (a) participating farmers, (b) neighbouring farmers and other agencies, (c) to analyze the production, (d) and to analyse performance for scientific feedback. The ICAR /Directorate of Rice Research, Hyderabad) is the nodal Institutions for organizing the FLDs on rice.
9. State Level Training Program on Rice Production Technology: This program since 1975-76 disseminates the latest rice production technology to extension officers of state governments. The three-day training sessions for 30 participants are conducted at ICAR research centers and SAUs (through the 9th Five Year Plan period). Assistance is limited to Rs. 22,900/- and is given to the organizing centers for conducting training programs.
10. Promoting Cereal Hybrid Seeds: Under the scheme "Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds."

thank you



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