

Achievements and Way Forward



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India, the land of spices produces about 8.41 million tons of spices from an area of 3.97 million hectares (2017-18). Among the spices, black pepper, cardamom, cinnamon, ginger and turmeric contribute about 30% of the total spice production. Seed spices, fennel, fenugreek, coriander and cumin occupy an area of 47.8% of total spices and contribute 22.5% of total spice production. Though every state/Union Territory in India grows at least a few spice crops, Kerala, Andhra Pradesh, Gujarat, Maharashtra, West Bengal, Karnataka, Tamil Nadu, Orissa, Madhya Pradesh, Rajasthan and North Eastern states are the major spices producing states.

The area under spices has shown a positive trend in the recent years, it still occupies only 1.6% of the gross cropped area of the country. During 2017-18, 1.08 million tons of spices and spice products valued at Rs. 20013.7 crores (US\$ 2668.5 Million) has been exported from the country registering an increase of 9% in volume, 15.3% in terms of value. Spices contribute 28.5% of the horticultural exports from the country and spices export occupies a prime place in terms of value after marine products, buffalo meat and basmati rice during 2017-18 and contributed 9.8% to the total agricultural products export.

The adoption of our technologies has helped in increasing the production of major spices in the recent years (31% increase in black pepper, 17% in cardamom, 7% in nutmeg, 20% in turmeric in 2016-17) and the decadal CAGR growth of spices is 4.24 when compared to the previous decade. From 10.0% of our spices export India commands 43.0% share in volume and 48.0% in value of world spice trade.

Our Approaches

- Conservation and utilization of genetic resources for crop improvement
- Varietal development with focus on quality and climate resilience through convergent and fast breeding approaches.
- Productivity enhancement through better input management/precision farming systems
- Prioritized research on bio-risk management to ensure the containment and management of biotic stresses in spice crops
- Nurturing and improving demonstrated techniques on precision farming, protected cultivation and urban horticulture
- Enhancing the skill set of spice crops to tolerate/ circumvent climate change along with other abiotic stress factors commonly associated with spices
- New market oriented technologies for secondary agriculture, value addition and food safety
- Exploiting the potential of spices and spice extracts as nutraceuticals, functional foods and wellness products through intensified research in the area of high value compounds in spices
- Development and deployment of human resources and technological capability in the niche areas of nutrigenomics and pharmacogenomics to harness the latent potential of bioactive compounds in spices
- Expanding the crop geography to non-traditional areas through strategic trait deployment in varieties

Achievements

- The Institute has been awarded twice (1999 and 2009) with the prestigious Sardar Patel Outstanding ICAR Institution Award



- The institute has the world's biggest germplasm collection of spice crops including wild relatives, related species and cultivated types of black pepper (3466), cardamom (618), ginger (668), turmeric (1404), nutmeg (510), clove (226), cinnamon (311), vanilla (94) and garcinia (116). The germplasm has been characterized for yield, quality traits and biotic and abiotic stresses
- Developed and released 29 high yielding varieties of spice crops (black pepper - 10, cardamom - 4, turmeric - 8, ginger - 3, nutmeg - 2 and cinnamon - 2) with desirable qualities which substantially increased the productivity of spices in the country.
- Developed improved vegetative and propagation technologies in spice crops including soil less pro-tray method for production of black pepper rooted cuttings and bud sprouts in ginger and turmeric for planting.
- Developed on-line database of soil fertility status for major, secondary and micronutrients for Wayanad and Kozhikode districts in Kerala and site-specific nutrient management plans for targeted yield of spices.
- Developed crop and soil pH specific micronutrient formulations for black pepper, cardamom, ginger and turmeric and commercialized.
- Identified efficient Bio-Control Agents and Plant Growth Promoting Rhizobacteria and developed novel delivery systems including encapsulation techniques (Biocapsule) for growth promotion, increased yield and management of diseases and pests in spices.
- Whole genome sequencing of *Phytophthora capsici*, *Ralstonia solanacearum*, *Banana bract mosaic virus*, *Cucumber mosaic virus* and *Piper yellow mottle virus* infecting black pepper, ginger and cardamom



to understand the transmission, virulence and host pathogen interaction.

- Developed molecular diagnostic assays for detection of major viral diseases of black pepper, cardamom and ginger for production of healthy planting materials.
- Developed molecular methods to detect the presence of biological adulterants in traded market samples of spices to ensure quality and safety of export-oriented spice products.
- Established Agricultural Technology Information Centre and Krishi Vigyan Kendra for transfer of technologies through on-farm trials, demonstration plots, training programmes and mass media.
- Established Business Planning and Development Unit with facilities for processing spices and an Incubation Centre to transform farmers into rural agri-business entrepreneurs.

Innovative Technologies

➤ Improved spice varieties

Black pepper: IISR Thevam; Ginger - IISR Varada, IISR Mahima, Turmeric - IISR Prathibha, IISR Pragati, Nutmeg - IISR Keralasree

➤ Disease free quality planting material production

Technologies for production of disease free quality planting material in spices

➤ Food safe spices production

Improved organic production technologies, GAPs and INM for the production of food safe spices.

Crop specific micronutrient formulations for enhanced yield and quality in major spices.

➤ Biocapsules

A smart delivery system for plant growth promoting rhizobacteria (PGPR) and other beneficial microorganisms.

➤ Microbial consortium

Effective PGPR consortium for enhanced growth and yield in black pepper and ginger

➤ Biocontrol agents

Formulations of

- *Trichoderma harzianum*: disease management in black pepper, cardamom, ginger and turmeric
- *Pochonia chlamydosporia*: management of root knot nematodes in spices
- *Lecanicillium psalliotae*: for the control of cardamom thrips
- Developed a new medium for the mass multiplication of entomopathogenic nematodes (EPN)
- Green technology for the management of cardamom thrips using new generation pesticides derived from actinomycetes
- Virus elimination technique in black pepper through somatic embryogenesis
- Integrated technology for rejuvenating virus affected black pepper plantations

Tribal farmer empowerment: Several demonstrations aimed at tribal farmer empowerment were undertaken under the Tribal Sub Plan project. Varietal demonstrations in black pepper were undertaken in Kerala, Tripura and

Arunachal Pradesh. Demonstration in collaboration with the Spices Board in black pepper and ginger is in progress in four districts of Arunachal Pradesh and in Shillong and Guwahati in Assam.

Future thrusts

- Crop improvement using cutting edge technologies and fast breeding strategies to develop climate-smart crop varieties.
- Development and refinement of GAPs and Organic Production Techniques in spices with emphasis on tribal empowerment.
- Review of extant farming systems to explore the possibility of offering choices and alternatives to the farming community for enhancing the output in several spices through crop intensification, optimal intercropping strategies astute land use planning and value addition.
- Increasing focus on food safety presents a significant challenge for the spice farming systems and application of DNA bar coding technology for detecting adulteration in many spices.
- Prioritization of pesticide residue and contaminant problems and focused research initiatives on addressing identified constraints to project India as a source for food safe spices.
- Effective transfer of technologies to empower stakeholders
- Pro-active foray into non-traditional and tribal areas especially North Eastern States

Budget

Details of RE and expenditure for the last 5 years (In Lakhs)

Financial Year	RE	EXP.
2013-14	1851.64	1814.76
2014-15	2271.00	2215.20
2015-16	2124.37	2118.07
2016-17	1987.0	1986.33
2017-18	1796.00	1794.35

Additional requirements

1. Farm improvement

Farm roads, construction of compound wall, electric fencing to prevent wild animal menace etc -Rs 400 Lakhs

2. Pesticide Residue and Quality Analysis Lab

To strengthen the existing facilities- Rs 300 Lakhs

3. Spice museum

Development of 'Spice Museum' displaying history and development of spices sector in the country

4. Conference Hall/Auditorium facility

5. International exposure visits

International opportunities for scientists to strengthen professional and research development and to build long lasting sustainable international networks

6. Alternate site for black pepper germplasm conservation

Additional area of 50 acres is required from ICAR- IIHR, Chettalli, Karnataka for establishing Black Pepper Genetic Resources facility

7. Filling up of vacant posts in Administrative/ Technical/ Supporting cadres
8. Permission for availing alternate flights in Mumbai-Calicut sector
9. Support for International Symposium organized by Indian Society of Spices in 2020.

ICAR-All India Coordinated Research Project on Spices (AICRPS), the largest network of spice scientists in India has adopted multidisciplinary approach to develop over 150 improved spice varieties and location specific technologies ensuring food safe spice production. ICAR- AICRPS, located at ICAR-Indian Institute of Spices Research, Kozhikode, Kerala has 38 centers (19 regular centers, 11 co-opting centers and 8 voluntary centers) representing 14 agro-climatic regions in 24 states including North Eastern States and Tribal areas.

Improved varieties of spices

The first hybrid variety of black pepper, Panniyur 1, developed and popularized through Panniyur center of ICAR-AICRPS is still the dominant cultivar not only in India but also worldwide.

Crop	Variety	Characters
Ginger	GCP-49	Bold rhizomes with dry recovery of 21.7%
	Solan Giriganga	Plumpy and bold rhizomes suitable for western Himalayas
Turmeric	NDH-8 (Narendra Saryu)	High curcumin content (5-6%), more number of primaries suitable for powder industry
Nutmeg	IISR Keralashree	First farmer participatory bred nutmeg with extra bold fruit mace and nut
	Konkan Sanyukta	Second monoecious nutmeg variety with bold nuts, high nut oil (27%) and mace oil (17.75%)

Clove	PPI (CL) 1	First clove variety with high oil content (6%)
Cassia	IISR Cassia	First cassia variety with low coumarin content
Coriander	Ajmer Coriander -3	High volatile oil (0.55 %) with high linalool (75.42 %)
	JD (SI)-1	High oil type coriander (0.67 %)
	Chhattisgarh Chandrahansini Dhania-2	Sri Climatic resilient dual purpose coriander variety suitable for both leafy and seed purpose
Fennel	RF- 281	Bold, attractive seeds, high volatile oil (2.58%)
	RF-157	Long attractive and bold seeds.
	Ajmer fennel 3	High yielding (21.43 q ha ⁻¹) and high oil (1.9%) fennel
Fenugreek	Ajmer Fenugreek 5	High antioxidant content and suitable for green leaf production under shade net condition in summer
	HM- 348	Dual purpose fenugreek
	Lam Methi 3	Medium diosgenin content (0.31%)
	Hisar Manohar	Unique green seed colour

Biotic and abiotic stress tolerant varieties

Crop	Variety	Characters
Black pepper	Panniyur 9	tolerance to <i>Phytophthora</i> foot rot
Small Cardamom	PV3 (S 1)	tolerant to drought, thrips and capsule borer
	Appangala 2	first <i>Katte</i> resistant hybrid of small cardamom
Turmeric	NDH-98	tolerance to salinity
	IISR Pragati	moderately tolerant to root-knot nematodes
	TCP 129	tolerance to leaf spot and leaf blotch
Cassia	IISR Cassia	first cassia variety with low coumarin content
Coriander	Ajmer Coriander 2	stem gall resistance
	Suruchi	off season coriander variety suitable for protected cultivation in summer
	RD 385 (Dr. RPCAU Dhania-1)	moderately resistant to stem gall disease and resistant to lodging
Cumin	Gujarat Cumin 5	high yielding wilt resistant cumin
Fennel	Ajmer Fennel-2	moderate resistance to <i>Ramularia</i> blight
Fenugreek	Narendra Methi 2	salinity tolerance and moderately resistance to <i>Cercospora</i> leaf spot and downy mildew
	RMt-354	resistant to powdery mildew and downy mildew
	Narendra Richa	dual purpose alkaline tolerant with moderate resistance to powdery mildew

Technologies for crop production and plant health management

ICAR-AICRPS has developed 176 crop wise technologies for varietal improvement, nutrient availability and plant health management in various spice crops. Important ones encompass:

- **Rapid propagation of planting materials** in ginger and turmeric through single node protray method
- **Micro irrigation and fertigation technologies** for black pepper, cardamom, turmeric, coriander, fennel and fenugreek.
- **Organic production technologies and GAPs** in black pepper, cardamom, ginger, turmeric, coriander and fennel.
- **Integrated pest and disease management technologies for spice crops including seed spices**

Tribal welfare programs: ICAR-AICRPS technologies have also percolated to the remote and inaccessible tribal lands of Chintapalle in Andhra Pradesh, Pottangi in Odisha, Raigarh in Chhattisgarh and NE states providing employment opportunities (especially to women) and uplifting the economic status of farmers by supplying quality planting materials and giving training programmes on high production technologies. Also, expanded the production of spices especially turmeric, ginger and black pepper in their nontraditional areas of cultivation. Organic production packages of large cardamom for North East and Large cardamom Guide has been published in collaboration with Spices Board.

भावता माहर Receipt sea:
दिनांक Date

05 JAN 2014

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