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Agricultural TECHNOLOGIES

HORTICULTURE

Volume-II

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ICAR

Indian Council of Agricultural Research
New Delhi

Agricultural Technologies
Ready for Commercialization

HORTICULTURE

Vol. II

Indian Council of Agricultural Research
New Delhi

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राधा मोहन सिंह
RADHA MOHAN SINGH

सत्यमेव जयते

कृषि मंत्री, भारत सरकार
MINISTER OF AGRICULTURE
GOVERNMENT OF INDIA

Message

Indian agriculture has overcome several challenges in the past and achieved phenomenal success ensuring self-sufficiency in food production. The technologies generated within the National Agricultural Research System (NARS) have significantly contributed to the transformation of Indian agriculture and ushering in Rainbow Revolution, representing Green, White, Golden, Brown and Blue revolutions, defining outstanding technology led performance in foodgrains, milk, oilseeds, pulses, horticulture and fisheries sectors. Agriculture along with other primary sectors is a major source of strength for the Indian economy. However, burgeoning population, increasing demand for food, feed and fodder, decreasing land availability, natural resource degradation, decreasing factor productivity, climate change, slow growth in farm income and changing in global trade regulations have put new challenges threatening food, nutritional and livelihood security.

Technological interventions by the NARS have led to spectacular accomplishments relating to input-use efficiency, climate resilience, mechanization and secondary agriculture, leading to economic transformation. These coupled with the application of information and communication technology will play a critical role in our future endeavours to accelerate agricultural growth in the country. I am glad that the Horticultural Science Division of the Indian Council of Agricultural Research (ICAR) has synthesized and compiled *Agricultural Technologies: Horticulture*, Vol II, practical and useful technologies in this series of publications on Agricultural Technologies in a user-friendly mode. I am sure this information will be useful to farming community, extension agencies, entrepreneurs and horti-industries in their efforts to make Indian agriculture economically viable and ecologically secure.

Radha Mohan Singh

(Radha Mohan Singh)

Krishi Bhavan
New Delhi 110 001

Foreword

Agriculture is the corner-stone of Indian economy. About 70% of India's 1.27 billion population live in rural areas with small and marginal land holdings. India with a geographical area of over 328 million hectares is endowed with diversity of climate, soils and vegetation. This rich resource endowment is, however, threatened with ever increasing population, vagaries of nature and climate change. The National Agricultural Research System (NARS) comprising the Indian Council of Agricultural Research (ICAR), 55 State Agricultural Universities, five Deemed Universities, four Central Universities with agriculture faculty, one Central Agricultural University and 637 Krishi Vigyan Kendras have attained excellence in several frontier areas of agricultural sciences and technology contributing significantly towards the spectacular growth of Indian agriculture during past 60 years.

Initiatives by NARS in the country have led to notable accomplishments resulting in the socio- economic transformation of farmers. The agriculture sector is, however, witnessing radical changes and challenges both at national and global level. The emerging challenges and opportunities necessitate wider and faster adoption of the improved technologies by all the stakeholders right from production to consumption in a food chain. In an effort to achieve this, the divisions of crop science, horticulture, animal science, natural resources management, fisheries and agricultural engineering in the ICAR have compiled the technologies already commercialised and the technologies ready for commercialization. This series of publications, brings out the salient features of the technologies with details on potential users and contact details of the developers for ready and easy access. It will be our endeavour to periodically update this Technology Series. I hope that this publication would be useful to the farming community, extension agencies, entrepreneurs and industry. I greatly appreciate the efforts put in by my colleagues in the Council, research institutes and State Agricultural Universities (SAUs) in bringing out this compilation.

(S. Ayyappan)
Secretary, Department of Agricultural
Research and Education, and
Director General, Indian Council
of Agricultural Research
New Delhi

July 2014
New Delhi

Preface

Horticulture has been a key driver of economic development in India and virtually improved the economy in several states. Horticulture contributed approximately 30 % to Agricultural GDP. During 2012-13, horticultural production (~268 million tonnes from ~23 million ha) surpassed foodgrains production. Globally, India is the second largest producer of fruits and vegetables. Further, we are the largest producer of mango, banana, coconut, cashew, papaya, and pomegranate; and the largest producer and exporter of spices. We are also the world leaders in productivity of grapes, banana, cassava, peas, papaya, etc. In monetary terms the growth in export of fresh fruits and vegetables is 14 % while it is 16.27 % in case of processed fruits and vegetables. Focused attention on horticulture has paid rich dividend and resulted in 7-fold increased production leading to substantial export. Approximately, 73,000 germpalsm accessions of various horticultural crops have been conserved across the country. Systematic research efforts on crop improvement have resulted in identification and release of ~1,600 high yielding varieties and hybrids of different crops, development and adoption of several high impact production and protection technologies. As a result, the productivity of banana, grapes, potato, onion, cassava, cardamom, ginger, turmeric etc. has improved significantly. Although we are leading in the production of many crops, post harvest/ production losses in some of these commodities is a cause of concern and need to be addressed on priority. Our overall achievements in R&D of horticultural crops are laudable, but the glass is only half full. We cannot be complacent given our demography and dwindling natural resources. The perceived threats on climate change pose greater challenges in achieving the targets in these crops now more than ever before.

Horticulture is expected to be largely technology driven. The technologies like protected cultivation, drip irrigation, fertigation, tissue culture, cryopreservation, post harvest packaging and handling, pheromones and bio-pesticides are likely to contribute significantly to increased horticultural productivity in the very near future. In addition, tapping the potential of molecular biology for the management of pests and diseases, including diagnostics, improving post-harvest shelf life, climate resilience, virus resistance, neutraceuticals etc. are likely to play a significant role. Twenty-first century will be knowledge driven period and not merely an era of technology generation. It is a prerequisite in this direction that we first classify and publish the relevant technologies to facilitate their utilization and sharing with the end users.

It gives me immense pleasure to put forth a compilation on *Horticultural Technologies-Ready for Commercialization,* under the series *Agricultural Technologies: Horticulture*, in a user-friendly manner. It will be our endeavor to attempt need-based revision of the publication to update the information. I hope that this publication would be equally useful to all concerned. I appreciate the efforts made by my colleagues in the Horticultural Science Division in compiling the above technologies in present form for the benefit of stakeholders.

N.K. Krishna Kumar
Deputy Director General (Hort. Sci.)
ICAR, New Delhi

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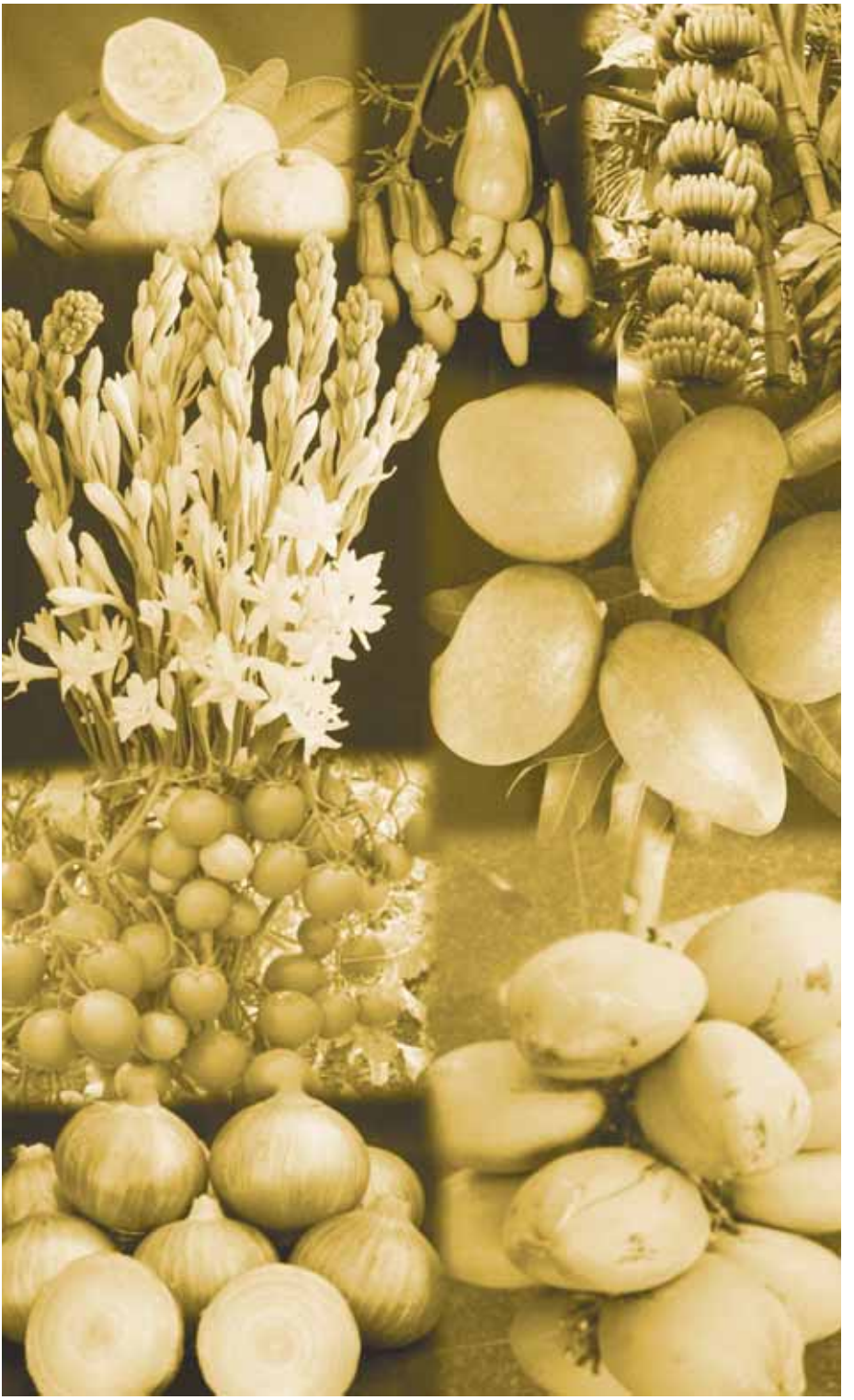

Mango Variety: Ambika

Salient features

- Fruit oblong oval, bright yellow with dark red blush, weighing 300-350g.
- Pulp dark yellow, firm with scanty fiber having TSS 21^0 B.

Performance

- The variety has wider adaptability and is performing well in contrast climatological regions.
- Produces 80 kg fruits/plant at the age of 10 years.
- It is a regular bearing variety with late ripening feature.

Impact and benefits

- Attractive red blushed peel with regular bearing and suitable for cultivation throughout mango growing areas of the country.
- The hybrid has potential for export as well as for internal market because of its attractive fruit colour.

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Mango Variety: Arunika

Salient features

- The tree has dwarf canopy.
- Fruits very smooth, ovate oblique, orange yellow with red blush, medium in size, weighing 190-210 g.
- Pulp orange yellow, firm with scanty fibre, sinus absent.
- Pulp content 65.5% with 24.6^0 B TSS.

Performance

- Fruit yield 69 kg/plant at the age of 8 years.
- This variety has wider adaptability and is performing well in major mango growing regions of India.

Impact and benefits

- Suitable for commercial cultivation in mango growing areas of the country with proper irrigation facilities.
- Has the potential for export as well as for internal market because of its attractive fruit colour.

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Guava Variety: Lalit

Salient features

- Saffron yellow fruits with red blush weighing 185-200 g.
- Pulp firm, pink with good blend of sugar and acid.
- Fruits rich in vitamin C, i.e. 250.63 mg/ 100 g.

Performance

- Yield higher than other commercial varieties, i.e. 100 kg fruits/plant at the age of 6 years.
- The pink colour in the beverage remains stable for more than a year in storage.
- Highly responsive to pruning.
- It has wider adaptability.

Impact and benefits

- Heavy bearer thus requires fruit thinning for quality fruits.
- It is suitable for both table purposes and processing.

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Guava Variety: Shweta

Salient features

- The variety has globose fruits, medium size weighing 225 g with creamy white peel having red spots or blush.
- Snow-white pulp, high TSS (12.5-13.2^0 B) and vitamin C (300 mg/100 g of pulp) with good keeping quality.

Performance

- Produces high yield of 90 kg fruits/tree at the age of 6 years.
- It has wider adaptability.

Impact and benefits

- Suitable for cultivation throughout guava growing areas of the country.
- Suitable for rainy season crop also.
- Suitable for both table purposes and processing.

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Guava Hybrid: Arka Kiran

Salient features

- Fruits yellow with deep pink pulp having 5-6 mg/100 g lycopene, TSS 12-13^0 B, Vit C 92.8 mg/100g and soft seeds (hardness of seed 9.0 kg/cm^2).
- It is a dual purpose variety, i.e. can be used for both table purposes and processing. The weight of fruit is 230 g with 7.2 cm length and 6.8 cm breadth.

Performance

- It produces 60-70 kg fruits/tree at full bearing.

Impact and benefits

- It is a dual purpose variety, hence can be used for both table purpose and processing.

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Papaya Variety: Arka Prabhath

Salient features

- It is a gynodioecious variety and flowering starts at 55 cm plant height.
- The weight of fruit ranges between 900 and 1,300 g, having mean length and breadth of 11.2 and 8.5 cm, respectively with 3.0 cm pulp thickness and 10% fruit cavity index.
- Fruit pulp is deep pink with TSS of 13-14^0 B and good keeping quality.

Performance

- A cumulative yield of 90-100 kg per plant can be obtained over a period of two year.

Impact and benefits

- This papaya variety is an advanced generation hybrid selection. Hence, farmers can produce the seeds themselves and need not change it every time.

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Banana Variety: Udhayam

Salient features

- A promising new variety belongs to Pisang Awak group similar to Karpuravalli.
- It has cylindrical bunch with well-spaced hands amenable to long distance transportation.
- The fruits have high sugar content with 32 B and suitable for processing into value added products like figs, banana juice, wine etc.

Performance

- The bunch weight ranges from 35 to 45 kg. It yields 80 tonne/ha.

Impact and benefits

- High yield and suitable for processing. Transportation losses are less and more bunches can be accommodated per unit volume.
- Suitable for cultivation in important banana growing states, viz. Tamil Nadu, Andhra Pradesh, Bihar, West Bengal, north eastern regions in place of local Karpuravalli banana. This variety is 40% high yielder. Highly suitable for processing industry.
- Due to cylindrical bunch, the transport losses are less.

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Cashew Variety: NRCC Selection 2

Salient features

- This is a selection from the segregating seedling progeny originally from a collection made from Andhra Pradesh.
- It has a mid-season flowering habit (November - January) with a flowering duration of 74 days.
- The number of fruits per bunch is 3 and the colour of apple is pink.

Performance

- The average yield is 9.0 kg/tree.
- The nut weight is 9.2 g.
- The shelling percentage is 28.6% and kernel grade conforms to export grade (W 210).

Impact and benefits

- Export of superior grade kernel of this variety (W210) fetches premium price in the market.

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Cashew Variety: Bhaskara

Salient features

- This variety was released in 2006 for coastal Karnataka.
- This is having mid-season flowering habit (December-March) with a flowering duration of 60 days and has potential to escape the attack of tea mosquito bug (TMB) under low to moderate outbreak situation.
- The number of fruits per panicle (bunch) ranges from 4 to13 with pinkish orange apple containing 67.5% juice.

Performance

- Yield in full grown tree is 10.7 kg.
- The nut and kernel weigh 7.4 g and 2.2 g, respectively.
- The shelling percentage is 30.6 and kernel size conforms to export grade (W 240).
- Mid-season flowering makes it less prone to the attack of Tea Mosquito Bug.
- This variety has become very popular in Dakshina Kannada district of Karnataka.

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Oil Palm Variety: Dwarf Tenera

Salient features

- It is a proven source of dwarf palm identified in India. It has an average yield of 134 kg/palm/year.
- This palm has short rachis length (4.85 m), inter-nodal leaflet distance (2.5-3 cm), leaflet length (85.33 cm), petiole width (8 cm), petiole depth (2.92 cm), leaflet breadth (4 cm), frond base length (75 cm), frond base width (10 cm) and other vegetative characteristics when compared to commercial tenera of same age.

Performance

- It is high-yielding type (134 kg/palm/year)

Impact and benefits

- High-yielding compact palms with slow stem elongation and short leaves become good alternative for prolonging commercial cultivation.
- It needs popularization due to dwarf plants, high yield and conveniene in harvesting.

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