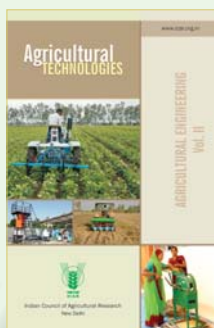
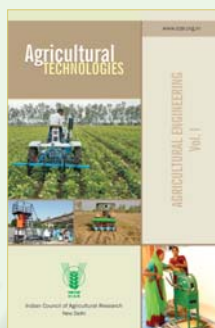
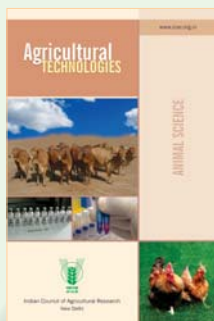


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Agricultural TECHNOLOGIES



HORTICULTURE

Volume-I



Indian Council of Agricultural Research
New Delhi



Agricultural Technologies Commercialized

HORTICULTURE

Vol. I



Indian Council of Agricultural Research
New Delhi

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शरद पवार
SHARAD PAWAR



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भारत सरकार
Minister of Agriculture &
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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 Rainbow Revolution representing Green, White, Golden, Brown and Blue revolutions defining outstanding technology-led performance in foodgrain, milk, oilseeds and 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 new 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 Subject Matter Divisions of Indian Council of Agricultural Research (ICAR) have synthesized and compiled 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 agro-industries in their efforts to make Indian agriculture economically viable and ecologically secure.

(Sharad Pawar)

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

January 2014
New Delhi

Preface

The horticultural production has witnessed rapid progress in the past and for the first time in the history of India, horticultural production (263 million tonnes from 23.24 million ha) has surpassed food production (259.32 million tonnes from 125 million ha) in 2011-12. There has been a 2.5 fold increase in production and 20 fold increase in export earnings (from ` 482 to ` 9,960 crore) during last 20 years (1991-2011). A glimpse of the number of horticultural technologies developed and commercialized during last few years indicates that more than 143 technologies have been commercialized. Horticulture as of today is largely driven by the private sector, which in itself is an indication that the strength of the technology is the driving force. Crops such as grapes and mushrooms, protected cultivation, drip irrigation and fertigation, tissue culture, cryopreservation, post-harvest packaging and handling, pheromones and bio-pesticides are some of the technologies that are going to contribute significantly to horticultural development in the years to come.

Furthermore, exploitation of molecular biology for the management of pests and diseases, extension of self-life, heat tolerance, virus resistance, neutraceutical etc. are also going to play a major role. Twenty-first century is not merely the century of technology generation but more of knowledge management. It is a pre-requisite in this direction that we first classify and publish the useful technologies to facilitate their utilization and sharing for the future.

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

Dr. N.K. Krishna Kumar
Deputy Director General
(Horticulture), ICAR
New Delhi

Content

	<i>Pages</i>
<i>Message</i>	<i>iii</i>
<i>Foreword</i>	<i>v</i>
<i>Preface</i>	<i>vii</i>
Crops/Varieties	
CITH Apricot-1	1
CITH Apricot-2	2
CITH Apricot-3	3
CITH Walnut-1	4
CITH Walnut-2	5
CITH Walnut-3	6
CITH Walnut-4	7
CITH Walnut-5	8
CITH Walnut-6	9
CITH Walnut-7	10
CITH Walnut-8	11
CITH Walnut-9	12
CITH Walnut-10	13
Ajmer Dill 1	14
Ajmer Dill 2	15
Ajmer Fennel 1	16
Ajmer Fenugreek 1	17
Ajmer Fenugreek 2	18
Ajmer Fenugreek 3	19
Ajmer Coriander 1	20
Advanced oil palm parent materials for hybrid seed production	21
Manjri Naveen: A Table Grape Variety	22
Red Globe: A Table Grape	23
KR White	24
<i>Manihot esculenta</i> Crantz: CO 1	25
<i>Manihot esculenta</i> Crantz: CO 2	26
<i>Manihot esculenta</i> Crantz: CO 3	27
<i>Manihot esculenta</i> Crantz: CO 4	28
<i>Manihot esculenta</i> Crantz: Indira Cassava-2	29
<i>Ipomoea batatas</i> (L.) Lam: CO 1	30
<i>Ipomoea batatas</i> (L.) Lam: CO 2	31
<i>Ipomoea batatas</i> (L.) Lam: CO 3	32
<i>Ipomoea batatas</i> (L.) Lam: COCIP-1	33
<i>Ipomoea batatas</i> (L.) Lam: CIP- 440038	34
<i>Ipomoea batatas</i> (L.) Lam: IGSP-14	35
<i>Ipomoea batatas</i> (L.) Lam: Samrat	36

<i>Ipomoea batatas</i> (L.) Lam: Kiran	37
<i>Ipomoea batatas</i> (L.) Lam: Konkan Ashwini	38
<i>Ipomoea batatas</i> (L.) Lam: Indira Priya	39
<i>Ipomoea batatas</i> (L.) Lam: Indira Narangi	40
<i>Ipomoea batatas</i> (L.) Lam: Indira Madhur	41
<i>Ipomoea batatas</i> (L.) Lam: Indira Naveen	42
<i>Ipomoea batatas</i> (L.) Lam: Indira Nandini	43
<i>Ipomoea batatas</i> (L.) Lam: Narendra Shakarkand - 9	44
<i>Ipomoea batatas</i> (L.) Lam: Rajendra Shakarkand -5	45
<i>Ipomoea batatas</i> (L.) Lam: Rajendra Shakarkand -35	46
<i>Ipomoea batatas</i> (L.) Lam: Rajendra Shakarkand -43	47
<i>Ipomoea batatas</i> (L.) Lam: Rajendra Shakarkand -47	48
<i>Ipomoea batatas</i> (L.) Lam: Rajendra Shakarkand -92	49
<i>Ipomoea batatas</i> (L.) Lam: Kamala Sundari	50
<i>Ipomoea batatas</i> (L.) Lam: Bidhan Jagannath	51
<i>Dioscorea esculenta</i> (Lour.) Burls: Konkan Kanchan	52
<i>Dioscorea alata</i> : CO 1	53
<i>Dioscorea alata</i> : Konkan Ghorkhand	54
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: CO 1	55
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Satamukhi	56
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Bhavapuri	57
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Indira Arvi – 1	58
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Narendra Arvi –1	59
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Narendra Arvi -2	60
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Rajendra Arvi- 1	61
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Upland	62
Taro-Bidhan Chaitanya	
<i>Colocasia esculenta</i> var. <i>antiquorum</i> (L.) Schott: Upland Taro	63
<i>Colocasia esculenta</i> var. <i>esculenta</i> (L.) Schott: Narendra Bunda -1	64
<i>Colocasia esculenta</i> var. <i>stoloniferum</i> (L.) Schott: BCST-13	65
<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson: Gajendra	66
<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson: Elephant	67
Foot Yam -Bidhan Kusum	
<i>Xanthosoma sagittifolium</i> (L.) Schott: Konkan Haritparni	68
<i>Plectranthus rotundifolius</i> (Poir): CO 1	69
<i>Pachyrhizus erosus</i> (L.) Urban: Rajendra Mishrikand – 1	70
Swarna Shree Brinjal	71
Swarna Mani Brinjal	72
Swarna Shyamli Brinjal	73
Swarna Pratibha Brinjal	74
Swarna Sobha Brinjal	75
Swarna Ajay (F ₁) Brinjal	76
Swarna Shakti (F ₁) Brinjal	77
Swarna Ageti Cucumber	78
Swarna Sheetal Cucumber	79
Swarna Poorna Cucumber	80
Swarna Utkrisht <i>Dolichos</i> Bean	81

Swarna Mukti Garden Pea	82
Swarna Rekha Pointed Gourd	83
Swarna Alaukik Pointed Gourd	84
Swarna Manjhari Ridge Gourd	85
Swarna Uphar Ridge Gourd	86
Swarna Prabha Sponge Gourd	87
Swarna Lalima Tomato	88
Swarna Naveen Tomato	89
Swarna Baibhav (F ₁) Tomato	90
Swarna Sampada (F ₁) Tomato	91
Cardozo Mankurad: A Promising Mango Variety from Goa	92
Goa-1: A Cashew Variety for Goa	93
Tiswadi-3: A Cashew variety from Goa	94
Ganje-2: A Cashew variety from Goa	95
KN 2/98: A Cashew variety from Goa	96
Crop Production and Propagation Technologies	
Cultivation Technology of Pink Oyster Mushroom Arka-OM-1	97
Cultivation Technology of Shiitake (<i>Lentinula edodes</i>) Mushroom	98
Cultivation Technology of Milky (<i>Calocybe Indica</i>) Mushroom	99
Production of Oyster Mushroom Using Arecanut Wastes	100
Softwood Grafting and Nursery Management in Cashew	101
Limb Pruning Technique in Cashew	102
Ultra Density Planting in Cashew	103
Meadow Orchardling in Guava	104
Rejuvenation of Old and Unproductive Mango Orchards	105
Wedge Grafting in Guava, Aonla and Mango	107
Management of Irregular Bearing in Mango	108
Crop Protection Technologies	
<i>Trichoderma viride</i> – 1.5% W.P	109
<i>Trichoderma harzianum</i> – 1% W.P	110
<i>Paecilomyces lilacinus</i> – 1% W.P	111
<i>Verticillium chlamyosporium</i> (<i>Pochonia chlamyosporia</i>) – 1% W.P	112
<i>Pseudomonas fluorescens</i> – 1% W.P.	113
Fruit Fly Pheromone Trap	114
Neem Soap and Pongamia Soap for Insect Pest Management in Vegetables	115
Biofertilizer cum Biofungicide/ Biobactericide Composition B5	117
Liquid Formulation of <i>Beauveria bassiana</i>	118
PCR Based Detection of Banana Streak Virus (BSV)	120
RT-PCR Based Technology for Detection of Banana Mosaic Caused by Banana Bract Mosaic Virus (BBrMV)	121
PCR Based Technology for Detection of Banana Bunchy Top Virus (BBTV)	122
RT-PCR Based Detection of Banana Mosaic Caused by Cucumber Mosaic Virus (CMV)	123

Post-harvest and Processing Technologies

Individual Shrink Wrapping (ISW) of Pomegranate, Capsicum and Sweet Oranges	124
Low Cost Ripening Technology for Fruits Using Ethylene Gas Released from Liquid Ethrel	125
Dried Flower Technology (Three Dehydration Processes for 15 Crops are Bunched)	127
Crushed Tomato	128
Fruit RTS Beverage/Blended RTS Beverage: Mango, Pineapple, Aonla, Grapes etc.	129
Fruit Beverage Concentrates (Squash): Mango, Pineapple, Aonla, Grapes etc.	130
Watermelon- RTS Juice	131
Technology for Making Fruit Bar (Mango, Mango+ Aonla Blend, Guava + Papaya Blend)	132
Osmotic Dehydration of Fruits (Mango, Pineapple, Papaya, Aonla Banana, Jackfruit, Guava and Fruit Bar) and Vegetable Slices (Carrot and Pumpkin)	133
Banana Fig	134
Banana Health Drink	135
Banana Flower Pickle	136
Banana Biscuit	137
Banana Ready-to-Serve Beverage	138
Banana Flour	139
Banana Stem Pickle	140
Banana Flour Soup Mix	141
Coconut Chips	142
Production of Virgin Coconut Oil by Fermentation Technique	143
Production of Virgin Coconut Oil by Hot Process Technique	144

Other Technologies

Elm Oyster Mushroom (<i>Hypsizygus ulmarius</i>)	145
Unique Bacteria Isolated from <i>Entomopathogenic Rhabditis (Osheius)</i> sp. (Rhabditidae : Nematoda)	146
Coconut Leaf Vermicompost	148

CROPS/VARIETIES

CITH Apricot-1

Salient features

- Fruits are bigger in size (50-60g), round in shape, orange in colour with reddish coloration on one side (25-30%), high yielder (15-20 t/ha), low acidity, high T.S.S (14° Brix), suitable for table use and also for processing.



Performance

- Fruit yield 15-20 t/ha with 50-60% increase over check.

Cost

- Through this technology new orchard for commercial purpose could be established which can fetch returns of ` 7-8 crore from 1.0 lakh plants.
- Institute has the capacity of producing 50,000 plants per year.



Impacts and benefits

- Medium density plantation has been standardized using spacing of 3.5 × 3.5 (816) and 5 × 5m (400 plants/ha) as against conventional spacing of 6 × 6m (278 plants/ha). The variety under medium density gives yield ranging from 15 to 20 t/ha.
- Through this variety new commercial orchards can be established which can come to bearing by 5th year and give returns of 4-5 lakh/ha. More returns can be generated, besides improved nutrition.
- Commercialized to State Agriculture Department, progressive orchardists, and fruit processing industries.

Contact

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K.D. Farm, Old Air Field, P.O. Rangreth, Srinagar-190007 (Jammu and Kashmir)

Tel: 0194-2305044, Fax: 0194-2305045

E-mail: dircithsgr@icar.org.in

CITH Apricot-2

Salient features

- Fruits are yellowish orange in colour, medium in size (40-50g), round in shape, low acidity, high T.S.S. (14° Brix) and high yielding (12-15 t/ha), mature trees are expected to yield 20-25 kg/tree. Suitable for table use and also for processing.



Performance

- Fruit yield 12-15 tons/ha with 40-50% increase over check..

Cost

- Through this technology new orchard for commercial purposes could be established which can fetch returns of ` 7-8 crore from 1.0 lakh plants. Institute has the capacity of producing 50,000 plants per year (1 lakh plants for 2 years).



Impacts and benefits

- Medium density plantation had been standardized using spacing of 3.5 × 3.5 (816) and 5 × 5 m (400 plants/ha) against conventional spacing of 6 × 6m (278 plants/ha). The variety under medium density gives yield ranging from 15 to 20 t/ha.
- Through this variety new commercial orchard can be established which can come to bearing by 5th year and gives returns of 4-5 lakh/ha and more remuneration will be generated, besides improved nutrition.
- The apricots are used by State agriculture departments, progressive orchardists, and fruit processing industries.

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CITH Apricot-3

Salient features

- Fruit is very attractive with bright colour (30-40% area of fruit with orange back ground), medium in size (40-45g), low acidity, high T.S.S. (16°Brix) and heavy yielder (10-12 t/ha), suitable for desert use.

Performance

- Fruit yield 10-12 t/ha with 20-30% increase over check.

Cost

- Through this technology new orchard for commercial purposes could be established which can fetch returns of ₹ 7-8 crore from 1.0 lakh plants. Institute has the capacity of producing 50,000 plants per year (1 lakh plants for 2 years) .



Impacts and benefits

- Medium density plantation had been standardized using spacing of 3.5 × 3.5 (816) and 5 × 5m (400 plants/ha) against conventional spacing of 6 × 6m (278plants/ha). The variety under medium density gives yield ranging from 15 to 20 t/ha.
- Through this variety new commercial orchard can be established which can come to bearing by 5th year and gives returns of 7 crore and more remuneration will be generated, besides improved nutrition.

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CITH Walnut-1

Salient features

- Suitable for export as well as domestic market, having light kernel color, bold nut (27g), and large kernel size (12.76g), good kernel recovery (47%), light shell colour, long trapezoidal in shape, easy to remove kernel halves.

Performance

- Mature tree expected to yield 60 kg/tree at 20-25 years of age.

Cost

- Through this technology new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ₹ 12-15 crore from 1.0 lakh plants. Institute has the capacity of producing 25,000 plants per year (10,000 for four years).



Impacts and benefits

- High and medium density plantation with 5 × 5 m, (400 plants/ha), and 7 × 7 m (204 plants/ha) spacing respectively had been recommended as against conventional 10 × 10 m (100 plants/ha) spacing.
- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ₹ 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

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CITH Walnut-2

Salient features

- Nuts are large, ovate, medium shell texture, medium shell colour, strong shell seal, intermediate shell strength, complete shell integrity, satisfactory kernel flavour, well filled kernel, plummy, easy to remove kernel halves and light kernel colour.
- It gives 13.51 g nut weight and 6.61 g kernel weight.



Performance

- Nut yield 60 kg/tree at 20-25 years of age.

Cost

- Through this technology new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 12-15 crore from 1.0 lakh plants. Institute has the capacity of producing 25,000 plants per year (10,000 for four years).

Impacts and benefits

- The budded and grafted plants under different densities with drip irrigation and organic mulching start bearing just after three years as against 12-15 years in seedling trees.
- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

Contact

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CITH Walnut-3

Salient features

- Nuts are large, round, medium shell texture, medium shell colour, strong shell seal, strong shell strength, complete shell integrity, satisfactory kernel flavour, well filled kernel, plummy, difficult to remove kernel halves and light kernel colour.
- It gives nut weight 16.75 g and kernel weight of 7.69 g.



Performance

- Nut yield 50 kg/tree at 20-25 years of age with 40-50% increase over check.



Cost

- Through this technology new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of rupees 12-15 crore from 1.0 lakh plants. Institute has the capacity of producing 25,000 plants per year (10,000 for four years).

Impacts and benefits

- The budded and grafted plants under different densities with drip irrigation and organic mulching start bearing just after three years as against 12-15 years in seedling trees.
- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

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CITH Walnut-4

Salient features

- Nuts are large, ovate, rough shell texture, light shell colour, strong shell seal, intermediate shell strength, complete shell integrity, thin, satisfactory kernel flavour, well filled kernel, moderately plummy, very easy to remove kernel halves and light kernel colour.
- It gives nut weight of 14.24 and kernel weight of 6.92 g.



Performance

- Nut yield 45kg/tree at 20-25 years of age with 40-50% increase over check.

Cost

- Through this technology new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of rupees 12-15 crore from 1.0 lakh plants. Institute has the capacity of producing 25,000 plants per year (10,000 for four years).

Impacts and benefits

- The budded and grafted plants under different densities with drip irrigation and organic mulching starts bearing just after three years as against 12-15 years in seedling trees.
- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

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CITH Walnut-5

Salient features

- High yielder, having extra light kernel color, suitable for export, bigger nut (19 g) and kernel (9.5 g) size, good kernel recovery (48.9%), light shell color, ovate in shape, moderate to remove the full kernel halves..



Performance

- Nut yield 50kg/tree at 20-25 years of age with 40-50% increase over check.

Cost

- Through this technology new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 12-15 crore from 1.0 lakh plants. Institute has the capacity of producing 25,000 plants per year (10,000 for four years).



Impacts and benefits

- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

Contact

Director

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CITH Walnut-6

Salient features

- Nuts are large, ovate in shape, shell colour medium, intermediate shell seal, Intermediate shell strength, satisfactory kernel flavour, well filled kernel, moderate plummy and easy to remove kernel halves. It gives in shell nut weight (24 g), kernel weight (12.2 g) with kernel recovery (50.8 %).



Performance

- Nut yield 60 kg/tree at 20-25 years of age with 50-60% increase over check.

Cost

- Average cost of production per ha: ` 1.00 lakh.
- Average returns per year: ` 5.00-6.00 lakh.

Impacts and benefits

- The budded and grafted plants under different densities with drip irrigation and organic mulching starts bearing just after three years as against 12-15 years in seedling trees.
- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of ` 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

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CITH Walnut-7

Salient features

- Matures 155-160 days after full bloom, nuts are medium in size, ovate in shape, medium shell texture, medium coloured shell, intermediate shell seal, intermediate shell strength, satisfactory kernel flavour, well filled kernel, plummy, moderate removal of kernel halves.
- It gives nut weight (24.7 g), kernel weight (12.26 g) with (49.60%) kernel recovery.



Performance

- Nut yield 50 kg/tree at 20-25 years of age with 40-50% increase over check.

Cost

- Average cost of production per/ha: 1.0 lakh. Average return/year: ` 5-6 lakh.

Impacts and benefits

- The budded and grafted plants under different densities with drip irrigation and organic mulching starts bearing just after three years as against 12-15 years in seedling trees.
- The growers in temperate region will have promising walnut variety by which they can start commercial orchard establishment. The new orchard starts production after four years, commercial bearing by 10th year and can fetch returns of rupees 5-6 lakh/ha.
- The nuts of walnut are used by food industry, cosmetic industry and exporters, while state development departments, nurserymen and farmers would be interested in mass multiplication for commercial growing.

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