COMPENDIUM ON VEGETABLES FOR HOME GARDEN

सत्यमेव जयते

Science for Equity Empowerment and Development (SEED) Division,
Department of Science & Technology,
Govt. of India

Vigyan Prasar
An Autonomous Organisation of the
Department of Science & Technology,
Govt. of India

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Published By

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Foreword

Compendium on Vegetables for Home Garden is indeed a significant addition to the list of titles published by Vigyan Prasar. The topic of this compendium has quite a relevance for the rural- and tribal-woman farmers. This publication aides to their daily requirements and capacity building, which is dependent on available yet limited resources. This compendium, thus, provides a reality check of the state of these women folk.

How did this compendium come up? The idea was inspired by thoughts that were relevant to meet the nutrition-security demands and upgrades related to the economical-status of the rural & tribal populace. This compendium aides the outreach program of a project titled - **Development of communication resources on gender-responsive applications of science & technologies for the home garden: popularize locally adaptable practices for real-life gains**. This program is supported by Science for Equity, Empowerment & Development (SEED) Division of the Department of Science & Technology, Government of India. This compendium is aimed at providing relevant information related to reducing hunger index levels, thereby improving nutritional balance levels of the rural and tribal stakeholders. From a science and technology communication standpoint, this publication provides insight into training and capacity building. This, thus, aligns with the objectives embedded in several United Nations' Sustainable Development Goals (UNSDG). Interestingly, this topic finds its relevance by the decade-old call made by the National Commission for Women.

The subject matter experts feel that this compendium provides the most effective approach for its outreach - the bottoms-up approach.

For the past thirty years, Vigyan Prasar has been bringing out compendiums of relevance regularly. The organization continues to increase the number of communication channels throughout society. In today's world, the print-, electronic-, digital-, and social-media four major media avenues.

This compendium, through print for the moment, shall for sure compel us to bring it in its various forms that'll be relevant to the other forms of media in the coming times.

Nakul Parashar
Director, Vigyan Prasar

Preface

Home gardens are valuable sources of nutrients for people. However traditional knowledge system about maintaining home gardens and the nutritional value of the products of home gardens is a scarcely documented gem. In order to capture the huge knowledge resource that lies scattered in different pockets it was felt necessary to prepare a compendium of nutrient rich vegetables that can be grown in the gardens for household level food and document their nutritional value.

The compendium contains a repository of information on the fruits and vegetable that can be easily grown in varied size gardens at home and how the productivity of the associated plants can be improved with the help of appropriate growth techniques and practices. The compendium encapsulates the nutrients that the vegetable and fruits contain and processes that can value add to create palatable dishes while retaining nutritional value to them.
The compendium specifically mentions about the sowing season, soil requirements, climatic conditions and tips for pest management of the vegetables which can be grown in the intervention region of Jharkhand which is also applicable to tribal belts of Bihar, West Bengal and Orissa. In addition, it mentions about the nutrient content in each crop which can help the rural and tribal women in planning the cultivation of vegetables as per their nutrient requirement.

Presented with attractive pictures and easy to understand text, the compendium can create awareness about value of traditional knowledge on biodiversity and needs for conservation and sustainable use of natural resources based on appropriate Science and Technology interventions. It can also build capacity of the women on ex-situ conservation of key species of flora in homestead garden, boost production of home gardens and prevent disproportionate and untimely interventions that disrupt productivity.

The most successful gardening initiatives train their extension workers and village promoters in both home-garden techniques and nutrition education. In addition, families need to know about factors that promote or inhibit bio-availability of nutrients. This compendium can be a rich resource book for such training needs and a ready reckoner or reference to which they can turn to time and again.

October 2019
New Delhi

Kinkini Dasgupta Misra
Vigyan Prasar

Introduction

Vigyan Prasar, a National level Organisation of the Department of Science and Technology (DST), Government of India, engaged in science communication and popularization, presents a compendium that includes the schedule for model home gardening. Home gardens are considered as valuable sources of nutrients for the common people. However, the traditional knowledge system about maintaining home gardens and the nutritional value of the products of home gardens are poorly documented. In order to capture the huge knowledge resources lying scattered in various silos, it is deemed necessary to disseminate the information in a calendar form regarding nutrient-rich vegetables that can be grown in the gardens at the household level, along with their nutritional significance.

The initiative of providing food as well as nutrition security to the tribal families through home gardening is implemented by Vigyan Prasar and supported by Science for Equity, Empowerment & Development (SEED) Division of Department of Science & Technology, Government of India. The initiative was aimed to present an easy to use information resource on locally adaptable tools and techniques for tribal women based in the state of Jharkhand, Bihar, Odisha, and West Bengal to optimise production and enhance livelihood options. The objective of the initiative is to empower these women to diagnose and develop need-based preventive and remediation strategies for use in a timely manner.

Under the aegis of Department of Science & Technology (DST), the Home Gardening - 36 square metre Model has been prepared for the tribal women in the state of Jharkhand. These contents are also significant for tribal areas of Bihar, West Bengal and Odisha. As part of this initiative, Vigyan Prasar has developed a crop calendar, a compendium of vegetables and fruits, and a recipe book to be used principally as training material. These training materials are to be utilised for providing training purpose to the agricultural extension workers, women workers in the grassroot level, Self Help Groups (SHGs), Krishi Vigyan Kendras (KVKs), and healthcare professionals.

Vegetables help in combating malnutrition and diversifying the diet. In order to provide nutritive and diversified diet to tribal communities having small land, this model was developed by KVK, Ranchi. The model was developed for the 6×6 m^2 area, which is normally available with every household in rural areas. Seasonal vegetables including leafy vegetables, cucurbits, leguminous vegetables and root vegetables are grown in this garden after preparation of land. A minimum of 10 types of vegetables is grown in each season, Rabi, Kharif and Zaid. So that vegetables are available for consumption throughout the year. The garden is managed by household members using only organic manures and pesticides. Fruit plants may be planted on the boundary in a direction, which doesn't prevent sunlight from coming. This garden can produce about 350 Kg of vegetables annually, which is sufficient to meet the minimum needs of nutrients for a small family having four members. The model was demonstrated among more than 150 tribal farmers of Ranchi district.

The women farmers came forward and replicated it to more areas. This shows that the model is successful, socially acceptable, environment-friendly and viable in tribal areas.

Fruits are also important, along with vegetables in our daily diet. Fruit plants may be planted in corners at boundaries of the garden. The location of plantations should be such that the garden crops may get proper sunlight. Small varieties with minimum spread areas should be selected. Papaya, guava, lemon, banana or small mango plants are best for the home garden.

Attaining food security is a matter of prime importance for India where more than one-third of its population is estimated to be poor, and as many as one-half of its children have suffered from malnourishment over the last three decades. India has a history of hunger and food insecurity in the past. After seven decades of independence, India is still suffering from the problem of food insecurity that has caused the death of people due to starvation. About 15.2% of the population is undernourished in India, 15% of children under five years are the prevalence of wasting (underweight as per height) and 38.8% children under five years is the prevalence of stunting.

Food energy intake at the household level is now given prominence in assessing food security. It has become common practice to estimate the number of food-insecure households by comparing their calorie intake with required norms. Attaining food security is a matter of prime importance for India where more than one-third of its population is estimated to be poor, and as many as one-half of its children have suffered from malnourishment over the last three decades. Both the supply side and demand side factors have their roles in the present condition of food security and undernourishment in India. Food security is thus a multi-dimensional concept and extends beyond the product availability, and demand for food.

One major indicator of food security is the level of undernourishment. This showed that 38.5% of children under five years were stunted and underweight in India. The level of food security is very low, and the level of hunger is very high in India. Even after the implementation of several National Nutrition Intervention Programmes, the prevalence of undernutrition, especially multiple micronutrient deficiencies continues to be of public health significance in India particularly in the states like Jharkhand, Odisha, and West Bengal, where the bulk of the tribal population live.

The problem of food security is addressed better if the production and consumption of localised crop suiting to geographical conditions are promoted. The challenge is providing food security for all, and localised self-sufficiency of localised production is the answer. Taking the concept forward, the home gardening calendar has been devised in a season based self-sustainable activities. Fresh vegetables are storehouses of micro-nutrient and their sufficient daily consumption could help to prevent micronutrient malnutrition and certain chronic diseases. Vegetables have all potential of providing a low-cost nutritional

supplement to ameliorate this situation and it is necessary to enhance the consumption of vegetables in a diversified form in the daily diets of the people.

Green leafy vegetables and fruits are an easily available source of micronutrients. This food can be grown in the backyard with little effort and cost. Even in lean seasons like summer, these can be grown using household wastewater. Home gardens can make an important contribution to food security as an additional food source or by supplying off-season production.

Tribal women have been actively engaged in economic activities. They have been participating in all the modes based on resource use in the long history of humankind, namely, the gathering (including shifting cultivation), settled cultivation and industry including construction and manufacturing. But the women especially the tribal women have not been able in making control over material assets, intellectual resource and ideology as yet in spite of constitutional provisions regarding raising their status-enhancing their quality of life, malnutrition, bringing about gender equality and gender justice.

Kinkini Dasgupta Misra
Vigyan Prasar

Vegetables For Homegarden

Crop name: Tomato


Scientific name: *Lycopersion esculentium* Mill.
Local name -
Jharkhand: Bilayati
Bihar: Tamaatar
Odisha: Bilati Baigana
West Bengal: Tomato
Assam: Bilahi
Season: Rabi/Kharif

Time of sowing	February –March, August-October
Varieties	Arka Rakshak, Arka Samrat, Swarn Vijaya, Swarn Samriddhi, Swarn Anmol, Kashi Amrit, Kashi Vishesh, Kashi Abhiman, Kashi Abhay, Pusa Ruby, Pusa Sadabahar, Arka Abha, Swarna Lalima, Swarna Sampada, Swarna Naveen, Swarna Baibhav-6, Castle Rock, Pusa Gaurav, TH802, TH1, Rupali F1, Arth 3, Arka Vikash, Pujab Chhuhara, Pujab Upma,, Castle Rock, etc.
Appropriate land	Upland, medium land
Appropriate soil	Sandy loam
Botanical properties	Typically grow as 1-3 m tall, with a weak woody stem that usually scrambles over other plants. The fruit is brightly colored (usually red, from the pigment lycopene) berry, 1-2 cm diameter in wild plants, commonly much larger in cultivated forms.
Edible parts	Fruit

Nutritional values (100 g)	Protein (g)	Fat (g)	Total Minerals (g)	Crude fibre (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)
	1.9	0.1	0.6	0.7	20	36	1.8

Seed rate	400-500 g/hectare (Open pollinated var.), 200g/ha. For hybrids
Nutrient management	20-25 tones of FYM, 100 kg nitrogen, 60 kg phosphorus, 60 kg potash/hectare for OP varieties and for hybrids 200:100:80 kg/ha. May vary based on soil nutrient status.
Water management	3-4 day intervals during summer and 10-12 day intervals during winter
Integrated pest management	**Fruit borer** – Plant 40 day old African tall marigold seedlings and 25 day old tomato seedlings in a planting pattern of 16 tomato rows alternate with one row of marigold. Spray with Thiodicarb 75% WP (1g/liter water) or Flubendiamide 480S.C. (0.25ml/liter water) or Chlorfluazuron 5% EC (1g/5liter water). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 10-15 days or neem seed kernel extract (4%) or Trizophos (0.05%) once in 3 week or Thiamethoxam 25 WG (1g/3lt water). **White flies** – Spray Thiamethoxam 25 WG (1g/3lt water) or fish oil rosin soap or Imidacloprid17.8 SL (0.5ml/lt.). Soak 100 g fish oil rosin soap in 5 l of hot water (80-90^{o}C) for 4 hr to dissolve. Dilute to 100 litres and spray. **Mite** – Spray Dicofol or Ethion (0.05%) or neem oil (1%) or Spiromesifen 240 S.C. (1ml/lt.) or Propargit 57% EC (1ml/lt.). **Mealy bugs** – Spray fish oil rosin soap. Soak 100 g of the soap in 10 l of hot water (80-90^{o}C) for 4 hr to dissolve then dilute to 50 litres and spray or Thiamethoxam 25 WG (1g/3lt water) or Acephate 75% SP (1g/ water). **Leaf eating caterpillar** – Large larvae should be controlled by hand picking and killing. Spray neem seed kernel extract (4%) or Thiodicarb 75% WP (1g/liter water) or Flubendiamide 480S.C. (0.25ml/liter water) or Chlorfluazuron 5% EC (1g/5liter water). **Thrips** – Spray neem formulations (2-3 ml/l) or apply neem cake to soil while planting (spot application, 500 kg/ha) or Fipronil 5% SC (1ml/liter). **Jassid** – Spray Imidacloprid 17.8 % SL (1ml/2liter water).
Integrated diseases management	**Damping Off** – Solarization of seed bed. Treat seed beds with Formalin @ 5 l/100 l water, 15-20 days before sowing. Sow the seed only after the soil becomes free from fumes/vapours. Mix 1kg *Trichoderma viride* with 25 kg compost to be used for seed bed preparation. Drench nursery beds with Copper oxychloride 50% WP (3g/lt water).

	Root rot – Drench nursery beds with Copper oxychloride 50% WP (3g/lt water). **Alternaria blight** – Treat seed with Thiram 75 WP 2.5 g/kg. Spray Hexaconazole 5%EC (2ml/liter) or Copper oxychloride (0.3%) or Mancozeb at 8-10 days intervals. **Septoria leaf blight** – Treat seed with Thiram 75 WP 2.53 g/kg. Hexaconazole 5%EC (2ml/liter) or Copper oxychloride (0.3%) or Mancozeb at 8-10 days intervals. **Bacterial wilt** – Choose resistant varieties e.g. Swarna Sampada, Arka Rakshak, Swarna Vijaya etc. Follow crop rotation by including cereals and crucifers. Drenching with Streptocycline 9% + Tetracycline Hydrochloride 1% SP (1g/6liter warer). **Late blight** – Spray Propineb 61.25% + Iprovalicarb 5.5% WP (2.5g/liter) or Mancozeb 50%+ Fenamidone 10%WG (2.5g/liter). **Bacterial canker** – Use disease-free seed and seedlings. Remove diseased plants and destroy them. Follow 3 year crop rotation in infested fields by including non-host crops. Spray Streptocycline 9% + Tetracycline Hydrochloride 1% SP (1g/6liter warer). **Leaf curl** – Grow nursery under insect proof net. Sow sorghum, pearl millet or maize as border crop at least 60 days before transplanting. Foliar application of Thiamethoxam 25 WG (1g/3lt water) or fish oil rosin soap or Imidacloprid17.8 SL (0.5ml/lt.). Use gray or black polythene mulches or straw mulching, yellow sticky traps and remove infected plants and weeds.
Harvesting	Mature green, turning stage, pink stage and red ripe stage. First picking 60-70 days after transplanting
Value addition scope	Sauce, puree, catch-up, juice, etc.

Crop name: Egg Plant (Brinjal)

Scientific name: *Solanum melongena* L.
Local name -
Jharkhand: Bhanta
Bihar: Baigan
Odisha: Baigana
West Bengal: Bengun
Assam: Bengena
Season: Rabi/Kharif/Autumn

Time of sowing	June-July, Nov.- Dec., March-April						
Varieties	Pusa Purple Round, Pusa Purple Cluster, Swarna Pratibha, Swarna Shyamali, Swarna Mani, Swarna Ajay, Pusa Hybrid 6, Punjab Barsati, Punjab Sada Bahar, Kashi Sandesh, Kashi Komal, Kashi Prakash, Kashi Taru etc.						
Appropriate land	Upland, medium land						
Appropriate soil	Loam, sandy loam						
Botanical properties	Fruit colour varies from pure white to purple, black, green and varieted in different shades. Fruit shape varies from long to oval, oblong and round.						
Edible parts	Fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.4	0.3	0.3	1.3	18	47	0.38
Seed rate	Open pollinated varieties- 375-500 g/hectare, Hybrid- 200g/hectare						
Nutrient management	25-30 tones of FYM, 165 kg nitrogen, 90 kg phosphorus, 90 kg potash/hectare						

Water management	4-6 day intervals in summer and 10-14 day intervals in winter
Integrated pest management	**Jassid** – Use simple water with power sprayer to wash off the insect. Spray Imidacloprid 17.8 % SL (1ml/2liter water). **Shoot and fruit borer** – Spray with Emamectin benzoate 5%SG (0.5g/liter water) or Thiodicarb 75% WP (1g/liter water) or Flubendiamide 480S.C. (0.25ml/liter water) or Chlorfluazuron 5% EC (1g/5liter water) or Chlorantraniliprole 18.5%SC (1ml/5liter water). **Mites** – Spray crop with wettable sulfur @ 2.5-3 g /l of water or dicofol @ 2.5 ml of water or Spiromesipfen 240SC (1ml/liter water). **Root knot nematodes** – Before transplanting, dip roots of seedlings in 20% EC Chlorpyrifos (5ml/liter) solution for 15mis. Small-scale planting or nursery beds can be treated with carbofuran @ 10 g/sq. meter. Field application with carbofuran (6kg/ha). **Mealy bug** – Spray fish oil rosin soap. For this soak 100 g/5 l of hot water (80-90oC) for 4 hr and dissolve. Dilute to 50 l and spray (2 kg/ha). Spray Acephate 75%SP (1.5g/liter). **Aphids** – Spray Imidacloprid 17.8 % SL (1ml/2liter water). **Leafhopper** – Apply Buprofezin 25%EC (1.5ml/liter). **Red cotton bug** – Apply Monocrotophos, Phosphamidon, Dimethoate, Methyl demeton @ 0.05%, if serious incidence. **Thrips** – Spray neem formulations (2-3 ml/l) or apply neem cake to soil while planting (spot application, 500 kg/ha) or Fipronil 5% SC (1ml/liter). **Epilachna beetle** – Spray the crop with Quinalphos 25 EC (2-3 ml/l) or Hostathion 40 EC (triazophos) @1.25 l or Sumicidin 20 EC (fenvelrate) @ 250 ml or Decis 2.8 EC (deltamethrin) @ 400 ml/hectare in 250-300 l of water. **Termites** – Drench soil with Chlorpyriphos (0.1%) or Bifenthrin 10% EC (1ml/liter). **Mites** – Spray Dicofol or Ethion (0.05%) or neem oil (1%) or Spiromesifen 240 S.C. (1ml/lt.) or Propargit 57% EC (1ml/lt.).
Integrated diseases management	**Damping off** – Avoid sowing nursery in the affected soils and ensure proper drainage conditions in the field. Solarization of seed bed. Treat seed beds with Formalin @ 5 l/100 l water, 15-20 days before sowing. Sow the seed only after the soil becomes free from fumes/vapours. Mix 1kg *Trichoderma viride* with 25 kg compost to be used for seed bed preparation. Drench

	nursery beds with Copper oxychloride 50% WP (3g/lt water). **Phomopsis blight** – Treat the seed with Thiram or Captan @ 2 g/kg. Destroy diseased plants and fruits. Spray crop with Dithane Z-78 or Cuman-L@ 0.2%. Repeat the spray at 7-10 day intervals. Spray Tebuconazole 50%+ Trifloxystrobin 25% WG (1g/lit). **Fusarium wilt** – Soil and foliar application of Benlate @ 0.1% or Copper oxychloride 50% WP (3g/lt water) to reduce the incidence of wilt. **Leaf spot** – Spray crop with Propineb 70% WP (2g/liter water) or Bavistin @ 0.1%. **Little leaf** – Keep jassid under check both in nursery and field. 10-50 ppm of tetracycline antibiotics or 50-100 ppm of chloremphenical prolong the incubation period and reduce the extent of sproting of auxiliary buds. Dip seedlings in 0.2% Carbofuran (75% WP) for 24 hr.
Harvesting	First picking 70-85 days after planting
Value addition scope	Pickles and dehydrated products

Crop name: Chilli


Scientific name: *Capsicum annuum* L.
Local name –
Jharkhand: Mircha
Bihar: Marcha
Odisha: Lankamaricha
West Bengal: Lanka
Assam: Jolokiya
Season: Kharif

Time of sowing	Feb.-March, September- October
Varieties	Swarn Prafullya, Arka Meghana, Arka Harita, Arka Lohit, Arka Ashish, Jawahar Mirch, Pusa Jwala, Pusa Sadabahar, Chamtkar, Aparna, Kashi Anmol, Kashi Surkh,
Appropriate land	Upland, medium land
Appropriate soil	Loam, slit loam, sandy and heavy clay
Botanical properties	Fruits are green to dull orange-red in colour, oblong-conical in shape, obtuse at the apex; two-celled varying from 12-75 mm in length and up to 7 mm wide at the centre. Sometimes attached to a five toothed, inferior calyx and a straight slender pedicel up to 2-3 cm long and tastes pungent.
Edible parts	Fruit

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.9	0.6	1.0	6.8	30	80	4.4

Seed rate	1-2 kg/hectare

Nutrient management	20 tones of FYM,125kg nitrogen, 75kg phosphorus, 30 kg potash/hectare
Water management	7-15 day intervals
Integrated pest management	**Thrips** – Spray neem formulations (2-3 ml/l) or apply neem cake to soil while planting (spot application, 500 kg/ha) or Fipronil 5% SC (1ml/liter). **Mites** – Spray crop with wettable sulfur @ 2.5-3 g /l of water or dicofol @ 2.5 ml of water or Spiromesipfen 240SC (1ml/liter water). **Aphids** – Spray Imidacloprid 17.8 % SL (1ml/2liter water). **Fruit borer** – Spray with Thiodicarb 75% WP (1g/liter water) or Flubendiamide 480S.C. (0.25ml/liter water) or Chlorfluazuron 5% EC (1g/5liter water). **Cut worm** – Drench soil with Chlorpyriphos (0.1%). **White grub** – Apply neem cake (1000 kg/ha) and drench soil with Chlorpyriphos (0.1%).
Integrated diseases management	**Damping off** – As in Brinjal. **Fruit rot and leaf blight** –Treat seed with Mancozeb (0.3%). Pick the rotten fruits and destroy them. Spray Metalaxyl/Mancozeb (0.25%) just before the onset of monsoon and with Bordeaux mixture (1%) or Copper oxychloride (0.3%) at 8-10 days intervals or benomyl 50% WP @ 80 g in 240 l of water/acre or difenoconazole 25% EC @ 50 ml in 200 l of water/acre or propineb 70% WP @ 200 g in 200-300 l of water/acre or tebuconazole 25% WG @ 200-300 g in 200 l of water/acre. **Anthracnose or die back** – Obtain seed from diseases free fruits and treat with Thiram 75 WP (0.3%) or Mancozeb (0.2%). Pick the rotten fruits and destroy them. Spray crop with Copper oxychloride (0.3%) or Mancozeb (0.25%) or captan 70% + hexaconazole 5% WP @ 200-400 g in 200 l of water/acre at fortnightly intervals. collect debris of the diseased plants and burn. **Mosaic** – Grow disease tolerant varieties. For vector control- Seed treatment with imidacloprid 70% WS @ 10 g/kg of seed. Spray fipronil 5% SC @ 320-400 ml in 200 l of water/acre. Apply carbofuran @ 1.5 kg at the time of transplanting. 3-4 foliar sprays of Dimethoate at 10 day intervals. Use 5-6 rows of border crops like sorghum or pearlmillet or maize. **Leaf curl virus** – Apply carbofuran @ 1.5 kg at the time of

	transplanting. For vector control- Seed treatment with imidacloprid 70% WS @ 10 g/kg of seed. 3-4 foliar sprays of Dimethoate at 10 day intervals. Use 5-6 rows of border crops like sorghum or pearlmillet or maize. **Spotted wilt** – Always transplant disease-free seedlings. Choose tolerant or resisitant varieties for cultivation. Follow 3 year crop rotation in infested fields by including cereals and crucifers. Drench Streptocycline 9% + Tetracycline Hydrochloride 1% SP (1g/6liter warer).
Harvesting	Green mature stage for vegetable purpose, red ripe stage for spices purpose, 55-60 days after planting
Value addition scope	Pickles, soups, sauces, dry powder, pungent oleoresin, colour oleoresin

Crop name: Cucumber


Scientific name: *Cucumis sativus* L.
Local name –
Jharkhand: Khira
Bihar: Khira
Odisha: Kakudi
West Bengal: Shosha
Assam: Tiyoh
Season: Rabi/Kharif/Summer

Time of sowing	Nov.-March, June-July, April-May						
Varieties	Swarn Ageti, Swarn Sheetal, Swarn Poorna, Poinsette, Pusa Uday, Himangi, Sheetal, Japanee Long Green, Straight Eight, Calypso F1, Balam Khira, Ajax, Stimora, Etc.						
Appropriate land	Upland with good organic matter						
Appropriate soil	Sandy, heavy clay, sandy loam, silt loam, clay loam						
Botanical properties	Fruit shape varies from flat, round, oval, oblong and long. Fruit colour varies from green to cream and flower colour is yellow.						
Edible parts	Fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.4	0.1	0.3	0.4	10	25	0.60
Seed rate	2.5-3 kg/hectare						
Nutrient management	15-20 tones of FYM, 100kg nitrogen, 75 kg phosphorus, 50 kg potash/hectare based on soil test.						

Water management	2.5-5 cm water/week
Integrated pest management	**Red beetle** – Deep summer ploughing exposes the grubs and pupae. Spray NSKE 5%. Apply trichlorfon 5% GR @ 200 g/acre or trichlorfon 5% DUST @ 200 g/acre. Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – As in tomato. **Fruit fly**- Collection and destruction of infested fruits. Slight raking of soil during fruiting time and after the harvest to expose pupae from the soil. Use methyl eugenol (0.1%) based trap. Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. Spray fipronil 5% SC @ 320-400 ml in 200 l of water/acre or imidacloprid 70% WS @ 1g/4 l of water. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – As in brinjal. **Mite** – As in brinjal. **Thrips** – As in Chilli **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management	**Bacterial wilt** – Choose resistant varieties and follow crop rotation. Removal and disposal of affected plant followed by drenching of Drenching with Streptocycline 9% + Tetracycline Hydrochloride 1% SP (1g/6liter warer). Check by controlling the striped cucumber beetle. **Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Chlorothalonil 75% SC 1g per l of water or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/ha, when vines are larger or spray Mancozeb 50% +Fenamidone10% WG 2.5g per l of water.

	Powdery mildew – Spraying with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance. **Angular leaf spot** – Soaking seeds for five minutes in 1:1000 mercuric chloride solutions, rinsing in water and drying. **Mosaic –** As Use barrier crops- sunflowers, sorghum and pearlmillet. **Green mottle mosaic** – Dry heat treatment of seeds for 3 days at 70^{o}C and soil fumigation with methyl bromide. **Phyllody** – Application of Carbofuran @ 1.5 kg/ha at the time of sowing followed by 5-6 foliar sprays of either Phosphamidon or Oxydemeton methyl (0.05%) at 10 day interval.
Harvesting	Bright green colour of about 10-20 cm 45 days after planting
Value addition scope	Pickles, juice, preserved in vinegar and acetic acid

Crop name: Bitter gourd

Scientific name: *Momordica charantia* L.
Local name –
Jharkhand: Kareli
Bihar: Karela
Odisha: Kalara
West Bengal: Korola
Assam: Tita Kerela
Season: Summer/ Kharif

Time of sowing	Jan.-March, June-July						
Varieties	Swarna Yamini, Pusa Domousmi, Pusa Vishesh, Kalyanpur Barahmansi, Coimbator Long, Ptiya, Arka Harit, Priyanka Punjab 14, Vk1priya, Coimbator Green, Phule Green, Pusa Hybrid 1, NS1024, etc.						
Appropriate land	Upland with good organic matter						
Appropriate soil	Sandy loam						
Botanical properties	Fruits vary in size, shape, colour and degree of bitterness. The dented ridges run along length of the fruit.						
Edible parts	Fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.6	0.2	0.8	0.8	20	70	0.61
Seed rate	4.5-6 kg/hectare						
Nutrient management	15-20 tones of FYM, 50-60 kg nitrogen, 24 kg phosphorus, 30 kg potash/hectare						

Water management	7-10 day intervals
Integrated pest management	**Red pumpkin beetle** – Deep summer ploughing exposes the grubs and pupae. Spray NSKE 5% or apply trichlorfon 5% GR @ 200 g/acre or trichlorfon 5% DUST @ 200 g/acre or spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – As in Tomato **Fruit fly** – As in cucumber **Blister beetle** – As in Cucumber. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – As in Brinjal. **Mite** – As in Brinjal **Thrips** – As in Brinjal. Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts and spray Lambda Cyhalothrin 5% EC @ 200ml in200-240 l of water/acre.
Integrated diseases management	**Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray zineb 75% WP @ 600-800 g in 300-400 l of water/acre or cymoxanil 8% + mancozeb 64% WP @ 600 g in 200-240 l of water/acre **Powdery mildew** – Spray carbendazim 50% WP @ 120 g in 240 l of water or benomyl 50% WP @ 80 g in 200 l of water/acre or thiophanate methyl 70% WP @ 572 g in 00-400 l of water/acre. **Mosaic** – Vector control by spraying imidacloprid 70% WG @ 14 g in 200 l of water/acre

	Cercospora leaf spot- Maintain good soil drainage and good aeration between vines. Spray zineb 75% WP @ 600-800 g in 300-400 l of water/acre.
Harvesting	Light green colour, thick, juicy, 10-15 days after fruit setting and 3 months after sowing
Value addition scope	Dehydrated, pickles, chips, medicines

Crop name: Ash gourd


Scientific name: *Benincasa hipida* (Thunb). cogn.
Local name –
Jharkhand: Bathua kohra
Bihar: Siskohra
Odisha: Pani Kakharu
West Bengal: Chal Kumro
Assam: Komora/ Lao Bishesh
Season: Summer/ Kharif

Time of sowing	Feb.-March, June-July						
Varieties	Kashi Dhawal, Kashi Ujwal, Kashi Surabhi, Pag 3, Co2, Apau Shakti, Indu, Co1, Co2, etc.						
Appropriate land	Upland with good organic matter						
Appropriate soil	Sandy loam, heavy clay						
Botanical properties	Fruit shape varies from spherical to elongate and the rind is covered with waxy coating.						
Edible parts	Fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.4	0.1	0.3	0.8	30	20	0.8
Seed rate	5-7 kg/hectare						
Nutrient management	15-20 tones of FYM, 50 kg nitrogen, 50 kg phosphorus, 50 kg potash/hectare						
Water management	7-9 day intervals						

Integrated pest management **(As in cucumber)**	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spray with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Full size, ripe, vines staret drying, 7-10 days after fruit setting and 100-120 days after sowing
Value addition scope	Sweets, baris, canned soup, dehydrated fruit slices, etc.

Crop name: Sponge Gourd


Scientific name: *Luffa cylindrical* L.
Local name –
Jharkhand: Gongra
Bihar: Ghia, Tori, Ram Toroi
Odisha: Janhi
West Bengal: Jhinga
Assam: Bhol
Season: Summer/ Kharif

Time of sowing	Feb-March, June-July
Varieties	Swarn Prabha, Kashi Divya, Rajendra Nenua-1, Kalyanpur Hari Chikani, PSG9, Pusa Chikni, Pusa Supriya, Pusa Sneha, MSGH1
Appropriate land	Upland with good organic matter contentcontentcontent
Appropriate soil	Sandy Loam, Loam, slit, clay soil
Botanical properties	Fruits are smooth, white fleshed, 20-50 cm long and cylindrical in shape. Female flowers are single where as male flowers appear in clusters.
Edible parts	Fruits, flower, leaves

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.2	0.2	0.5	2.0	36	19	1.1

Seed rate	2.5-3.5 kg/hectare
Nutrient management	10-15 tones of FYM, 20-30 kg nitrogen, 30-40 kg phosphorus, 30 kg potash/hectare

Water management	7-10 day intervals
Integrated pest management (As in Cucumber)	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in Cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spray with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Tender, bright green colour, 40-45 days after sowing
Value addition scope	Air filters, packaging materials, marine steam engine filters, insulation and stuffing for shoulder pads

Crop name: Summer squash


Scientific name: *Cucurbita pepo* L.
Local name –
Jharkhand: Vilayati kadoo
Bihar: Chappan kaddoo, Vilayati kadoo
Season: Kharif/ Summer

Time of sowing	June-July, End of Feb.
Varieties	Punjab Chpapan Kaddu-1, Pusa Alankar, Australian Green, Early Yellow Prolific, Hisar Selection-1
Appropriate land	Upland with good organic matter content
Appropriate soil	Sandy loam
Botanical properties	Bush type plants set fruits in close succession. Fruit are quick growing larger, round, sausage, elongated, dark green to green, yellow to white and variegated. Low in energy value.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.5	0.1			10		0.6

Seed rate	4-5 kg/hectare
Nutrient management	15-20 tones of FYM, 100 kg nitrogen, 75 kg phosphorus, 50 kg potash/hectare

Water management	2.5-3.0 cm/week
Integrated pest management (As in Cucumber)	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in Cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spray with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Bright green colour, presence of pubescence, 1 week after fruit settings and 50-60 days after sowing
Value addition scope	Pickle, roasted, baked, seeds are hashed

Crop name: Bottle gourd


Scientific name: *Lagenaria siceraria* (Molina) Stendl.
Local name –
Jharkhand: Kaddu, Laua
Bihar: Ghiya, lauki
Odisha: Lau
West Bengal: Laau
Assam: Lau
Season: Summer /Kharif

Time of sowing	Feb.-March, June-July
Varieties	Swarna Sneha, Kashi Ganga, Kashi Bahar, Narendra Rashmi, Pusa Sandesh, Arka bahar, Punjab Kamal, Punjab Long, Pusa Naveen, Pusa Summer Prolific Long, Arka Bahar, Kalyanpur Long Green, Ajad Nutan, Samrat, Pusa Hybrid 3, etc.
Appropriate land	Well drained
Appropriate soil	Organic matter rich sandy loam and clay soil with pH between 6-7.
Botanical properties	Fruit shape varies from flat to round, oval, oblong and long. The fruit colour varies from green to cream or yellow. The flesh is invariably white.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.2	0.1	0.5	0.6	20	10	0.46

Seed rate	4-5 kg/hectare
Nutrient management	15-20 tones of FYM, 60 kg nitrogen, 40 kg phosphorus, 40 kg potash/hectare

Water management	3-7 day intervals
Integrated pest management (As in cucumber)	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days or neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spraying with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Bright green colour, presence of pubescence, 60-70 days after sowing
Value addition scope	Pedda, barfi, soups, appetizer and dry fruits are used in making musical instruments like sitar, toombi, etc.

Crop name: Squash melon/ Round melon


Scientific name: *Citrullus lunatus var Fistulosusu Syn. Praecitrullus fitulosus* Pang
Local name –
Jharkhand: Tinda
Bihar: Tinda
Season: Summer/ Kharif

Time of sowing	Feb.-March, June –July
Varieties	S 48, Arka Tinda, Punjab Tinda, Tinda Ludian, Tinda Tonk
Appropriate land	Upland with good organic matter content
Appropriate soil	Sandy, sandy loam
Botanical properties	Fruits are small, tender, rough, spherical and 5-8 cm in diameter.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.4	0.2	0.5	1.0	25	24	0.9

Seed rate	3.5-5 kg/hectare
Nutrient management	15-20 tones of FYM, 50 kg nitrogen, 75 kg phosphorus, 50 kg potash/hectare
Water management	4-5 day intervals
Integrated pest management	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%).

	Serpentine leaf miner – Spray neem formulations (2-3 ml/l) once in 0-15 days or neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in Cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spray with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Shinning green, pubescent and tender, 1 week after fruit settings and 60-70 days after sowing
Value addition scope	Pickles, candy, roasted seeds

Crop name: Pumpkin


Scientific name: *Cucurbita moschata* Duchesne ex Poir
Local name –
Jharkhand: Kohra
Bihar: Kohdra, halwa kadoo, lal kaddoo
Odisha: Kakharu
West Bengal: Kumro
Assam: Ronga Lau
Season: Kharif/ Summer

Time of sowing	Jan.-March, June- July
Varieties	Swarn Amrit, Kashi Harit, Narendra Abhushan, PP113, Arka Chandan, Co1, Co2, Pusa Viswas, Ambili, Pusa Vikas, Pusa Hybrid 1, Pinjab Chappan Kaddu1, Arka Suryamukhi, S 107, Patty Pan, S 101, Early Yellow Prolific, Chaitali, Australian Green, Large Red, Barsathi, Pusa Alankar, Large Round, Green Hubbard, Red Flesh, Golden Hubbard, Ch14, Yellow Fesh, Butternut, etc.
Appropriate land	Well drained upland
Appropriate soil	Sandy loam, clay loam rich in organic matter content
Botanical properties	Fruits have hollow cavity, strong flavor and long self life. The skin colour is green when immature and brownish yellow when mature.
Edible parts	Fruits and leaves

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.4	0.1	0.6	0.7	10	30	0.7

Seed rate	1.5-2.5 kg/hectare

Nutrient management	15-20 tones of FYM, 100 kg nitrogen, 50 kg phosphorus, 50 kg potash/hectare
Water management	5-6 day intervals
Integrated pest management (As in Cucumber)	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in Cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds, and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger.

	Powdery mildew – Spraying with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance. **Mosaic** – Apply Carbofuran (1.5 kg/ha) at the time of sowing. Spray Phosphamidon (0.5%) at 10 day intervals. **yellow-vein mosaic** – Soil application of Carbofuran @ 1.5 kg/ha at the time of sowing followed by foliar application of Dimethoate or Phosphamidon (0.2%) at 10 day intervals. straw mulching and coloured polythene mulching are quite effective.
Harvesting	Green to Fully riped, vines start drying, 100-120 days after sowing
Value addition scope	Jam, jelly, barfi, sauces, roasted seeds, sweets, bari

Crop name: Long melon

Scientific name: *Cucumis melo var. utilissimus* (Roxb.)
Local name –
Jharkhand: Kakdi
Bihar: Kakdi
Season: Summer/ Kharif

Time of sowing	Feb.-March, June-July
Varieties	Punjab Long Melon1, Arka Sheetal etc.
Appropriate land	Well drained upland
Appropriate soil	Sandy loam, clay loam rich in organic matter content
Botanical properties	Fruits are slender, elongated, pale or dark green, smooth or ridged and pubescent.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.4	0.1	0.3	-	0.01	0.03	0.0015

Seed rate	0.5-1 kg/hectare
Nutrient management	15-20 tones of FYM, 100 kg nitrogen, 75 kg phosphorus, 50 kg potash/hectare
Water management	3-4 day intervals

Integrated pest management	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly** – Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in cucumber)	**Anthracnose** – Controlled by crop rotation, eradication of weeds and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spraying with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Tender, succulent with hairy growth, 60-70 days after sowing
Value addition scope	Pickles, moisturizer

Crop name: Snake gourd


Scientific name: *Trichosanthes cucumerina* L.
Local name –
Jharkhand: Chichinda
Bihar: Chichinda, Chachenda
West Bengal: Chichinga
Season: Summer/ Kharif

Time of sowing	Feb.-March, June-July
Varieties	Co1, Co2, Co4, TA19, APAU Swetha, PKM-1, Baby, Manusree, Konkan Sweta, etc.
Appropriate land	Well drained upland
Appropriate soil	Sandy loam, clay loam rich in organic matter content
Botanical properties	Fruits are narrow, cylindrical, 50-100cm long, light green with white strips, dark green with yellowish or pale green strips.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.5	0.3	0.5	0.8	26	20	1.51

Seed rate	4-5 kg/hectare
Nutrient management	15-20 tones of FYM, 75 kg nitrogen, 25 kg phosphorus, 25 kg potash/hectare
Water management	4-5 day intervals

Integrated pest management (As in cucumber)	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly**- Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in cucumber)	**Anthracnose** – Controlled by crop rotation, eradication of weeds and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spraying with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting Value addition scope	Green and tender, 20-25 days after fruit setting and 75-80 days after sowing Roasted seeds, canned

Crop name: Pointed gourd


Scientific name: *Tichosanthes dioica* Roxb.
Local name –
Jharkhand: Patal
Bihar: Parwal, Padwal, Chichinga
Odisha: Patol
West Bengal: Patol
Assam: Patol
Season: Rabi/Kharif

Time of sowing	Sowing June to August and transplanting in October-November
Varieties	Swarn Suruchi, Kashi Sufal, FP1, FP3, FP4, Swarna Rekha, Swarna Alaukik, Dandali, Kalyani, Guli, Bihar Sarif, Sopari Safed, Naria, Shankolia, Ches Elite Line, CHES Hybrid 1, CHES Hybrid 2, Chotta Hilli, Hilli, Rajendra Parwal 2, Shankolia, etc.
Appropriate land	Uplands, diara lands (River bank)
Appropriate soil	Sandy loam soil with good organic matter content
Botanical properties	Fruit shape may vary from round to long of 5-15 cm in green colour with or without strips and tapering towards ends.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.0	0.3	0.5	3.0	30	40	1.7

Seed rate	3-5 kg/hectare or 6000-7500 cuttings/ hectare
Nutrient management	20-25 tones of FYM, 60-80 kg nitrogen, 40 kg phosphorus, 40-50 kg potash/hectare
Water management	At 10-12 day intervals

Integrated pest management (As in cucumber)	**Red beetle** – Spray Carbaryl (0.2%) or Quinalphos or Chlorpyriphos (0.05%). **Serpentine leaf miner** – Spray neem formulations (2-3 ml/l) once in 0-15 days. Apply neem seed kernel extract (4%) or Trizophos (0.05%) once in a week. **Fruit fly-** Foliar spray of Fenthion (0.05%) with 5% jiggery at fruit formation/ripening stage. **Blister beetle** – Collect and destroy flying adults. **Stink Bug** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Aphids** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Mite** – Spray Dimethoate or Ethion (0.05%) or wettable sulphur (0.2%). **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or apply neem cake (500 kg/ha) while sowing. **Plume moth** – Hand picking is the best method of control. **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) one time. **Stem gall fly** – Destroy affected parts or spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in cucumber)	**Anthracnose** – Control by crop rotation, eradication of weeds and seed treatment with a corrosive sublimate solution of 2.5 ml in 35-40 l of water for 5 min. spraying and dusting with an insoluble copper compound. Spray Mancozeb or Hexacap (0.25%) or Carbendazim (0.1%) at 15 days intervals. **Downy mildew** – Removal of badly infected leaves followed by chemical spraying prevents spread of the diseases. Spray Mancozeb at 8-10 days intervals. Dusting with tribasic sulphate (5% copper content) at 20-25 kg/hectare early in the season, 45-60 kg/hectare when vines are larger. **Powdery mildew** – Spray with Karathane and Morestan, Benlate, Bavistin at 30-50 kg/hec. Spray Dinocap (0.1%) or Wettable sulphur (0.2%) or Calixin (0.05%) 2-3 times at 10 days intervals after diseases appearance.
Harvesting	Green, tender, 10-15 days after fruit settings and 80-90 days after planting
Value addition scope	Sweets, soups, pickles

Crop name: Cauliflower


Scientific name: *Brassica oleracea var. botrytis* L.
Local name –
Jharkhand: Phul kovi
Bihar: Kovi
Odisha: Phul Kobi
West Bengal: Fulkopi
Assam: Phul-Kobi
Season: Rabi/Kharif

Time of sowing	May-June, Aug.-Sept., Sept.-Oct.,
Varieties	Sabour Agrim, Kashi Kwari, Early Kanwari, Pant Gobi 2, Pant Gobi 3, Pusa Deepali, Arka Kranti, Pusa Sharad, Pant Gobi 4, Pusa Synthetic, Pant Shubhra, Pusa Shubhra, Pusa Himjyoti, Punjab Giant 26, Pusa Snowball1, Pusa Snowball K1, Snowball 16, Kunwari, Early Patna, Aghami, Poori, Patna Main Crop, Dania, Pusa Himjyoti,Pusa Kartik Sankar, Pusa Hybrid-2 etc.
Appropriate land	Well drained upland to medium land
Appropriate soil	Sandy Loam to loam soil with high organic matter content
Botanical properties	The stems are short or thicken. Leaves are large, oblong. The dibble part is hypocotyls branches or pre-floral fleshy epical meristem.
Edible parts	Curd or head, leaves

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.6	0.4	1.0	1.2	33	57	1.23

Seed rate	600-750 g seed/hectare (early crop) 350-400 g seed/hectare (late crop)

Nutrient management	20-25 tones of FYM, 120 kg nitrogen, 60 kg phosphorus, 50-60 kg potash/hectare
Water management	7-10 days interwal
Integrated pest management	**Diamond back moth** – Use Indian mustard as trap crop and apply neem seed kernel extract to manage. Sow 2 rows of mustard for every 25 rows, plant the first row 12 days before transplanting and the second row 25 days after transplanting. 2-3 additional sprays of neem seed kernel extract (4%) at 10-15 days intervals is required. Spray flubendiamide 20% WG @ 15 g in 150 l of water/acre or lufenuron 5.4% EC @ 240 g in 200 l of water/acre or spinosad 2.5% SC @ 240–280 in 200 l of water/acre or indoxacarb 15.8% EC @ 106.4 ml in 200–400 l of water/acre or emamectin benzoate 5% SG @ 60- 80 g in 200 l of water/acre or fipronil 5% SC @ 320–400 ml in 200 l of water/acre. (last spray should be 15 days before harvesting). **Leaf webber** – Remove and destroy the webbed leaves with caterpillars within. Set up light traps @ 1/acre. Use Indian mustard as trap crop and apply neem seed kernel extract at 10 day intervals. Spray Imidachloprid 17.8% SL @0.5ml per liter water. **Aphids** – Install yellow sticky traps, yellow water pan traps @ 12/acre to monitor alates (winged adult). Foliar spray with dimethoate 30% EC @ 264 ml in 200-400 l of water/acre or fenvalerate 20% EC @ 120-150 ml in 240300 l of water/acre or phosalone 35% EC @ 571 ml in 200-400 l of water/acre or acetamiprid 20 % SP @ 300 ml in 200-240 l of water/acre. **Stem borer** – Thick foliage of mustard is required. Malathion 50 EC @ 600 ml in 200-400 l of water/acre. **Tobacco caterpillar** – Setting up light traps for adults @ 1/acre. Erecting of bird perches for encouraging predatory birds such as mynah, drongo etc. Spray NSKE 5% against eggs and first instar larvae. Spray NPV @ 40LE/ac in combination with jaggery 1 kg, sandovit 100 ml or Robin Blue 50 g thrice at 10-15 days interval on observing the eggs or first instar larvae in the evening hours. Spray trichlorfon 5% GR @ 300 g/acre or thiodicarb 5% GR @ 300g/acre or chlorfluazuron 5.4% EC @ 600 ml in 200 l of water/acre. **Mustard saw-fly** – Spray contact insecticides like Quinalphos or Chlorpyriphos (0.05%). **Striped-flea beetle** – Spray contact insecticides like Trizophos Quinalphos or Chlorpyriphos (0.05%). **Painted bug** – Apply single spot application of Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases	**Brown/red rot disease** – Apply borax@10.0-15.0/hectare.

management	**Whiptail** - improves soil pH to 6.5 by liming. Apply sodium or ammonium molybdate @ 1 kg/hectare. **Club root** – Long rotations of cops without any cruciferous crops. A pH slightly above neutral (usually about pH 7.2) helps to minimize disease. Add hydrated lime to soil to increase pH to 7.2 (6 weeks before planting @ 1.5 t/ac). Avoid excess irrigation. **Phoma lingam** – Hot water treatment at 50^{o}C for 25-30 minutes. **Damping off** – Treat nursery bed with Formalin (5 l/100 l of water) at least 20 days prior to sowing. Sow hot water treated seeds. Use raised beds: more than 15cm height is better for water drainage or use pro trays for raising seedlings. Treat the seed with Carbendazim (0.2%) before sowing. Drench the nursery beds with a mixture of Mancozeb (0.25%) Carbendazim (0.05%). **Black rot** – Treat the seed by soaking in tap water for 30 min. followed by hot water dip at 52^{o}C for 30 min. and finally dip in streptocycline solution (1 g/10 l of water) for the same duration. Dry in shade. Give a spray of streptocycline (10 g/100 l of water) at curd stage. **Curd rot** – Give a spray of Mancozeb (0.25%) streptocycline (0.1%) to curds before likelihood of frost. repeat twice at 8-10 day intervals. Remove the small rotten areas on curds with knife and spray Bordeaux mixture (4:4:50) or Copper oxychloride (0.3%). **Stalk rot** – Spray the crop with a mixture of Carbendazim (0.05%) and Mancozeb (0.25%) from the curd initiation to pod setting stage at 10-15 days intervals. **Downy mildew** – Give hot water treatment to seed or dress with Thiram (0.03%). Remove the diseased portions of curd and aplly Copper oxychloride (0.3%) to the cut surface. Spray the crop with Mancozeb (0.2%) at 10-15 days intervals.first spray given on the appearance of symptoms. Follow crop rotation and sanitation practices. **White rust or white blisters** – Spray Copper oxychloride (0.3%) or Bordeaux mixture (0.8%) on the appearance of symptoms and repeat at 10-15 days intervals, if necessary. Ploughing under and destruction of diseased crop debris helps in the reduction of inoculums. **Alternaria leaf spot** - Spray zineb 75% WP @ 600-800 g in 300-400 l of water/acre or mancozeb 75% WP @ 600-800 g in 300 l of water/acre
Harvesting	Curd about 15 cm in dm and compact, 45-100 days after transplanting
Value addition scope	Dried, canned, fried, pickles

Crop name: Cabbage


Scientific name: *Brassica oleracea var. capitata* L.
Local name –
Jharkhand: Bandgovi
Bihar: Pattagobhi
Odisha: Patrakobi
West Bengal: Bandha Kopee
Assam: Bandhakobi
Season: Rabi/ Post Kharif

Time of sowing	August – November
Varieties	Golden Acre, Pusa Ageti, Pusa Mukta, Pride Of India, Drumhead Early, Pusa Drumhead **Hybrid Cultivars-** KGMR-1, Quisto, Kranti Bajrang F1, Swarna, Sri Ganesh Gol, Copenhagrn Market, Drumhead Savoy, Red Cabbage, Mammoth Rock Red, Express, Jersy Wakefield, Chieftain, etc.
Appropriate land	Well drained upland to medium land
Appropriate soil	Sandy Loam to loam soil with high organic matter content
Botanical properties	Herbaceous annual, Glabrous erect stem, Upper leaves sessile those on base much more fleshy, petiolated and with lobules .
Edible parts	Fruits, leaves, heads

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.8	0.1	0.6	1.0	39	44	0.8

Seed rate	400-500 g/hectare

Nutrient management	200-250 quintals of FYM, 150 kg nitrogen, 75 kg phosphorus, 75 kg potash/hectare
Water management	10-15 day intervals
Integrated pest management (As in cauliflower)	**Cabbage maggot** – Dusting of water suspension of Calomel or Aldrin or Dieldrin. **Green cabbage worm and cabbage looper** – Spray DDT or Malathion 2-3 weeks prior to harvesting and apply Pyrethrum when curds formed. **Cabbage alphids** – Spray Malathion or Parathion but if the curd is ready to harvest, nicotine sulphide is used. Apply Phosphamidon (0.05%) and neem seed kernel extract (4%) or Oxydemeton methyl (0.02%). **Diamond back moth** – Use Indian mustard as trap crop and apply neem seed kernel extract to manage. Sow 2 rows of mustard for every 25 rows. 2-3 additional sprays of neem seed kernel extract (4%) at 10-15 days intervals is required. **Leaf webber** – Use Indian mustard as trap crop and apply neem seed kernel extract at 10 day intervals. **Stem borer** – Thick foliage of mustard is required. **Gram caterpillar** – Spray Dichlorvos (0.1%). Use a sharp thick iron needle to pick the larvae boring the head. **Tobacco caterpillar** – Spray neem kernel extract (4%) in the early stage of the larvae. Use a sharp thick iron needle to pick the larvae boring the head. **Mustard saw-fly** – Spray contact insecticides like Quinalphos or Chlorpyriphos (0.05%). **Striped-flea beetle** - Spray contact insecticides like Quinalphos or Chlorpyriphos (0.05%). **Painted bug** – Apply single spot application of Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%).
Integrated diseases management (As in cauliflower)	**Black leg** – Crop rotation, seed treatment with hot water. **Yellows** – Clean seed beds and growing resistant varieties. **Damping off** – Treat nursery bed with Formalin (5 l/100 l of water) at least 20 days prior to sowing. Sow hot water treated seeds. Treat the seed with Carbendazim (0.2%) before sowing. Drench the nursery beds with a mixture of Mancozeb (0.25%) Carbendazim (0.05%).

	Black rot – Treat the seed by soaking in tap water for 30 min. followed by hot water dip at 52oC for 30 min. and finally dip in streptocycline solution (1 g/10 l of water) for the same duration. Dry in shade. Give a spray of streptocycline (10 g/100 l of water) at curd stage. **Curd rot** – Give a spray of Mancozeb (0.25%) streptocycline (0.1%) to curds before likelihood of frost. repeat twice at 8-10 day intervals. Remove the small rotten areas on curds with knife and spray Bordeaux mixture (4:4:50) or Copper oxychloride (0.3%). **Stalk rot** – Spray the crop with a mixture of Carbendazim (0.05%) and Mancozeb (0.25%) from the curd initiation to pod setting stage at 10-15 days intervals. **Downy mildew** – Give hot water treatment to seed or dress with Thiram (0.03%). Remove the diseased portions of curd and aplly Copper oxychloride (0.3%) to the cut surface. Spray the crop with Mancozeb (0.2%) at 10-15 days intervals.first spray given on the appearance of symptoms. Follow crop rotation and sanitation practices. **White rust or white blisters** – Spray Copper oxychloride (0.3%) or Bordeaux mixture (0.8%) on the appearance of symptoms and repeat at 10-15 days intervals, if necessary. Ploughing under and destruction of diseased crop debris helps in the reduction of inoculums.
Harvesting	Large heads, stem ¼-1/2 inch long, 70-80 days after transplanting
Value addition scope	Dried, pickles, canned

Crop name: Sprouting broccoli


Scientific name: *Brassica oleracea var. italic* L.
Local name –
Jharkhand: Broccoli
Bihar: Hari gobi, Broccoli
Odisha: Sabuja kobi
West Bengal: Broccoli
Assam: Broccoli
Season: Rabi

Time of sowing	September – October
Varieties	Pusa Broccoli, Kt.Sel. 1, Palam Samridhi, Palam Kanchan, Punjab Broccoli No. 1, Bronzine, Calabrese, Green Comet, Green Duock, Premium Crop, Green Globe, Grusendar
Appropriate land	Well drained upland to medium land
Appropriate soil	Sandy Loam to loam soil with high organic matter content
Botanical properties	Main head is produced on a fleshy, branching, elongated stem. Longer, more slender and small heads appear in the axils of leaves.
Edible parts	Flower buds, heads and fleshy stems

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg**
	3.6	0.3	-	-	103	78	1.1

Seed rate	500 g/hectare
Nutrient management	20 tones of FYM, 125 kg nitrogen, 65 kg phosphorus, 65 kg potash/hectare
Water management	10-15 day intervals

Integrated pest management (As in cabbage)	**Cabbage maggot** – Dusting of water suspension of Calomel or Aldrin or Dieldrin. **Green cabbage worm and cabbage looper** – Spray DDT or Malathion 2-3 weeks prior to harvesting and apply Pyrethrum when curds formed. **Aphids** – Spray Malathion or Parathion but if the curd is ready to harvest, nicotine sulphide is used. Apply Phosphamidon (0.05%) and neem seed kernel extract (4%) or Oxydemeton methyl (0.02%). **Diamond back moth** – Use Indian mustard as trap crop and apply neem seed kernel extract to manage. Sow 2 rows of mustard for every 25 rows. 2-3 additional sprays of neem seed kernel extract (4%) at 10-15 days intervals is required. **Thrip** – Spray crop with Malathion 50EC @ 625 ml/hectare in 200 l of water. Spray Monocrotophos, Phosphamidon, Dimethoate and Methyl demeton (0.05%) or neem formulations (2-3 ml/l).
Integrated diseases management (As in cabbage)	**Clubroot –** Add lime annually to affected soils below pH 7.2. Provide good drainage. Minimize the spread of the pathogen by using pathogen-free transplants. Avoid planting plants where other infested plants in the mustard family have grown, such as broccoli and cabbage. **Damping off** – Treat nursery bed with Formalin (5 l/100 l of water) at least 20 days prior to sowing. Sow hot water treated seeds. Treat the seed with Carbendazim (0.2%) before sowing. Drench the nursery beds with a mixture of Mancozeb (0.25%) Carbendazim (0.05%). **Black soft rot** – Treat the seed by soaking in tap water for 30 min. followed by hot water dip at 52oC for 30 min. and finally dip in streptocycline solution (1 g/10 l of water) for the same duration. Dry in shade. Give a spray of streptocycline (10 g/100 l of water) at curd stage. **Downy mildew** – Give hot water treatment to seed or dress with Thiram (0.03%). Remove the diseased portions of curd and aplly Copper oxychloride (0.3%) to the cut surface. Spray the crop with Mancozeb (0.2%) at 10-15 days intervals.first spray given on the appearance of symptoms. Follow crop rotation and sanitation practices.
Harvesting	Mature heads called curd harvested before sprouting, bud clusters green and compact, 55-75 days after transplanting
Value addition scope	Sauces, dried, canned

Crop name: Onion


Scientific name: *Allium cepa* L.
Local name –
Jharkhand: Pyaj
Bihar: Pyaj
Odisha: Piaja
West Bengal: Pyajj
Assam: Piyaz
Season: Rabi/Kharif

Time of sowing	Nov.-Dec., June
Varieties	Bheema Super, Bheema Dark Red, Pusa Red, Pusa Ratnar, N 53, Arka Niketan, Arka Kalian, Agrifound Dark Red, Agrifound Light Red, Punjab Naroya, Punjab Red Round, Pro 6, Pusa Madhvi, Arka Bindu, Arka Pragathi, Arka Kirthiman F1, Pusa White Flat, etc.
Appropriate land	Well drained upland to medium land
Appropriate soil	Sandy Loam to loam soil with high organic matter content
Botanical properties	Bulb is fleshy, enlarged leaf bases or scales. Inflorescences in the form of umbely with numerous small flowers, a single spathe which splits into segments and ovary above the six stamens and the petals.
Edible parts	Fruits, bulb

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.2	0.1	0.4	0.6	46.9	50	0.60

Seed rate	450-500 kg/hectare

Nutrient management	20 tones of FYM, 100 kg nitrogen, 60 kg phosphorus, 60 kg potash/hectare
Water management	8- 10 day intervals
Integrated pest management	**Onion maggots** – Avoid close spacing while planting. Spray Thiamethoxam 25 WG (1g/3lt water) or fish oil rosin soap or Imidacloprid17.8 SL (0.5ml/lt.). **Thrip** – Spray dimethoate 30% EC @ 264 ml in 200-400 l of water/ acre or oxydemeton methyl 25% EC @ 480 ml in 200-400 l of water/ acre or quinalphos 25% EC @ 480 ml in 200-400 l of water/acre or lambda cyhalothrin 5% EC @ 120 ml in 120-160 l of water/acre. **Mite** – Avoid planting onion after cole crops, as decaying cole crops, especially caulifl ower, may harbour very high bulb mite populations in the field. Chemical control as in brinjal. **Onion fly** – Apply Carbofuran/Phorate (0.5 kg/ha) or neem cake (500 kg/ha) to the soil while sowing. **Cut worm** – Apply Chlorpyriphos (0.1%) to the soil. **Groundnut earwig -** Apply Chlorpyriphos (0.1%) to the soil.
Integrated diseases management	**Purple blotch**- Spray difenaconazole 25% EC @ 1 ml in 5 l of water or kitazin 48% EC @ 1 ml / l of water. **Blight** – Apply 1% Boradeaux mixture or Mancozeb (Dithane M 45) @ 2-5 g/l of water or Copper oxychloride (Blitox 50) @ 5.0 g/l of water or zineb 75% WP @ 2.5-3 g/ l of water. **Onion smut** – Treat seed with Arasan or Tersan. **Downy Mildew** – Apply Bordeaux mixture and cotton seed oil or Cupros oxide and Rosin soap. Spray zineb 75% WP @ 2.5-3 g/ l of water.
Harvesting	4-5 months after planting when leaves start drying
Value addition scope	Dehydration, sauces, powder, etc.

Crop name: Garlic


Scientific name: *Allium sativum* L.
Local name –
Jharkhand: Lahsun
Bihar: Lahsun
Odisha: Rasuna
West Bengal: Rasuna
Assam: Nohoru
Season: Rabi/Kharif

Time of sowing	Oct.-Nov., Aug.-Oct., Mar.-Apr.						
Varieties	Punjab Garlic, Agrifound White (G-41), G-50, Yamuna Safed, Agrifound Parvati, Favori, Rajalle Gaddi, etc.						
Appropriate land	Well drained upland to medium land						
Appropriate soil	Sandy loam, clay loam						
Botanical properties	Bulb having group of small segments or cloves surrounded by a thin white or pinkish seath. Leaves have thin solid blades.						
Edible parts	Leaves, cloves						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	6.3	0.1	1.0	0.8	30	310	1.2
Seed rate	500-600 kg/hectare						
Nutrient management	20 tones of FYM, 65 kg nitrogen, 65 kg phosphorus, 50 kg potash/hectare						

Water management	10-12 irrigation at 10-15 day intervals
Integrated pest management	**Thrip** – Spray crop with Malathion 50EC @ 625 ml/hectare in 200 l of water. Spray Monocrotophos, Phosphamidon, Dimethoate and Methyl demeton (0.05%) or neem formulations (2-3 ml/l). **Onion maggots** – Apply Thimet 10 G (phorate) granules @ 10 kg/hectare as a soil application followed by light irrigation. **Mite** – Spray Dimethoate or Ethion (0.05%) at initial stage of infestation. **Onion fly** – Apply Carbofuran/Phorate (0.5 kg/ha) or neem cake (500 kg/ha) to the soil while sowing. **Cut worm** – Apply Chlorpyriphos (0.1%) to the soil. **Groundnut earwig -** Apply Chlorpyriphos (0.1%) to the soil.
Integrated diseases management	**Damping off** – Treat seed with captan or Thiram @ 2-3 g/kg. **Stemphylium blight** – Spray crop with Dithane M 45 @ 0.25% at 15 day intervals. **Downy mildew and Purple bloth** – Treat seed with Captan or Thiram @ 3 g/kg. Spray the crop with Indofil M 45 @ 1.5 kg or 500 ml Troton/hectare in 500 litres of water at 10 day intervals. **Bacterial soft rot** – Treat bulbs with Streprotycycline @ 2000 ppm. **Black mold** – Maintain temperature at 0^{o}C and RH at 60-70% in cold stores and proper ventilation under ordinary storage.
Harvesting	Top turns yellow or brownish and signs of drying up and fall down, 4-5 months after planting
Value addition scope	Dehydration, paste, powder, canned etc.

Crop name: Radish

Scientific name: *Raphanus Sativus* L.
Local name –
Jharkhand: Murai
Bihar: Muli, moorayee
Odisha: Mula
West Bengal: Mula
Assam: Mula
Season: Rabi

Time of sowing	Sept.- Jan.						
Varieties	Asiatic type (February to September sowing)- Pusa Deshi, Pusa Reshmi, Pusa Chetki, Kashi Sweta, Kashi Hans, Baramasi, Kalyanpur No.1, Japanese White, Punjab Safed, Kalyani White, Arka Nishant, IIHR 1, Rapid Red White Tipped, Chinese Pink, Kasi Hans, etc. European type (October to January sowing) - Pusa Himani, White Icicile, Rapid red white tipped, Scarlet.						
Appropriate land **Appropriate soil**	Upland with rich organic carbon Fairly acidic, sandy loam						
Botanical properties	Rosette leaves are lyrate-pinnatified and 10-15 cm or may vary. Leaves are covered with stiff bristles. Edible portion shape varies from oblate to long tapering and exterior colour.						
Edible parts	Roots and leaves						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.7	0.1	0.6	0.8	35	22	0.4
Seed rate **Nutrient**	10-12 kg/hectare 20 tones of FYM, 120 kg nitrogen, 65 kg phosphorus, 100 kg						

management	potash/hectare
Water management	8-10 day intervals
Integrated pest management	**Termite** – Treat seed with Chlorpiryphos liquid at 5-10 ml/kg and spray with 2.5ml/l water. **Mustard saw fly** - Spray neem seed kernel extract (NSKE) 5% or Himbesidin 2ml/l water. Spray Quinalphos or Chlorpyriphos one time. **Painted Bug** – Spot application of Phosphamidon and Oxymethyl demeton (0.05%) is enough. **Aphids** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%). **Striped flea beetle** – Spray Quinalphos or Chlorpyriphos (0.05%).
Integrated diseases management	**White rust** – Spray crop with 2 kg Macozeb/800 l water/hectare. **Brown heart** – Apply Borax @ 15-20 kg/hectare of foliar application of 0.1% boran. **Mosaic I** – Soil application of Carbofuran @ 1.5 kg/ha at the time of sowing followed by 2-3 foliar sprays of either Phosphamidon (0.05%) at 10 day intervals. **Mosaic II** – Soil application of Carbofuran @ 1.5 kg/ha at the time of sowing followed by 2-3 foliar sprays of either Phosphamidon (0.05%) at 10 day intervals. **Phyllody** – Soil application of Thimet 10 G, Disulfoton or Carbofuran @ 1.5 kg/ha at the time of sowing.
Harvesting	Tender and crisp roots, 45 days after planting
Value addition scope	Sauces, chips, dried, pickles, etc.

Crop name: Turnip


Scientific name: *Brassica rapa var. rapa* L.
Local name –
Jharkhand: Saolgam
Bihar: Shaljam
Odisha: shaalagam
West Bengal: Shalgam
Assam: Shalgum
Season: Rabi

Time of sowing	September – November						
Varieties	Pusa Meghali, Pusa Yandangri, Pusa Kesar, Naitis, Chantni, Pusa Sweti, Pusa Swarnima, L 1, Purple Top White Globe, Pusa Chandrima, Golden Ball, Snow Ball, Pusa Kanchan, 4 Red, 4 White, Early Millan Red Top, etc.						
Appropriate land	Moderately deep, highly fertile soil with slightly acidic in nature						
Appropriate soil	Sandy loam						
Botanical properties	Turnip is hypocotyls. Their shapes vary from flat through globular, top shaped and long. Ground colour may be red, purple, white, yellow or green.						
Edible parts	Roots, leaves						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.5	0.2	0.6	0.9	30	40	0.4
Seed rate	3-4 kg/hectare						
Nutrient management	20 tones of FYM, 60 kg nitrogen, 30 kg phosphorus, 30 kg potash/hectare						

Water management	At 7-10 day intervals
Integrated pest management	**Aphid** – Spray crop with nicotine sulphate and soil application of furadan. **Diamond back moth** – Spray the crop with 500ml Ekalux 25 EC (quinalphos)/ 250 ml Sumicidin 20 Ec (fenvelrate)/hectare in 200-250 l of water.
Integrated diseases management	**Black spot** – Apply adding 40-60 ppm chlorine to the washing water and by hilding packaged radish at $5^{o}C$-$10^{o}C$ during storage. **Alternaria leaf spot** – Crop rotation and treat the seed with hot water at 50oC for 30 min. and then with Captan or Thiram @ 2g/kg seed. **White rust** – Spray crop with Dithane Z78 or Ridomil MZ@ 0.2-0.3% at 10-15 day intervals. **Mosaic virus** – Remove and destroy the diseased plant and host plants from vicinity of turnip.
Harvesting	Tender and crisp root, 35-45 days after sowing.
Value addition scope	Sauces, chips, dried, pickles, barfi, moisturizer etc.

Crop name: Carrot

Scientific name: *Daucus carota subsp.sativus* (Hoffm.)
Local name –
Jharkhand: Gajar
Bihar: Gazar
Odisha: Gajar
West Bengal: Gajar
Assam: Gaazor
Season: Rabi

Time of sowing	October- December						
Varieties	Nontes, Pusa Neghali, Pusa Vandagni, Pusa Rudeera, Pusa Vrishti, Pusa Asita, Gajar no.29, Pusa Keasr, Selection 21, Pusa Meghali, Hisar Gairic, PC 34, Chantenaqy, Nantes Half Long, Pusa Yandagni, Ooty 1, Coreless, etc.						
Appropriate land	Upland with good drainage						
Appropriate soil	Deep, loose loamy soil						
Botanical properties	Root consists of phloem or cortex and cone or xylem and thick, fleshy tap root. Stems are erect, elongate and branched.						
Edible parts	Roots						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	0.9	0.2	1.1	1.2	80	530	1.03
Seed rate	5-6 kg/hectare						

Nutrient management	20-25 tones of FYM, 60 kg nitrogen, 50 kg phosphorus, 60 kg potash/hectare
Water management	8-10 day intervals
Integrated pest management	**Termite** – Treat seed with Chlorpiryphos liquid at 5-10 ml/kg and spray with 2.5ml/l water. **Leaf hopper** – Apply Monocrotophos, Phosphamidon or Dimethoate or Oxymethyl demeton (0.05%). **Cut worm** – Drench soil with Chlorpyriphos (0.1%).
Integrated diseases management	**Powdery mildew-** Spray with Sulphur 80% WP 2.5-3g/l of water. **Cercospora leaf spot** – Spray with Dithane Z 78 @ 2 g/l of water. **Alternaria blight** – Spray with Dithane Z 78 @ 2 g/l of water and apply nitrogenous fertilizers along with fungicides. **Crown rot** – Treat seed with Captan or Thiram 2 2-3 g/kg.
Harvesting	2-3 cm thick at crown, 90-100 days after sowing
Value addition scope	Sauces, chips, dried, pickles, barfi, sweets, canned, moisturizer etc.

Crop name: Beet root


Scientific name: *Beta vulgaris* L.
Local name –
Jharkhand: Beet
Bihar: Chukandar
Odisha: Beet
West Bengal: Beat - Palang
Assam: Bit
Season: Rabi

Time of sowing	Sepetember –November
Varieties	Crimson Globe, Detroit Dark Red, Crosby's Egyptian, Early Wonder, Ooty 1, etc.
Appropriate land	Upland with rich organic carbon and good drainage
Appropriate soil	Loams, sandy loam
Botanical properties	Biennial producing enlarged hypocotyls roots and a rosette of leaves and flowers.
Edible parts	Roots, leaves

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.7	0.1	0.8	0.9	18.3	55	1.19

Seed rate	6-7 kg/hectare
Nutrient management	15-20ton FYM, 70 kg nitrogen, 110 kg phosphorus, 70 kg potash/hectare

Water management	5-7 irrigation
Integrated pest management	**Leaf miner** – Spray the crop with neem seed kernel extract @ 2 g/l of water. Spray systematic pesticides like Rogor 30 EC (dimethoate) @ 500 ml/hectare. **Aphid** – Spray the crop with systematic pesticides like Rogor 35 EC (dimethoate) @ 500 ml/hectare.
Integrated diseases management	**Cercospora leaf spot** – Apply potash before sowing. Spray crop with copper oxychloride @ 0.3%. **Downy mildew** – Treat the seed with Captan or Thiram @ 2-3 g/kg. Spray the crop with Chlorothalonil 75% @ 1g/l of water. **Beet mosaic virus** – Spray the crop with systematic pesticides like Rogor 35 EC (dimethoate) @ 500 ml/hectare to control vector.
Harvesting	Tender roots of 3-5 cm in dm, 60-90 days after sowing
Value addition scope	Chips, dried, pickles, barfi, sweets, canned, moisturizer, etc.

Crop name: Pea

Scientific name: Pisum sativum
Local name –
Jharkhand: Matar
Bihar: Matar
Odisha: Motoro
West Bengal: Matar
Assam: Matara
Season: Rabi

Time of sowing	Sep.-Nov.
Varieties	Arkel, Azad Pea-1, Azad Pea-3, Swarn Mukti, Swarn Amar, Early Gaint, Alderman, Early December Nector, Bonneuilla, New Lime Protection, Mp 29, Sylvia, 4f68, B22, T163, New Line Perfection, T19, T17, P 8, P35, P87, P88, Narrow Fat, Thoma Laxtons, Telephone, Jawahar 1, Jawahar 2, Jawahar 3, Jawahar 4, Matar Ageta 6, Jawahar Pea 56, Hisar Harit, Punjab 87, Punjab 88, Punjab 89, Bonneville Arka, Sampoorna Arka Karthik, Arka Ajit, Orgegon Sugar Pod, Oregan Sugar Pod 11, Sugar Snap, etc.
Appropriate land	Well drained rich soil
Appropriate soil	Loose, friable soil, sandy loam, clay loam, slit loam with high organic matter content
Botanical properties	Short lived, herbaceous annual, climb by leaflet tendrils. Seeds are angular orglobose, 4-10 in number, smooth, green or brown, sometimes mottled seed. The leaves are pinnate with three pairs of leaflets and terminal branched tendril, stipulate ovate or elliptic.
Edible parts	Fruits

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	5.42	0.40	-	-	25	-	1.47

Seed rate	100-120 kg/hectare
Nutrient management	15-20 tones of FYM, 55 kg nitrogen, 20 kg phosphorus, 40 kg potash/hectare
Water management	3-5 irrigation at 10-20 day intervals
Integrated pest management	**Pea aphid/leaf miner** – Spray Imidachloprid 17.8% SL @0.5ml per liter water. **Pea stem fly** – Treat seed with Bavistin 50 WP @ 1 g/kg in 15 ml of water. **Pod borer** – Apply Sevin 50 WP (carboryl) @ 0.2%.
Integrated diseases management	**Powdery mildew** – Apply Kerathan 40 EC @ 200 ml or Sulphur 80% WP @ 1.5 kg/hectare in 500 l of water or Carbendazim or Baycor (0.05%) and repeat after 10-15 days, if necessary. **Ascochyta foot-rot and blight** – Use healthy and treat them with Carbendazim (0.25%) before sowing. Spray crop with Carbendazim (0.1%) or Mancozeb at flowering and afterwards at 10-15 days intervals. **Furarium wilt** – Treat seed with Bavistin @ 2 g/kg or Thiram (0.3%) or Carbendazim (0.2%) before sowing. Follow 3 year crop rotation and sanitation. Drench the infected area with blue copper 3g/l of water or Carbendazim (0.5%). destroy the weed hosts such as Lathyrus vicia etc. **Root rots** – Treat seed with or Captan or Thiram @ 2 g/kg. **Rust** – Apply Indofil M 45 @ 1 kg/hectare in 500 l of water. Spray Mancozeb (0.25%) or Bayleton (0.05%) or triadimefon 25% WP @ 0.1 % in 300 l water per acre on disease appearance and repeat at 10-15 days intervals. **Bacterial blight** – Give a pre-sowing seed dip in Streptocycline solution (1 g/10 l of water) fror 1-2 hr. Give a spray of Streptocycline (0.01%) on appearance of the disease, repeat after 7 days, if necessary.
Harvesting	Light green pods, thick, fleshy and crunchy, 10 days after flower anthesis
Value addition scope	Frozen, canned, dried, powder, etc.

Crop name: Cowpea


Scientific name: *Vigna sinensis* Savi.
Local name –
Jharkhand: Bodi
Bihar: Lobia
Odisha: Chani
West Bengal: Barabati
Assam: Daannbdii
Season: Rabi/ Summer

Time of sowing	Feb.-March, June-July						
Varieties	Swarn Harita, Swarn Mukut, Kashi Kanchan, Kashi Unnati, Kashi Nidhi, Pusa Dofasli, Pusa Komal, Cow Pea 263, Bhagyalakshmi, Arka Samrudhi, Arka Garima, Bidhan Barbati 1, Pusa Barsati, Lola, Arkagarima, T2, C152, T59, JC 5, JC 10, CO 1, CO 2, Pusa 3, K11, C 20, Pua Phalguni, FS 68, No 21, No 5, etc.						
Appropriate land **Appropriate soil**	Well drained acidic soil Sandy loam, low fertile soil						
Botanical properties	Pods size vary with small seeds, kidney shaped seeds or fleshy pods with elongated kidney.						
Edible parts	Pods						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	3.5	0.2	0.9	2.0	72	59	2.5
Seed rate	18-20kg/ha for bush type varieties and 6-8 kg/hectare for pole type						

Nutrient management	20 tones of FYM, 20 kg nitrogen, 30 kg phosphorus, 10 kg potash/hectare
Water management	5-7 day intervals
Integrated pest management	**Aphids** – Spray crop with systematic insecticides as Metasystox 25 EC or Rogor 30 EC (dimethoate) @ 2 ml/l of water. Apply Monocrotophos, Phosphamidon, Dimethoate, Oxymethyl demeton (0.05%). **Pod borer** – Spray crop with Hexavan 50 WP (carbaryl) @ 2 g/l of water. Spray Quinalphos or Chlorpyriphos (0.05%) or Carbaryl (0.15) or Cypermetrhrin (0.0125%) at flower bud stage. **Galerucid beetle** – Apply systematic granule pesticideds like Thimet 10 G (phorate) @ 10 kg or Furadan 3 G (carbofuran) @ 20 kg/hectare to soil. Spray crop with Sevin/Hexavan 50 WP (carbaryl) @ 2 g/ l of water. **Cowpea curculio** – Spray crop with Sevin/Hexavan 50 WP (carbaryl) @ 2 kg/ hectare or Ekalux 25 EC (quinalphos) @ 2 l/hectare. **Stem fly** – Spray Phosphamidon or Oxymethyl demeton (0.05%) or neem seed kernel extract (4%). **Bruchid** – Dry seed thoroughly before storage. Add 2% edible oil (volume/weight). **Bugs** – Dust with Malathion/Quinalphos (2% dust). **Leaf eating caterpillar** - Spray Quinalphos or Chlorpyriphos (0.05%) or Carbaryl (0.2%) or Cypermetrhrin (0.0125%).
Integrated diseases management	**Rust diseases** – Spray crop with Dithane M45 @ 2.5 g/l of water. **Anthracnose** – Treat seed with Captan or Captaf or Thiram @ 2-3 g/kg. Spray crop with Dithane M45 @ 2 g/l of water. **Cercospora leaf spot** – Spray crop with Indofil M45 @ 2 g/l of water. **Powdery mildew** – Spray crop with wettable sulphur @ 3 g/l of water. Treat seed with Benlate or Bavistin @ 15 g/l of water. **Ashy stem blight** – Treat seed with Cerasan or Captan or Thiram @ 2-3 g/kg. **Cowpea strain** – The virus in the embryo can be activated by very rapid dehydration of the seeds. **Mosaic** – Spray Dimethoate (0.05%) at 10 day intervals. **Yellow flecks** – Apply granular or emulsifiable insecticides and mineral oil.
Harvesting	Tender pods before fibrous, 60-90 days after sowing
Value addition scope	Frozen, canned, dried

Crop name: Dolichos Bean


Scientific name: *Lablab purpureus* (L.) Sweet
Local name –
Jharkhand: Sembi
Bihar: Sem
Odisha: Semi
West Bengal: Rajashimbi
Assam: Urahi
Season: Kharif/ Summer

Time of sowing	June-Aug., February						
Varieties	Swarn Utkrisht, Swarn Rituwar, Arka Jay, Arka Vijay, Kankan Bhusan, Hebbal Avare, Pusa Early Prolific, Pusa Sem 2, Pusa Sem 3, Kashi Harit etc.						
Appropriate land	Dry land						
Appropriate soil	Deep sand, heavy clay						
Botanical properties	Vigorous trailing, twining herbaceous, annual crops propagated through seeds.						
Edible parts	Fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	3.8	0.7	0.9	1.8	210	68	1.7
Seed rate	10-12 kg/hectare						
Nutrient	20 tones of FYM, 20 kg nitrogen, 60 kg phosphorus, 60 kg potash/hectare						

management	
Water management	7-10 day intervals
Integrated pest management	**Bihar Hairy Catterpiller** - Spray crop with Malathion 50 Ec @ 2 ml/l of water. Spray soap water suspension @ 25 ml liquid detergent/l of water or neem extract. **Pod borer** – Spray crop with Servin 50 SP (carbaryl) @ 0.2 % and 5 % neem extract. Spray Quinalphos or Chlorpyriphos (0.05%) or Cypermetrhrin (0.0125%) at flower bud stage and small pod stage and flat pod stage. **Aphids** – Apply Monocrotophos, Phosphamidon, Dimethoate and oxymethyl demeton (0.05%). **Leaf eating caterpillar** – Spray Quinalphos or Chlorpyriphos (0.05%) or Carbaryl (0.2%). **Bugs** – Dust with Quinalphos/Malathion (2% dust). **Weevils** – Apply Quinalphos or Chlorpyriphos (0.05%) or Carbaryl (0.15%) locally on the vines. **Red spider mite** – Spray Dicofol or Ethion (0.05%). **Leafhopper** – Apply Phosphamidon, Dimethoate, Oxymethyl demeton (0.05%).
Integrated diseases management	**Powdery mildew** – Spray crop with wettable sulphur @ 0.25%. **Anthracnose** – Spray crop with Bordeaux mixture @ 1% or copper oxychloride @ 0.25 %. **Common blight** – Treat seed with hot water at 50^{o}C for 10 min. followed by dipping in streptocycline solution. **Yellow mosaic** – Spray crop with rogor or metasystox @ 1 ml/l of water at 10 day intervals. Apply carbofuran @ 1.5 kg (a.i.)/hectare at sowing. 2-3 foliar sprays of Dimethoate (0.05%) or Phosphamidon (0.02%) at 10 days intervals. **Spotted wilt** – Always transplant disease-free seedlings. Follow 3 year crop rotation in infested fields by including cereals and crucifers.
Harvesting	Green pods, tender, succulent, 2 months after sowing
Value addition scope	Green manure, fodder crops

Crop name: French bean


Scientific name: *Phaseolus vulgaris* L.
Local name –
Jharkhand: Pharas bean
Bihar: Farasbee, Gawar phalli
Odisha: Beans
West Bengal: phrench beens
Assam: French Beans
Season: Rabi/Kharif

Time of sowing	Jan.-Feb., July-Sept.						
Varieties	Swarn Priya, Kashi Priya, Kashi Samapann, Kashi Rajhans, Contender, Pusa Parbati, Arka Kamal, Arka Suvidha, Arka Anoop, Phule Surekha, Pant Anupama, Kentucky Wonder, Pusa Himlata, SVM 1, Swarna Lata, Bountiful, Green Rular, Romana, etc.						
Appropriate land	Well drained upland to medium land						
Appropriate soil	Sandy loam, clay loam						
Botanical properties	Green tender pods varies from thin, pencil like to about 2 cm in dm. pods are round, flat, curved in shape and colour varies from green to yellow, red or purple.						
Edible parts	Fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.7	0.1	0.5	1.8	50	28	0.61
Seed rate	25-60 kg/hectare						
Nutrient management	20 tones of FYM, 50 kg nitrogen, 100 kg phosphorus, 60 kg potash/hectare						

Water management	6-7 irrigation
Integrated pest management	**Bean Stem Borer**- Spray with Thiodicarb 75% WP (1g/liter water) or Flubendiamide 480S.C. (0.25ml/liter water) or Chlorfluazuron 5% EC (1g/5liter water). **Bean aphid** – Spray crop with systematic pesticides as Metasystox 25 EC or Rogor 30 EC (dimethoate) @ 500ml/hectare. **Stem fly** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or neem seed kernel extract (5%) as soon as puncture marks are observed. Repeat when petiole mining is observed. Alternately spray 10 and 15 days after swoing during May-August. **Leafhopper** – Spray Monocrotophos, Phosphamidon, Dimethoate and Oxymethyl demeton (all at 0.05%). **Sepentine leaf miner** – Spary neem seed kernel extract (4%) or neem formulations (3-5 ml/l) or Triazophos (0.05%), 10-20 days after sowing. **Thrips** – Spray Phosphamidon, Dimethoate and Oxymethyl demeton (0.05%) or neem formulations (2-3 ml/l) **Red spider Mite** – Spray Dicofol or Ethion (0.05%).
Integrated diseases management	**Anthracnose** – Treat seed with Captan or Thiram @ 2 g/kg. Apply dithane M 45 @0.2% or Bavistin @ 0.1%. **Rhizoctonia** – Treat seed with Captan or Thiram or Bavistin @ 2-3 g/kg. **Pythium root rot** – Treat seed with Captan or Thiram @ 2-3 g/kg. **Rust diseases** – Spray crop with Dithane M45 @ 2 g/l of water. **Angular leaf spot** – Treat seed with Vitavax or Agrosan GN @ 2 g/kg. Spray the crop with Bavistin @ 0.2%. **Common or bacterial blight** - Treat seed with hot water at 50^{o}C for 10 min. followed by dipping in streptocycline solution. **Bean mosaic virus** – Spray crop with systematic pesticides as dimethoate (Rogor). **Spotted wilt** - Always transplant disease-free seedlings. Follow 3 year crop rotation in infested fields by including cereals and crucifers. **Common mosaic** – Rouge infected plants and weed hosts in and around bean field. Apply Carbofuran or Disulfotan or Phorate 10 G granules @ 1.5 kg/ha at the time of sowing followed by 2-3 folliar spraying of Dimethoate (0.05%).

	Golden mosaic – Soil application of Carbofuran or Disulfoton @ 1.5 kg/ha at the time of sowing. **Phyllody** – Foliar application of Oxytetracycline hydrochloride solution (500 ppm) at weekly intervals.
Harvesting	Fully riped, yellow in colour, pods bulge and apparent seeds, 7-10 days after flowering and 50-60 days after sowing
Value addition scope	Dried, canned

Crop name: Cluster bean

Scientific name: *Cyanopsis tetragonoloba* (L.) Taub.
Local name –
Jharkhand: Simba
Bihar: Guar-Ki-Phalli
Odisha: Guanra Chhuin
West Bengal: Borboti, Jhar Sim
Assam: Barbati
Season: Rabi/Autumn

Time of sowing	Feb.-Mar., July
Varieties	Pusa Sadabahar, Pusa Mausami, Pusa Navbahar, Sharad Bahar, P-28-1-1, I.C-11204, I.C.11388, P.L.N-850
Appropriate land	Well drained upland to medium land
Appropriate soil	Sandy loam
Botanical properties	Pods are small, double ridged on the dorsal side and borne in clusters.
Edible parts	Pods

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	3.2	0.4	1.4	3.2	130	57	1.08

Seed rate	20-25 kg/hectare
Nutrient management	10-20 tones of FYM, 40 kg nitrogen, 60 kg phosphorus, 60 kg potash/hectare

Water management	2-3 irrigation
Integrated pest management	**Aphid** – Spray crop with Rogor 30 EC (dimethoate) @ 0.03-0.05%. Apply carbofuran granules (furadan 3G) @ 1 kg a.i./hectare at the time of sowing. Spray Monocrotophos, Phosphamidon, Dimethoate, Methyl demeton (0.05%). **Pod borer** – Spray crop with Sevin 50 WP (carbaryl) @ 2 g/l of water. Spray Quinalphos or Chlorpyriphos (0.05%) or Carbaryl (0.5%) or Cypermetrhrin (0.0125%) at pod formation stage. **Bugs** – Dusting with Malathion/ Quinalphos (2%).
Integrated diseases management	**Anthracnose** – Treat seed withn Captan/Thiran @ 2 g/kg. Spray crop with Bavistin or Benlate @ 0.1% at 10 day interval. **Leaf blight** – Treat seed with Agrosan Gn or Captan @ 2 g/kg. Spray crop with Dithane M45 @ 0.2% or Difolatan @ 0.03%. **Bacterial blight** – Treat seed with hot water at 56^{o}C for 10 min. Spray crop with streptocycline @ 100-250 ppmm or Agrimycin @ 100-500 ppm. **Powdery mildew** – Spray crop with Sulfex or other formulations of wettable powder @ 0.2 %. **Spotted wilt** – Always transplant disease-free seedlings. Follow 3 year crop rotation in infested fields by including cereals and crucifers.
Harvesting	Green pods, 45-60 days after sowing
Value addition scope	Pulses, extraction of gum, green manure, fodder, lusturing agent

Crop name: Winged bean


Scientific name: *Psophocarpus tetragonolobus* L.
Local name –
Jharkhand: Pankhiya bean
Bihar: Pankhiya bean
West Bengal: Charkoni sem
Season: Rainy

Time of sowing	June-July
Varieties	IIHR Selection 21, IIHR Selection 60, IIHR Selection 71, Revathy, Wbc 2, Ups 66, Ups 89, Ups 99, Ups 122, Chimbux, Boger, Ribban, Butterfly, Mariposa Lunita, Always, Siempre, Alipasto, Tinge, Pt 2, Pt 16, etc.
Appropriate land	Well drained upland to medium land
Appropriate soil	Loamy, acidic
Botanical properties	Pods are 15-25 cm long. Roots are small, irregular, spindle shaped weighing about 50 g.
Edible parts	Leaves, flowers, pods, seeds, tuberous roots

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.4	0.2-0.3	0.4-1.9	0.8-2.6	-	-	-

Seed rate	15-20 kg/hectare
Nutrient management	20 tones of FYM, 50 kg nitrogen, 100 kg phosphorus, 50 kg potash/hectare

Water management	day intervals
Integrated pest management	**Aphid** – Spray crop with Rogor 30 EC (dimethoate) @ 0.03-0.05%. Apply carbofuran granules (furadan 3G) @ 1 kg a.i./hectare at the time of sowing. **Pod borer** – Spray crop Sevin 50 WP (carbaryl) @ 2 g/l of water.
Integrated diseases management	**Collor rot** – Treat seed with Captan or Thiran @ 2 g/kg. **Anthracnose** – Spray crop with Bavistin @ 0.1%. **Witches broom** – Spray crop with Oxytetracycline hydrochloride @ 500 ppm. **Spotted wilt** – Always transplant disease-free seedlings. Follow 3 year crop rotation in infested fields by including cereals and crucifers.
Harvesting	Pods at 15-20 cm long, 2 cm thick, 70-80 days after sowing
Value addition scope	Roasted, canned, dried

Crop name: Spinach

Scientific name: *Spinacea olercea* L.
Local name –
Jharkhand: Paalak
Bihar: Paalak
Odisha: Palanga saga
West Bengal: Palang sag
Assam: Paleng
Season: Rabi/Kharif

Time of sowing	Sept.- Nov., Aug-Oct.
Varieties	All Green, Sauory, Early Smooth Leave, Banerjee Giant, Virginia Savoy, Long Standing, etc.
Appropriate land	Well drained upland to medium land
Appropriate soil	Light, sandy, slit, clay loam, heavy and muck soils
Botanical properties	Edible parts consist of the compact rosette of leaves prior to the elongation of the central bud in flower stalk formation.
Edible parts	Leaves, stalks

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.0	0.7	1.7	0.6	73	21	1.14

Seed rate	8-10 kg/hectare
Nutrient management	25 tones of FYM, 30 kg nitrogen, 15 kg phosphorus, 15 kg potash/hectare
Water management	10-15 day intervals
Integrated pest management	**Leaf eating caterpillar** – Destroy all wild amaranth plants and grasses from the surroundings. Remove infected plants. Spray Dichlorvos (0.05%), if required.

	Leaf webber – Destroy all wild amaranth plants and grasses from the surroundings. Remove infected plants. Spray Dichlorvos (0.05%), if required. **Aphids** – Remove infested plant. Apply Monocrotophos or Phosphamidon or Dimethoate or Oxymethyl demeton (0.05%), if required. Spray crop with Malathion. **Scale** – Avoid spraying as far as possible. If essential then spray Monocrotophos (0.05%). **Stem weevil** – Remove infected plants. Spray Dichlorvos (500 g/ha). **Blue beetle** – Spray neem seed kernel extract (4%). Apply neem cake 500 kg to soil while sowing, if grubs regularly destroy crop.
Integrated diseases management	**Damping off** – Treat seed with Cerasan before sowing. **Cercospora leaf spot** – Spray crop with Copper fungicide like Bordeaux mixture or Fytolan.
Harvesting	5-6 leaf stage before seed stalk formation, 40-50 days after sowing
Value addition scope	Canned, colouring agent

Crop name: Lettuce

Scientific name: *Lactuca sativa* L.
Local name –
Jharkhand: Sag
West Bengal: Lote
Season: Rabi/Kharif

Time of sowing	Sep.- Nov., Mar.-June						
Varieties	Punjab lettuce no.1, great lakes, Alamo 1, slobolt, chinnese yellow, imperial 859, white boston, dark green						
Appropriate land	Well drained upland to medium land						
Appropriate soil	Sandy loam, slit loam, sandy						
Botanical properties	Plants generally have a height and spread of 15 to 30 cm (6 to 12 in). The leaves are colorful, mainly in the green and red color spectrums, with some variegated varieties. Lettuces have a wide range of shapes and textures, from the dense heads of the iceberg type to the notched, scalloped, frilly or ruffly leaves of leaf varieties.						
Edible parts	Leaves and stem						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.1	0.3	1.2	0.5	50	28	2.4
Seed rate	400-500 g/hectare						
Nutrient management	10-15 tones of FYM, 25 kg nitrogen, 90 kg phosphorus, 25 kg potash/hectare						
Water management	4-5 day intervals						

Integrated pest management	**Leaf eating caterpillar** – Destroy all wild amaranth plants and grasses from the surroundings. Remove infected plants. Spray Dichlorvos (0.05%), if required. **Leaf webber** – Destroy all wild amaranth plants and grasses from the surroundings. Remove infected plants. Spray Dichlorvos (0.05%), if required. **Aphids** – Remove infested plant. Apply Monocrotophos or Phosphamidon or Dimethoate or Oxymethyl demeton (0.05%), if required. Spray crop with Malathion.
Integrated diseases management	**Tip burn** – Do not apply excessive fertilizers specilly nitrogen; increase soil pH by liming to improve calcium.
Harvesting	50-60 days after sowing in summer and 120 days after sowing in winter
Value addition scope	Colouring agent

Crop name: Fenugreek


Scientific name: *Trigonella foenum – graecum* L.
Local name –
Jharkhand: Methi
Bihar: Hari Methi
Odisha: Methi Saga
West Bengal: Mēthi-gācha
Assam: Methi Xaak
Season: Rabi

Time of sowing	September- February						
Varieties	Pusa Early Bunching, Methi No.14, Methi No. 47, Hisar Suvarna, Kasuri Methi, Kasuri Selection						
Appropriate land	Well darined soil with good organic matter content						
Appropriate soil	Loam, sandy loam						
Botanical properties	2-3 white flowers at the base of each leaf and has 6-7cm straight long pods.						
Edible parts	Leaves, stems, seeds						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	4.4	0.9	1.5	1.1	395	51	1.93
Seed rate	30-35 kg/hectare						
Nutrient management	15-20 tones of FYM, 20-30 kg nitrogen, 100 kg ammonium sulphate/hectare						
Water management	4- 6 irrigation						

Integrated pest management	**Blue beetle** – Spray crop with Sevin 50 Wp (carbaryl) @ 0.1%. **Leaf miner** – Spray crop with Metasystox 25 EC (methyl demeton) @ 2.5-3.0 l or Rogor 30 EC (dimethoate) @ 1 l/hectare. **Aphids** – Spray crop with Malathion 50 EC @ 2.5-5 ml @ 1.5-3 ml/l of water or Dichlorvos (0.05%) or Thiometon (0.03%) or Methyl-o-demeton (0.05%). **Seed midge** – Spary Fenvalerate (0.01%) or Methyl-o-demeton (0.025%).
Integrated diseases management	**Powdery mildew** – Dust crop with sulphur powder (300 meshes) at 2 months old. If neede @ 10-12 kg/hectare. Apply 2 rounds of spray with Karathane (0.1%) at the start of disease and again with Carbendazim (0.1%) 10-15 days after the first round or with wettable sulphur (0.25%). **Damping off** – Sterilize the soil with 1-1.5% solution of Formalin. Soak seed in 50^{o}C hot water for 25 mins. Followed by seed treatment with 1% sodium hypochloride solution for 10 mins. Treat seed with Captan or Thiram @ 2-3 g/kg. Drench soil with 0.2% solution of Captan or Thiram. **White rust** – Spray crop with Ridomil MZ @ 2 g/l of water. **Downy mildew** - Spray crop with Indofil m 45 @ 2 g/l of water or Alliete @ 2-3 kg/hectare. **Leaf spot** – Spray crop with Blitox @ 0.2%. **Spinach mosaic** – Use systemic insecticides like Rogor 30EC and Malathion.
Harvesting	25-30 days after sowing
Value addition scope	Dried, powder, flavoring agent

Crop name: Coriander


Scientific name: *Corindrum sativum* L.
Local name –
Jharkhand: Dhaniya
Bihar: Dhaniya
Odisha: Dhaniya
West Bengal: Dhaniẏā
Assam: Dhoniya
Season: Rabi/Kharif

Time of sowing	August-September, October-January
Varieties	Sindhu, CO 3, Rcr4, Gujarat Coriander I, Gujarat Coriander II, Swathi, etc.
Appropriate land	Well darined soil with good organic matter content
Appropriate soil	Sandy loam, clay loam, heavy soil
Botanical properties	An annual heb of 30-90 cm hight with small, white or pinkish purple flower borne on compound terminal umbels. Lower leaves are braod with centrally cobed margins while upper ones are narrow, finally cut linear lobes. Fruits are globular and ribbed yellow brown in colour and 2-3.5m.
Edible parts	Leaves, seeds

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	3.3	0.6	2.3	1.2	184	71	1.42

Seed rate	5-6 kg/acre
Nutrient management	20 tones of FYM, 150 kg ammonium sulphate, 300 kg sulphur phosphate, 100 kg murate of potash/hectare

Water management	4-5 irrigation
Integrated pest management	**Aphids** – Spray Dichlorvos (0.05%) or Thiometon (0.03%) or Methyl-o-demeton (0.05%). **Seed midge** – Spary Fenvalerate (0.01%) or Methyl-o-demeton (0.025%).
Integrated diseases management	**Powdery mildew** – Dust crop with sulphur powder (300 meshes) at 2 months old. If neede @ 10-12 kg/hectare. Apply 2 rounds of spray with Karathane (0.1%) at the start of disease and again with Carbendazim (0.1%) 10-15 days after the first round or with wettable sulphur (0.25%). **Stem gall** – Treat seed with Thiram @ 250 g/100 kg. Spray plants with 0.25% Thiram. **Wilt** – Treat seed with Agrosan GN. Adopt summer ploughing twice or thrice and crop rotation. Spray the foliage twice with Carbendazim (Bavistin, 0.1%) at the age of 1 and 2 month. **Grain moulds** – Spray Carbendazim (0.1%) 20 days after seed set.
Harvesting	After a month of sowing for leaves and 50%seeds turn yellow for seeds at about 70-90 days after sowing
Value addition scope	Dried, seeds, flavoring agent

Crop name: Amaranth


Scientific name: *Amaranthus dubis* L.
Local name –
Jharkhand: Lal sag
Bihar: Lal sag
Odisha: Cosola saag
West Bengal: Lal sag
Assam: Ronga Xaak
Season: Rabi/Rainy

Time of sowing	Feb.- Mar., June-July
Varieties	Swarn Raktim, Co2, Co5, Pusa Badi Chulai, Pusa Kiran, Arka Suguma, Co1, Co3, Pusa Chhoti Chulai, Pusa Kirti, etc.
Appropriate land	Sandy loam, clay loam, heavy soil
Appropriate soil	Loam
Botanical properties	Dwarfish plant with small leaves with taller stems in various sizes.
Edible parts	Leaves, grains

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	3.0	0.7	3.3	1.0	200	40	-

Seed rate	2 kg/hectare
Nutrient management	25 tones of FYM, 50 kg nitrogen, 50 kg phosphorus, 20 kg potash/hectare
Water management	5-7 day intervals

Integrated pest management	**Leaf eating caterpillar** – Destroy all wild amaranth plants and grasses from the surroundings. Remove infected plants. Spray Dichlorvos (0.05%), if required. **Leaf webber** – Destroy all wild amaranth plants and grasses from the surroundings. Remove infected plants. Spray Dichlorvos (0.05%), if required. **Aphids** – Remove infested plant. Apply Monocrotophos or Phosphamidon or Dimethoate or Oxymethyl demeton (0.05%), if required.
Integrated diseases management	**Scale** – Avoid spraying as far as possible. If essential then spray Monocrotophos (0.05%). **Stem weevil** – Remove infected plants. Spray Dichlorvos (500 g/ha). **Blue beetle** – Spray neem seed kernel extract (4%). Apply neem cake 500 kg to soil while sowing, if grubs regularly destroy crop.
Harvesting	Tender greens, 3-4 weeks after sowing
Value addition scope	Grains are popped, parched, milled, flour, gruel

Crop name: Potato


Scientific name: Solanum tuberosum
Local name –
Jharkhand: Aaloo
Bihar: Aaloo
Odisha: Aalu
West Bengal: Aaloo
Assam: Alu
Season: Rabi/Kharif

Time of sowing	Sep.-Jan., May-June
Varieties	Kufri Kanchan, Kufri Lalit, Kufri Chandramukhi, Kufri Ashoka, Kufri Pukhraj, Kufri Jyoti, Kufri Jawahar, Kugri Sutlej, Kufri Lalima, Kufri Bahar, Kufri Giriraj, Kufri Sindhuri, Kufri Badshah, Kufri Swarna, Kufri Chipsona 1, Kufri Chamatkar, K.Sheetman, K.Deva, K.Lalima, Kufri Meghna, etc.
Appropriate land	Well drained porus soil with rich organic matter content
Appropriate soil	All soil except saline, alkaline, sodic
Botanical properties	Potato stolons are lateral shoots. Diageotropic shoots with elongated internodes, hooked at the tip, spirally arranged scale leaves.
Edible parts	Tubers, leaves

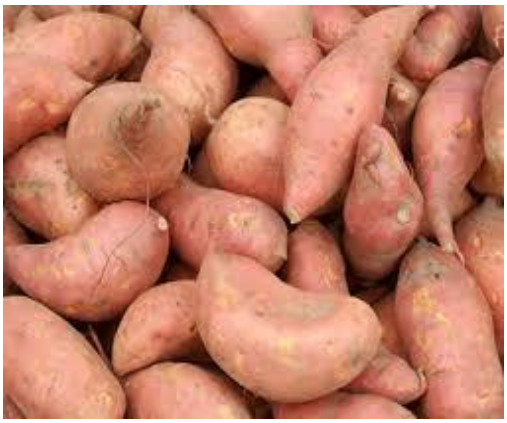
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.6	0.1	0.6	0.4	10	40	0.48

Seed rate	40 quintal/hectare
Nutrient management	20 tones of FYM, 185 kg nitrogen, 100 kg phosphorus, 125 kg potash/hectare

Water management	350-550 mm, 7-10 day intervals
Integrated pest management	**Jassid -** Spray crop with Rogor 30 EC (dimethoate) @ 750 ml/hectare at 10 days interval. For seed crop, apply 12.5 kg Thimet 10 G (phorate)/hectare to soil at the time of first earthing. **Cutworm** – Drench soil around plant with Chloropyriphos 20 EC @ 2.5 l/hectare. **Aphids** – Apply 10 kg/ha Phorate at planting or spray either Methyl demeton 25 EC (1.2 l/ha), Dimethoate (1.2 l/ha) or Monocrotophos 40 EC (1.2 l/ha). **Mites** – Spray Kelthane (2 l/ha). **Tuber moth** – Spray Carbaryl 50 WP (2 kg/ha) or Monocrotophos (1.5 l/ha). Aplly 250 g/q Quinalphos dust on stored seed. Cover potato with 2.5 cm thick layer of banana leaves in store. Use sex pheromones for trapping the moth both in field and stores. **Cut worms** – Drench soil around the plants and ridges with Carbaryl 50 WP (2 kg/ha) or Chloropyriphos 20 EC (2.5 l/hectare). **Golden cyst nematode** – Apply Carbofuran (60-75 kg/ha) in split dose, half at planting and half at earthing-up.
Integrated diseases management	**Early blight/Late blight** – Spray crop with Indofil M 45/Kavach/antracol @ 1.25 kg or copper oxychloride 50 WP @ 1.87 kg/ hectare before appearance of the disease followed by 5 more sprays at 7 day interval. Use Ridomil M2/Curzate M8 @ 1.75 kg/hectare at 10 day intervals for 3 and 4 spray. **Black scurf** – Disinfect tubers with Agallol @ 5 g or with Tafasan or Emisan @ 2.5 g/l of wter for 10 mins. Keep treated seed in shade for 24 hours. **Stem canker** – Treat seed tubers with 3% boric acid for 30 minutes. Follow crop rotation with sunhamp or maize. **Dry rot -** Treat seed tubers with 3% boric acid for 30 minutes. Harvests tubers at fully maturity and store them in cold storage. **Charcoal rot** – Treat seed with Emisan @ 2.5 g/l of water for 30 mins. **Leaf spot** – Spray crop with Indofil M 45/Kavach/antracol @ 1.25 kg or copper oxychloride 50 WP @ 1.87 kg/ hectare before appearance of the disease followed by 5 more sprays at 7 day interval. Use Ridomil M2/Curzate M8 @ 1.75 kg/hectare at 10 day intervals for 3 and 4 spray. **Leaf spot complex** – Spray Mancozeb (0.2%) plus urea (2%).

	Potato leaf roll virus and mosaics – Apply 10.5 kg Thimet 10 G (phorate)/hectare to the soil at the time of earthing. **Wart** – Use healthy seeds of immune varieties. **Bacterial wilt** – Use potato seed from bacterial wilt free areas. Use whole tubers for planting and sterilize cutting knife with Methanol every time while cutting seeds to avoid spread of the disease form tuber to tuber. Minimize tillage operations and give full earthing up at planting time. Use bleaching powder @ 12 kg/ha mixed with fertilizer in furrows at planting. Follow 2-3 years crop rotations with finger millets, maize, sorghum, wheat, cabbage, garlic. **Soft rot** – Treat seed with either of the solution of boric acid (3%) or Benomyl (500 ppm) for 30 min; Mancozeb (0.2%), Captafol (0.25%) for 10 min. **Common scab** – Treat seed with boric acid (3%) for 30 min. follow crop rotations with wheat, rice, berseem or pearl millet for 3-7 years. Irrigate crop at 7-10 days intervals. **Latent or faint mosaic** – Use certified seed. Blind earthing up and rogue infected plants. **Severe mosaic** – Use certified seed. Blind earthing up and rogue infected plants. Change tuber seed every 4-5 years in north-western plains. **Rugose mosaic** – Change seed every 4-5 years in north-western plains. **Crinkle mosaic** – Change seed every 4-5 years in north-western plains. **Leaf roll** – Apply 10 kg/ha Phorate at planting or spray either Methyl demeton 25 EC (1.2 l/ha), Dimethoate (1.2 l/ha) or Monocrotophos 40 EC (1.2 l/ha). Change seed every 4-5 years in north-western plains.
Harvesting	Thick tuber skin, tough and firmly attached, 60-120 days after planting
Value addition scope	Flour, flakes, French fries

Crop name: Sweet potato




Scientific name: *Ipomea betatas* (L.) Lam.
Local name –
Jharkhand: Mitha Aaloo
Bihar: Ganji
Odisha: Kandamula
West Bengal: Rangaloo/ Sakorkanda
Assam: Mitha Aalu
Season: Rabi

Time of sowing	September-October						
Varieties	H42, H268, Sree Nandini, Sree Vardhini, Sree Bhadra, Punjab Sweet Potao 21, V-2 (FA 17 White), V-6 (FA 17 Red), V-8 (FB 4004), V-12 (T.S. White), B-219, Ranger, B-5941, B-4306, SP-3, SP-9, SP-Canka, Hongur Red, Hongur Green, Bhadra Kali, Velmon, etc.						
Appropriate land	Well drained upland soil with good organic matter content						
Appropriate soil	Loamy sand						
Botanical properties	Tuberous root is long and tapered with a smooth skin. The skin colour ranges between red, purple, brown and white. The flesh colour ranges between white, yellow, orange and purple.						
Edible parts	Tuber						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.2	0.3	1.0	0.8	46	50	0.21
Seed rate	40-50 thousands cuttings/hectare						
Nutrient management	10 tones of FYM, 123 kg nitrogen, 15 kg phosphorus, 175 kg potash/hectare						

Water management	7-10 day intervals
Integrated pest management	**Sweet potato weevil** – Disinfect the propagation material (vine cuttings) with 0.05% solution of Fenitrothion. **Leaf and shoot folders** – Erthing up or reridging the crop 30 and 60 days after planting. Crop rotation and spray Fenthion, Fentrothion at 1 month intervals. Use synthetic sex pheromone (Z-3-dodecen-l-ol-E2-butarate) 1 mg dose. **Vine borer** – Spray Fenthion or Fentrothion (0.05%) and adopt crop rotation.
Integrated diseases management	**Scurf** – Stem cuttings 2-3 cm above soil line. **Sweet potato mosaic** - Spray crop with systematic pesticides like Rogor or Metasystox @ 0.05%. **Chlorotic leaf distortion** – Spray Bavistin (0.001%) at monthly interval. Spray Dipotassium hydrogen phosphate or Disodium hydrogen phosphate (0.001%) 3-4 times at fortnightly interval. **Feathery mottle disease** – Rogue-out infected plants.
Harvesting	Yellowing of leaves, 3.5-5 months after planting
Value addition scope	Fried, baked, chips, flour, noodles, candies

Crop name: Cassava


Scientific name: *Manihot esculenta* Crantz
Local name –
Jharkhand: Simal Kand
Bihar: Sakarkand
Odisha: Kondho moolo
West Bengal: Kāsābhā
Assam: Kaath aalu
Season: Rainy

Time of sowing	June-July						
Varieties	H 97, H 165, H 226, Sree Visakham, Sree Rekha, Sree Prabha, Sree Sahya, Sree Prakash						
Appropriate land	Upland with proper drainage						
Appropriate soil	Sandy loam						
Botanical properties	Perennial woody shrub with an edible root. root tubers are 2.5-10 cm in dm, 10-40 cm long and are borne in clusters of 4-8 at the stem base.						
Edible parts	Tuber						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (µg)**	**Iron (mg)**
	1.36	0.3	-	1-2	16	27	0.27
Seed rate	10000 cuttings/ hectare						
Nutrient management	125 quintals of FYM, 45 kg nitrogen, 45 kg phosphorus, 50 kg potash/hectare						
Water management	10-15 day intervals						

Integrated pest management	**Scale insect** – Spray stems with Dimethoate (0.05%) at the time of storing. In case of acute shortage of planting material and scale attack is mild, dip in Dimethoate (0.05%) for 10-15 min. before planting. **Termite** – Apply Carbaryl (10%) dust or spary Chlorpyriphos (0.05%) to the soil. **White grub** – Collect adult beetles from harbouring plants and trees. Deep plough the grubs and apply Carbaryl (10%) dust to the soil. **Spidermites** – Spray Dimethoate or Methyldemeton (0.05%) in severe infestation. spary water at run-off level. foliar application of urea followed by spraying of Dimethoate (0.05%) in severe cases. **Thrips** – Spray Dimethoate (0.05%). **Spiral whitefly** – Spray neem based products (Azadirachtin). **Common White fly** – Spray Dimethoate (0.05%). **Chips borers** – Dry cassava chips to very low moisture content (below 10%) and store in polythene impregnated bags. **Flour beetle** – Store clean and day chips. Methyl bromide and aluminium phosphide used for fumigation. Impregnate the bags using Malathion (05%), Fenvalerate (0.1%) or Azadirachtin (Nimbicidin 2%) before storing.
Integrated diseases management	**Cassava mosaic** – Spray crop with systemic pesticides like Rogor or Metasystox@ 0.05%. Rogue-out infected plants and follow strict field sanitation. **White grubs** – Apply Thimet 3G (phorate) granules @ 25-30 kg or Furadan 3G (carbofuran) @ 30-40 kg/hectare. **Spider mites and thrips** - Spray crop with Rogor 30EC (dimethoate) @ 0.05%. **Brown leaf spot** – Spary Bavistin (0.1%). **Anthracnose/die back** – Spray mancozeb @ 0.3% or bavistin @ 0.1% once or twice. **Tuber rot** – Remove infected tubers from field and incorporate *Trichoderma viridae* into soil.
Harvesting	10-11 months after planting
Value addition scope	Roasted, fried, chips, powder, glue, starch, sago, liquid glucose, dextrin, gums, high fructose, syrup, animal feed, etc.

Crop name: Elephant foot yam

Scientific name: *Amorphophallus paeoniifolius* (Dennst.) Nicolson
Local name –
Jharkhand: Jamikhand
Bihar: Jimikand
Odisha: Khamba aloo
West Bengal: oal
Assam: Kath Alu
Season: Kharif

Time of sowing	February- March, May- June
Varieties	Gajendra, Sree Padma, WB/RC-43, WB/RC-44, WB/RC-52, WB/RC-101, WB/RC-175, Santragachi, Kawer, Dharampura, Chakdah, Champadanga, etc.
Appropriate land	Upland with proper drainage
Appropriate soil	Sandy, loam
Botanical properties	Tubers are depressed, globose in shape and dark brown in colour. Leaves are simple, petioles, smooth or warly and variously spotted.
Edible parts	Tubers, leaves

Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.2	0.1	0.8	0.8	50	34	0.6

Seed rate	50-60 Qtls./ha.
Nutrient management	25-30 tons FYM, 40 kg nitrogen, 50 kg phosphorus, 50 kg potash/ ha.
Water management	7-10 day intervals

Integrated pest management	**Mealy bug** – Dip planting material in 0.05% solution of Monocil 36 Sl/Nuvacran 36 SL (monocrotophos) for 10 minutes before planting. **Aphids** – Spray Dimethoate, Quinalphos or Fenthion (0.05%) at 30 and 60 days after planting. **Scale insect** – Dip seed tubers before planting in 0.1% Dimethoate. **Arecanut beetle** – Storing unifested tubers in white sand or saw dust prevents infestation. Store seed tubers in a mixture of sand and Carbaryl dust (10%) in a 100:1 ratio. **Mealy bugs** – Apply Dimethoate (0.05%) solution.
Integrated diseases management	**Collor rot** – Drenching the soil qwith Brasical 0.1% twice at monthly interval commencing from first appearance. **Mosaic** – Rouging the infested plants. **Leaf blight/anthracnose** – Spray Mancozeb (0.2%). **Leaf spots** – Spray Mancozeb or Captan (0.25%) at fortnight interval.
Harvesting	8-10 months after planting
Value addition scope	Chips, flour, etc.

Crop name: Drumstick


Scientific name: *Moringa oleifera* Lam.
Local name –
Jharkhand: Sooty
Bihar: Shahjan/ Munga
Odisha: Sajana Chhoin
West Bengal: Sajna Danta
Assam: Sojina
Season: Kharif/ Summer

Time of sowing	Feb-March, July-September						
Varieties	Chanvakacheri, Muringai, Chemmurungai, Jaffna Type, Kattumurungai, Kodikalmurimgai, Palmurungai, PKM 1, Punamurungai, Yazphanam Muringa, etc.						
Appropriate land	Neutral to slightly acidic, well drained						
Appropriate soil	Sandy red, balck soil						
Botanical properties	Fruit length varies from 25-100 cm. each fruit weighs around 230 g containing 10-20 seeds each an average.						
Edible parts	Flowers, leaves, fruits						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	2.10	0.20	-	3.2	30	50	0.36
Seed rate	500 g/hectare						
Nutrient management	75 tonnes FYM, 90 kg nitrogen, 16 kg phosphorus, 30 kg potash/ plant						
Water management	2 months interval						

Integrated pest management	**Moringa pod fly** – Soil application of Thiamethoxam 25 WG @ 200g a.i. / ha on 150, 180 and 210 days after planting; placement of fermented tomato fruit trap @ 25 / ha; and need based foliar spray of Spinosad 45 SC @ 56g *a.i.* / ha followed by Profenophos 50 EC@ 250g *a.i.* / ha. **Bud worm, leaf caterpillar and leaf webber** – Dust Carbaryl 10 D @ 25 kg/ha or spray Carbaryl 50 WP @ 2 g/l. **Hairy caterpillar** – Use flame torch when the caterpillars settle on the tree trunk.
Integrated diseases management	**Ratoon crop** – Cut back the trees at 90 cm from ground level after the harvest is over. In another 4 – 5 months, plants will again come for harvest. Ratoon crops can be taken for 3 years. Apply the fertilizer dose of 45:15:30 g NPK/plant, within a week after cutting back along with 25 kg of FYM or compost every year.
Harvesting	4-5 months after heading
Value addition scope	Pickles, dehydrated moringa, moringa powder, moringa flesh mesocarp powder, etc.

Crop name: Plantain banana


Scientific name: *Musa paradisiacal* L.
Local name –
Jharkhand: Sabji kela
Bihar: Kachha Kela
Odisha: Kancha kadali
West Bengal: Kaca Kala
Assam: Kaaskol
Season: Rabi/Kharif

Time of sowing	September-October, June-July						
Varieties	Champa, Mortman, Rasthali, Amrit Sagar, Giant Governor, Lacatan and Monthan, Dwarf Cavendish, Robusta, Amritpant, Jahaji, Borjahaj, Dwarf Cavendish, Alpon, Chinia, Chini Champa, Harichal, Poovan, Lal Vekhi, Safed Velchi, etc.						
Appropriate land	Well drained fertile soil with good moisture retention capacity						
Appropriate soil	Loam						
Botanical properties	The fruit is variable in size, color and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind which may be green, yellow, red, purple, or brown when ripe. The fruits grow in clusters hanging from the top of the plant.						
Edible parts	Fruits, flower						
Nutritional values (100 g)	**Protein (g)**	**Fat (g)**	**Total Minerals (g)**	**Crude fibre (g)**	**Calcium (mg)**	**Phosphorus (mg)**	**Iron (mg)**
	1.4	0.2	0.5	0.7	10	39	6.27
Seed rate	4000 to 6000 plant/hectare						
Nutrient management	10 kg FYM, 200 kg nitrogen, 50 kg phosphorus, 300 kg potash/hectare						

Water management	15days to 2 month interval
Integrated pest management	**Rhizome weevil** – Avoid initial infestation by selecting healthy suckers. Do not take several rations in the same field. Clean the suckers before planting and dip in 0.1% Quinalphos dust/pit at the time of planting.after harvesting remove pseudostem. **Pseudostem weevil** – Avoid initial infestation by selecting healthy suckers. Do not take several rations in the same field. Clean the suckers before planting and dip in 0.1% Quinalphos dust/pit at the time of planting.after harvesting remove pseudostem. Insert 3 tablets of aluminium phosphide (0.5g)/plant in the pseudostem. Apply carbofuran @ 3.33 g/plant in the soil. **Aphid** – Spray crop with Phosphamidon (0.05%) or Dimethoate (0.05%). **Flea beetles** – Spray crop with Carbaryl (0.1%).
Integrated diseases management	**Panama Wilt** – Dip suckers in Carbendazim (10g/10 litres of water) followed by bimonthly drenching starting from 6 months after planting is also recommended. Application of bioagents, such as, Trichoderma viride or Pseudomonas fluorescence in the soil is effective. **Leaf Spot, Leaf Streak or Sigatoka Disease** – Spray Dithane M-45 WP (in oil-water emulsion) and Dithane M-45 (in water only). Foliar spray of Copper Oxychloride (3 g/litre of water) or Thiophanate Methyl 1 g/ litres of water). **Anthracnose** – Spray Chlorothanlonil (0.2%) and Bavistin (1 %) four times at 15 days interval. Minimising bruising; proper sanitation of handling and prompt cooling to 14oC are essential in minimising the disease in cold storage. **Cigar End Tip Rot** – Remove pistil and perianth by hand 8-10 days after bunch formation and spraying the bunch with Dithane M -45 (0.1%) or Topsin M (0.1%) controls the disease effectively. **Crown Rot** – Dip bunches or hands in Thiobendazole or Benomyl and/or using fungicide impregnated cellulose pad for packing. **Stem-end Rot** – Minimise bruising; prompt cooling to 14oC; proper sanitation of handling facilities and hot water treatment of hands (such as 5 minutes in 50øC water) helps in controlling the disease in cold storage. **Pseudostem Heart Rot** – Spray Captan or Dithane M-45 or Dithane Z-78. **Head Rot** – Apply good drainage and soil conditioning and use rhizomes with dead central buds and active lateral buds.

	Banana Bunchy Top Virus – Spray with Metasystox (0.1-0.5%). Kill the affected plant with kerosene or herbicides such as 2, 4-D or 2, 4, 5-T. The rhizome should be dug out, cut into small sections and sprayed again so that no suckers can be produced.
Harvesting	90-150 days after planting
Value addition scope	Chips, flour, canned