Good Agricultural Practices (GAP) for

GINGER

(Zingiber officinale Rosc.)

A Practical Guide for Sustainable and Quality Ginger Production

ICAR – Indian Institute of Spices Research
ICAR – All India Coordinated Research Project on Spices
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Foreword

Ginger *(Zingiber officinale* Rosc.) is one of the most important spice crops cultivated in India and is valued for its rhizomes, which are widely used as a spice, condiment and raw material in food, pharmaceutical and nutraceutical industries. India is among the leading producers of ginger in the world, with a production of about 22.46 lakh tonnes from an area of 1.93 lakh hectares during 2024–25. The crop is cultivated across several states, with Madhya Pradesh, Karnataka, Odisha, Assam, West Bengal, Maharashtra and Gujarat together accounting for 72 per cent of the national production.

The adoption of Good Agricultural Practices (GAP) is essential for ensuring sustainable production of high-quality ginger while minimizing adverse impacts on the environment. GAP emphasizes the use of healthy planting materials, balanced nutrient management, efficient water use, integrated pest and disease management, soil and water conservation, and protection of worker health and safety.

This publication has been prepared to provide farmers, extension personnel and other stakeholders with scientifically validated recommendations covering various aspects of ginger cultivation, including planting material selection, field establishment, nutrient management, plant protection, harvesting and post-harvest handling.

I am grateful to Dr. S. K. Singh, Deputy Director General (Horticultural Science) Indian Council of Agricultural Research (ICAR) and Dr. Sudhakar Pandey, Assistant Director General, Horticultural Science, ICAR for their constant support, guidance and encouragement.
The contributions from Spices Board, Directorate of Arecanut and Spices Development, Kerala Agricultural University, and World Spice Organization have helped immensely in fine tuning and curating the content of this publication.

I am confident that this manual will serve as a useful guide for promoting sustainable ginger cultivation, improving productivity and quality, and enhancing the profitability of ginger farming.

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Preface

Ginger cultivation in India has undergone significant changes in recent years owing to changing climatic conditions, increasing pest and disease pressures, and growing demand for quality produce in domestic and international markets. These developments necessitate the adoption of scientifically sound and environmentally sustainable production practices.

This manual presents Good Agricultural Practices (GAP) for ginger cultivation and incorporates recommendations generated through research, field validation and practical experiences from farmers and extension agencies. The publication covers major aspects of ginger production, including planting material selection, seed rhizome treatment and storage, land preparation and planting, nutrient management, water and soil management, weed management, pest and disease management, harvesting, post-harvest handling, and safe use of agrochemicals.

The objective of this manual is to provide a practical reference for farmers, extension personnel and other stakeholders involved in the ginger value chain. Adoption of the recommended practices will help improve productivity, enhance produce quality, ensure food safety and promote sustainable ginger cultivation.

The authors gratefully acknowledge the contributions of scientists, technical staff, farmers and institutions whose efforts have supported the development of these recommendations.

Disclaimer

The crop production, plant protection and post-harvest management recommendations presented in this publication are based on research findings, field evaluations and technical expertise available at the time of publication. Certain products, active ingredients and management practices included in this document may be based on their demonstrated efficacy under experimental, field or validation studies.

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1. Introduction

Ginger (*Zingiber officinale* Rosc.), belonging to the family Zingiberaceae, is an important spice crop cultivated for its underground rhizomes, which are widely used as a spice, condiment and medicinal ingredient. India is one of the leading producers of ginger in the world. During 2024–25, the country produced about 22.46 lakh tonnes of ginger from an area of 1.93 lakh hectares. Major ginger-producing states include Madhya Pradesh, Karnataka, Odisha, Assam, Maharashtra, West Bengal and Gujarat.

Ginger is valued for its characteristic aroma, pungency and medicinal properties. The crop is widely used in fresh, dried, preserved and processed forms and serves as an important raw material for food, pharmaceutical, nutraceutical and beverage industries. Owing to its diverse uses and increasing market demand, ginger cultivation plays a significant role in improving farm income and supporting the spice sector.

The adoption of Good Agricultural Practices (GAP) is essential for ensuring the production of high-quality and safe ginger while promoting environmental sustainability. GAP facilitates efficient use of inputs such as water, fertilizers and plant protection chemicals, reduces pest and disease incidence, improves soil health and enhances productivity and profitability.

2. Climate and Soil Requirements

Climate

Ginger thrives well in warm and humid tropical climates and can be cultivated from sea level up to an altitude of about 1500 m above mean sea level. The crop grows best at temperatures ranging from 20–30°C and requires an annual rainfall of 1300–1500 mm. Moderate rainfall during sprouting and well-distributed rainfall throughout the crop growth period favour optimum growth and rhizome development. Dry weather conditions prior to harvest are desirable for proper rhizome maturation and ease of harvesting.

Soil

Ginger grows best in well-drained soils rich in organic matter. The crop can be cultivated successfully in sandy loam, clay loam, red loam and lateritic soils, provided adequate drainage is ensured. Loose, friable and well-aerated soils with high humus content are ideal for healthy rhizome development. Since ginger is an exhaustive crop that removes substantial quantities of nutrients from the soil, continuous cultivation in the same field should be avoided to maintain soil fertility and to reduce the incidence of pests and diseases.

3. Soil Health and Water Conservation

Maintenance of soil health is essential for sustainable ginger production. Application of organic manures and compost, use of biofertilizers such as *Azospirillum* and phosphate-solubilizing bacteria (PSB), application of beneficial microorganisms including *Trichoderma* and plant growth-promoting rhizobacteria (PGPR), crop rotation with non-host crops like cowpea , mustard etc, and incorporation of neem cake help improve soil fertility, suppress soil-borne pathogens and enhance crop productivity.

Soil and water conservation measures are equally important for successful ginger cultivation. Adoption of raised beds preferably in an east–west direction to ensure uniform sunlight exposure and efficient drainage, provision of adequate drainage channels, mulching with green leaves or straw, and contour planting in sloping lands help prevent soil erosion, conserve moisture and reduce water stagnation around the rhizomes.

4. Varieties

Selection of suitable varieties is an important component of Good Agricultural Practices (GAP). The choice of variety should be based on the intended use (fresh ginger, dry ginger or processing), yield potential, quality attributes, tolerance to major pests and diseases, and adaptability to local agro-climatic conditions. Important ginger varieties released by ICAR–Indian Institute of Spices Research (ICAR-IISR) and other research organizations are presented in Tables 1 and 2.

IISR VARADA

IISR REJATHA

Table 1. Ginger varieties released by ICAR–Indian Institute of Spices Research (ICAR-IISR)

Variety	Fresh mean yield (t ha^{-1})	Area suitability	Characteristic features
IISR Varada	22.6	All ginger-growing regions of India	Suitable for fresh ginger, dry ginger and candy preparation
IISR Mahima	23.2	Kerala	High-yielding variety
IISR Rejatha	22.4	Kerala and Karnataka	High-yielding variety
IISR Vajra	26.4	Kerala, Karnataka, Odisha and West Bengal	High yield with desirable flavour
IISR Navya	36.2	Kerala, West Bengal and Meghalaya	Good quality attributes and less susceptible to rhizome rot
IISR Surasa	24.3	Kerala	Bold rhizomes; suitable for vegetable ginger

IISR MAHIMA

IISR VAJRA

IISR NAVYA

ATHIRA

SOLAN GIRIGANGA

Table 2: List of other promising notified/ released varieties of ginger

Variety	Fresh mean yield (t ha^{-1})	Salient features	Suitability
Kerala Agricultural University, Vellanikkara, Thrissur, Keralam			
Athira	21.0	High gingerol and high zingiberene content with good yield. Suitable for fresh and dry ginger. Tolerant to soft rot and bacterial wilt diseases.	Kerala
Karthika	19.0	High pungency clone with high gingerol. Suitable for fresh and dry ginger. Tolerant to soft rot and bacterial wilt diseases.	Kerala
Aswathy	23.0	Very high essential oil (3.6%) and oleoresin; tolerant to soft rot and bacterial wilt.	Kerala
KAU Chandra	23.5	Ideal for fresh and dry ginger. Suitable for moist humus rich soils of tropics	Kerala
KAU Chitra	22.1	Extra bold rhizomes, Ideal for dry ginger	Kerala

Odisha University of Agriculture & Technology, Pottangi, Odisha			
Suprabha	16.6	Low fibre and suitable for both early and late sowing; moderately resistant to soft rot and leaf spot	Odisha, Chhattisgarh, Andhra Pradesh Madhya Pradesh
Suruchi	12.0	High dry recovery (23%) with low fibre; moderately resistant to soft rot and leaf spot	Odisha Chhattisgarh
Suravi	17.5	High oleoresin content (10.2%) and adaptable to irrigated and rainfed conditions; Moderately resistant to soft rot and leaf spot	Odisha, West Bengal, Chhattisgarh, Andhra Pradesh Madhya Pradesh
Sourabh	14.0	Plumpy rhizomes with good dry recovery	Eastern plateau and hill regions
YS Parmar University of Horticulture & Forestry, Solan, Himachal Pradesh			
Himgiri	13.5	Suitable for rainfed conditions and less susceptible to rhizome rot	Himachal Pradesh
Solan Giriganga	20.0	Less susceptible to rhizome rot with good quality rhizomes	Eastern and western Himalayas
Uttar Banga Krishi Viswa Vidyalaya, Pundibari, West Bengal			
Mohini	14.0	High yield potential.	Kerala, Odisha, Himachal Pradesh, West Bengal

School of Agricultural Sciences and Rural Development (SASARD), Nagaland University, Medziphema, Nagaland			
Sas Kevu	17.2	Bold, soft-textured rhizomes, suitable for fresh use as well as processing into dry ginger	Nagaland, Mizoram, West Bengal, Andhra Pradesh

Ginger varieties can be classified based on their end use as dry ginger, green ginger, or dual-purpose types. Varieties preferred for dry ginger production include Maran, Wayanad, Himachal, KAU Chitra, IISR Mahima, and IISR Vajra due to their desirable dry recovery and processing qualities. For green ginger production, varieties such as Rio-de-Janeiro, Aswathy, SAS KEVU, and IISR Surasa are commonly cultivated for their fresh rhizome characteristics. Dual-purpose varieties suitable for both fresh consumption and dry ginger production include Athira, Karthika, IISR Varada, IISR Rejatha, IISR Mahima, IISR Vajra, and KAU Chandra.

5. Propagation and Planting Material

Ginger is propagated vegetatively using rhizome pieces known as seed rhizomes. Healthy rhizome pieces measuring 2.5–5.0 cm in length and weighing 20–25 g are selected for planting. Each seed rhizome should possess one or two healthy buds to ensure proper sprouting and vigorous crop establishment.

5.1 Seed Rate

The seed rate varies depending on agro-climatic conditions, planting method and size of seed rhizomes used.

Region	Recommended seed rate (kg ha^{-1})
Kerala, Tamil Nadu and Karnataka	1500–1800
North Eastern Hill (NEH) region	2000–2500
Other ginger-growing regions	1500–2000

5.2 Seed Rhizome Treatment

Before planting, stored seed rhizomes should be cut into pieces of 2.5–5.0 cm length weighing 20–25 g, each possessing one or two healthy buds.

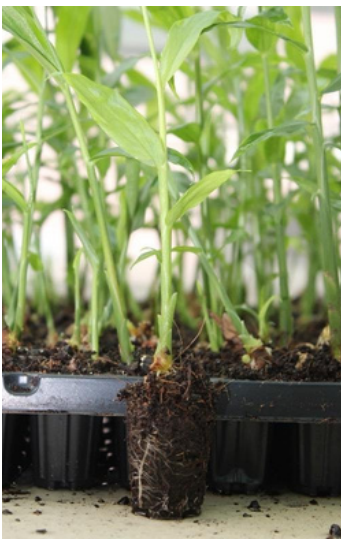
The seed rhizomes may be treated with Metalaxyl 8% + Mancozeb 64% WP (1.25 g/L), Propiconazole 25% EC (1 ml/L) and Imidacloprid 17.8 SL (1 ml/L) for 30 minutes. The treated rhizomes should be shade-dried for 3–4 hours before planting.

Priming of seed rhizomes with Trichoprime @ 5% before to storage (30-60days before e planting) improves bud vigour, enhances sprouting and protects rhizomes from fungal infection during storage.

5.3 Transplanting Using Single Bud Sprouts

Transplanting using single bud sprouts is an efficient technique for reducing seed rhizome requirement and producing healthy planting material.

Healthy, disease-free rhizomes are treated with Metalaxyl + Mancozeb (0.125%) for 30 minutes and stored in a well-ventilated place. About one month before planting, the rhizomes are cut into single-bud pieces weighing 4–6 g and treated again with the same fungicide solution.



The bud pieces are planted in pro-trays containing a nursery medium of coir pith and vermicompost (75:25) enriched with PGPR or *Trichoderma* @ 10 g kg^{-1} of nursery medium. The trays are maintained under shade-net conditions and irrigated as required. Seedlings become ready for transplanting within 30–40 days.

This technique reduces seed rhizome requirement, lowers production costs and ensures healthy and uniform crop establishment.

6. Field Preparation and Planting

The land should be ploughed 4–5 times to obtain a fine tilth. Raised beds of 1 m width and 30 cm height with 50 cm spacing between beds are prepared. Under irrigated conditions, ridges may be formed at 40 cm spacing.

In areas prone to soil-borne diseases, soil solarization using transparent polythene sheets (30–50 micron thickness) for 40–45 days is recommended before planting.

6.1 Planting Season and Spacing

Under rainfed conditions, planting is generally undertaken during the first fortnight of May. Under irrigated conditions, planting can be carried out during February–March. Early planting with the onset of summer showers promotes better crop establishment, higher yield and reduced disease incidence.

Seed rhizomes are planted in shallow pits prepared on raised beds and covered with soil and well-decomposed organic manure. A spacing of 20–25 cm between plants and 20–25 cm between rows is generally followed. In a standard bed measuring 3 m × 1 m, approximately 40 pits can be accommodated.

7. Mulching

Mulching is an important cultural practice in ginger cultivation. It conserves soil moisture, suppresses weeds, reduces soil erosion and enriches the soil with organic matter.

Immediately after planting, beds should be mulched with green leaves or organic residues @ 10–12 t ha^{-1}. Dried coconut leaves (without petioles) or paddy straw (2–3 kg per bed) may also be used. Green leaf mulching should be repeated at 45 and 90 days after planting @ 7.5 t ha^{-1}.

Mulching is preferably carried out after weeding, fertilizer application and earthing up.

8. Shade Management

Ginger grows well under partial shade with approximately 25–50% light interception. The crop is commonly cultivated as an intercrop under coconut, arecanut, coffee and orange plantations where such conditions naturally prevail.
Partial shade reduces heat stress, minimizes foliar disease incidence and promotes better crop growth and rhizome development.

9. Irrigation Management

Ginger requires approximately 1300–1500 mm of water during the crop growth period. Adequate moisture is particularly important during germination, rhizome initiation and rhizome development.

The first irrigation should be given immediately after planting. Subsequent irrigations may be scheduled at 7–10 day intervals depending on soil type and weather conditions.

9.1 Drip Irrigation

Drip irrigation supplies water directly to the root zone, improving water-use efficiency and reducing losses through evaporation. It also minimizes weed growth and reduces foliar disease incidence.

The daily water requirement generally ranges from 1.0–2.5 L per plant depending on crop stage, soil type and prevailing climatic conditions.

9.2 Sprinkler Irrigation

Under sprinkler irrigation, water may be applied at 30–40 mm depth at intervals of 7–10 days depending on soil type and climatic conditions. Usually, about 3–4 hours of sprinkler operation is required to deliver this quantity of water. This helps maintain uniform soil moisture and promotes healthy rhizome development.

10. Nutrient Management

Balanced nutrient management is essential for achieving higher rhizome yield, maintaining soil fertility and ensuring sustainable ginger production. Application of organic manures, inorganic fertilizers and micronutrients based on soil test recommendations helps improve nutrient-use efficiency and crop productivity.

10.1 Organic Manure Application

Application of well-decomposed farmyard manure (FYM) or compost is an integral component of nutrient management in ginger. At the time of planting, FYM or compost @ 25–30 t ha^{-1} should be applied either by broadcasting over the beds before planting or by incorporating it into the planting pits.

Application of neem cake @ 2 t ha^{-1} at planting helps reduce the incidence of rhizome rot and nematode infestation while improving rhizome yield and soil health.

The organic manure requirement is broadly similar across major ginger-growing regions of India. In Kerala, Karnataka and Tamil Nadu, FYM or compost is generally applied @ 25–30 t ha^{-1} along with neem cake @ 1.5–2.0 t ha^{-1}. In the North Eastern Hill (NEH) region, FYM is applied @ 20–25 t ha^{-1} and may be increased to 30 t ha^{-1} in low-fertility soils, together with neem cake @ 2.0 t ha^{-1}.

10.2 Fertilizer Application

Fertilizer requirements vary across states depending on soil fertility, climatic conditions and production systems. State-wise fertilizer recommendations for ginger are presented in Table 3.

Table 3. Fertilizer schedule for ginger in different states of India

State	Recommendation
Kerala	FYM 30 t ha^{-1}; NPK 70:50:50 kg ha^{-1}. Full dose of P may be applied as basal dose. Half of N & K applied at 45 DAP. The remaining quantity of N and K applied at 90 DAP.
Karnataka	FYM/compost 25 t ha^{-1}; NPK 100:50:50 kg ha^{-1}. Apply the entire dose of P and K at planting. Half of N applied at 30-40 DAP and other half at 60-70 DAP.
Odisha	FYM 25 t ha^{-1}; NPK 125:100:100 kg ha^{-1}. Full P applied as basal dose in furrows before planting and N and K in 2 splits at 45 and 90 DAP.
Meghalaya	FYM 10 t ha^{-1}; NPK @ 60:90:60 kg ha^{-1}
Himachal Pradesh	20-30 t FYM/ha, 100:50:60 kg NPK/ha and 15 kg superphosphate/ha. Apply super phosphate and potash at the time of planting and N in 3 equal doses first at the time of planting and subsequent 2 doses at 1 month interval and apply K_2O in splits, half at sowing and another half dose at rhizome initiation (90DAP)
Bihar	20-30 t FYM/ha and NPK @ 60:60:120 kg/ha or 80:50:50 kg/ha.
Andhra Pradesh	20-30 t FYM/ha, 75:50:50 kg NPK/ha.
Chhattisgarh	20-30 t FYM/ha, NPK @ 150:120:120 kg/ha
Sikkim	40-60 tonnes manure/ha.

DAP: Days After Planting

10.3 Site-Specific Nutrient Management

Since soil fertility varies with soil type, agro-ecological conditions and management practices, site-specific nutrient management based on soil test results is recommended.

Fertilizer recommendations for different soil test values of nitrogen, phosphorus and potassium for fresh rhizome yield targets of 25 and 30 t ha^{-1} are presented in Table 4. Fertilizers should be applied in two or three split doses. The entire quantity of phosphorus should be applied as a basal dose at planting. Nitrogen and potassium should be top-dressed in equal splits at 45 and 90 DAP, and where required, an additional split may be applied at 120 DAP.

Table 4. Soil test-based fertilizer recommendations for fresh rhizome yield targets of 25 and 30 t ha^{-1}

Soil test value for available nutrients (kg ha^{-1})	Fertilizer nutrient recommended (kg ha^{-1}) for yield targets	
	25 t ha^{-1}	**30 t ha^{-1}**
Nitrogen		
< 150	250	340
150-250	180	270
250-400	90	175
>400	-	50
Phosphorus (P_2O_5)		
< 10	55	75
10-30	35	55
30-50	15	25
>50	-	5-10
Potassium (K_2O)		
< 110	100	130
110-300	75	100
300-500	35	50
>500	5	15

10.4 Micronutrient Management

Micronutrients play an important role in rhizome development, yield and quality. In zinc-deficient soils, a basal application of zinc fertilizer up to 6 kg Zn ha^{-1} (equivalent to approximately 30 kg zinc sulphate ha^{-1}) is recommended.

In addition, foliar application of a ginger-specific micronutrient mixture (IISR ginger special) @ 5 g L^{-1} should be carried out twice during the crop growth period, at 60 and 90 days after planting (DAP). This helps improve plant nutrition and enhances rhizome yield and quality.

11. Soil Testing

Soil testing is an important component of Good Agricultural Practices (GAP) and provides valuable information on soil fertility status and nutrient availability. Regular soil analysis helps in the adoption of balanced fertilizer schedules, improves nutrient-use efficiency, reduces unnecessary fertilizer application and enhances crop productivity and profitability.

Since ginger is generally cultivated in different plots each season to avoid problems associated with continuous monocropping, growers are advised to undertake soil testing every year and adopt nutrient management practices based on soil test recommendations. Soil testing facilities are available at accredited laboratories of State Departments of Agriculture, State Agricultural Universities (SAUs), ICAR institutes and other recognized soil testing laboratories.
Detailed guidelines for soil sample collection and submission are provided in Annexure I.

12. Weed Management

Effective weed management is essential during the early stages of crop growth, as weeds compete with ginger plants for nutrients, moisture, light and space. Depending on weed intensity, 2–3 hand weedings may be carried out during the crop growth period. Weeding should preferably be undertaken before fertilizer application and mulching operations.

As a chemical weed management option, oxyfluorfen @ 500 ml ha^{-1} may be applied as a pre-emergence herbicide on the second day after planting. This may be followed by quizalofop-ethyl 10% EC @ 1.0 L ha^{-1} as a post-emergence application at 30 days after planting. A final hand weeding at about 90 days after planting helps maintain a weed-free environment during critical stages of rhizome development.

13. Intercultural Operations

Intercultural operations play an important role in maintaining crop health and ensuring optimum rhizome development.

Proper drainage channels should be maintained throughout the cropping period to prevent water stagnation and reduce the incidence of soil-borne diseases.

Earthing up is an essential operation in ginger cultivation and helps prevent rhizome exposure, improves soil aeration and promotes healthy rhizome development. Earthing up should be carried out at 45 and 90 days after planting, preferably after weeding and fertilizer application.

14. Intercropping and Crop Rotation

Crop rotation and intercropping are important components of sustainable ginger production. Rotation with suitable crops helps improve soil health and reduces the build-up of pests and diseases.

Ginger is commonly rotated with crops such as tapioca, finger millet (ragi), paddy, sesame, maize and vegetables. In Karnataka, ginger is often intercropped with finger millet, pigeon pea and castor. The crop is also successfully cultivated as an intercrop under coconut, arecanut, coffee and orange plantations.

Rotation with solanaceous crops such as tomato, potato, chilli and brinjal, as well as groundnut, should be avoided since these crops may serve as alternate hosts for the bacterial wilt pathogen *Ralstonia solanacearum*.

15. Integrated Pest Management

Integrated Pest Management (IPM) is an environmentally sustainable approach that combines cultural, biological and chemical methods for the effective management of pests and diseases while minimizing risks to human health, beneficial organisms and the environment.

Key components of IPM in ginger include the use of healthy and disease-free seed rhizomes, seed treatment prior to planting, soil solarization, crop rotation with non-host crops, field sanitation, and maintenance of proper drainage. Application of biological control agents such as *Trichoderma*, *Pseudomonas fluorescens*, plant growth-promoting rhizobacteria (PGPR) and entomopathogenic microorganisms is encouraged to suppress soil-borne pathogens and improve plant health.

Regular field monitoring should be undertaken for early detection of pests and diseases. Chemical pesticides should be applied only when necessary, using approved products at recommended dosages and in accordance with label instructions. Adoption of IPM practices helps reduce pesticide use, minimizes residue problems and promotes sustainable ginger production.

16. Diseases of Ginger

Ginger is affected by several fungal and bacterial diseases that can significantly reduce rhizome yield and quality.

Adoption of integrated disease management practices, including the use of healthy planting material, crop rotation, biological control agents, field sanitation and need-based application of approved fungicides, is essential for sustainable disease management.

16.1 Soft Rot

Soft rot is the most destructive disease of ginger and is caused by soil-borne species of *Pythium*, particularly *Pythium aphanidermatum* and *P. myriotylum*. Disease development is favoured by high soil moisture and waterlogged conditions during the monsoon period.

Symptoms

Typical symptoms include:

- Water-soaked lesions at the collar region
- Yellowing of leaves
- Lodging of pseudostems
- Soft, foul-smelling rhizome
- Progressive wilting and death of affected plants

Management

- Select well-drained fields and avoid water stagnation.
- Use healthy and disease-free seed rhizomes.
- Treat seed rhizomes with Metalaxyl 8% + Mancozeb 64% WP (1.25 g/L), Propiconazole 25% EC (1 ml/L) and Imidacloprid 17.8 SL (1 ml/L) for 30 minutes before storage and planting.
- Prime the seed rhizomes with Trichoprime @ 5% before storage.
- Adopt soil solarization using transparent polythene sheets for 45–50 days before planting.
- Apply farm yard manure fortified *Trichoderma asperellum* or T. *harzianum* @ 1 kg per bed.
- Apply formulations of *Bacillus amyloliquefaciens* as seed treatment and soil drench.
- Apply *Pseudomonas fluorescens* (2%) + cow dung supernatant (2%) at planting, 2 months and 4 months after planting.
- Remove infected plants and drench the soil with Metalaxyl M 3.3% + Chlorothalonil 33.1% SC, Metalaxyl + Mancozeb (0.125%), Mancozeb (0.3%) or Copper oxychloride (0.2%).

16.2 Bacterial Wilt

Bacterial wilt caused by *Ralstonia solanacearum* is an important soiland seed-borne disease of ginger.

Symptoms

Typical symptoms include:

- Drooping and downward curling of lower leaves
- Initial green wilting of the plant followed by yellowing
- Browning of vascular tissues
- Milky bacterial ooze from cut pseudostems
- Plant collapse under severe infection

Management

- Follow all recommended soft rot management practices.
- Use disease-free seed rhizomes.
- Avoid continuous cultivation of ginger in the same field.
- Avoid fields previously cultivated with solanaceous crops.
- Solarize nursery beds and planting beds using transparent polythene (100 micron) for 45–50 days.
- Drench with calcium chloride (3%) at planting and at 30, 45, 60 and 90 days after planting.
- Treat seed rhizomes with *Bacillus licheniformis* (2%) @ 2 kg per 100 L water.
- Drench soil with 1% bacterial suspension of *Bacillus licheniformis* at planting and at 30, 45, 60 and 90 days after planting.

16.3 Leaf Spots

Leaf spot diseases are caused mainly by *Phyllosticta zingiberi, Colletotrichum gloeosporioides* and *C. capsici.*

Symptoms

Symptoms caused by *Phyllosticta zingiberi* include:

- White spots with brown margins
- Yellow halo surrounding lesions
- Coalescence of lesions leading to large necrotic patches

Symptoms caused by *Colletotrichum spp*. include:

- Elliptical brown lesions with yellow halos
- Expansion and coalescence of lesions
- Drying of affected leaves

Management

- Remove and destroy infected leaves and plant debris.
- Adopt crop rotation and avoid successive cultivation of zingiberaceous and solanaceous crops.
- Spray Hexaconazole (0.1%) or Propiconazole (0.1%) and repeat twice at 20-day intervals.
- Alternatively, spray Mancozeb (0.2%) or Bordeaux mixture (1%) at 15-day intervals.

16.4 Leaf Blight

Leaf blight caused by *Exserohilum rostratum* is an emerging disease in several ginger-growing regions.

Symptoms

Typical symptoms include:

- Reddish-brown lesions surrounded by yellow halos
- Enlargement and coalescence of lesions
- Extensive blighting and drying of leaves

Management

- Treat seed rhizomes with recommended fungicides before planting.
- Spray Tebuconazole (0.1%) at disease initiation.
- Alternate sprays of Tebuconazole (0.1%), Bordeaux mixture (1%) or Mancozeb (0.2%) at fortnightly intervals.

16.5 Leaf Blast

Leaf blast caused by *Pyricularia* spp. is an emerging disease of ginger capable of causing significant yield loss.

Symptoms

Typical symptoms include:

- Yellowing of leaves
- Black to dark olive-green spots surrounded by an yellow halo
- Rapid spread under favourable conditions
- Reduction in rhizome yield and quality due to loss of photosynthetic area

Disease development is favoured by high humidity (≥90%), temperatures of 25–28°C and prolonged leaf wetness.

Management

- Treat seed rhizomes with Metalaxyl 8% + Mancozeb 64% WP (1.25 g/L), Propiconazole 25% EC (1 ml/L) and Imidacloprid 17.8 SL (1 ml/L) before storage and planting.
- Apply prophylactic sprays of Propiconazole or Tebuconazole (1 ml/L) at 3–4 months after planting.
- Initiate spraying immediately upon appearance of initial symptoms.
- Repeat spraying after 10–15 days using the same fungicide or a combination fungicide such as Tebuconazole + Azoxystrobin.

16.6 Dry Rot

Dry rot caused by *Macrophomina phaseolina* is an important disease of ginger that often remains latent during the cropping period and becomes evident during storage, leading to considerable post-harvest losses.

Symptoms

Typical symptoms include:

- Yellowing of pseudostems during crop maturity
- Drying and shrivelling of rhizomes
- Elongated brown to black streaks inside the rhizomes
- Presence of black mycelial growth extending from the cut end towards the tip.
- Reduction in rhizome quality and marketability during storage

Disease development is favoured by warm conditions, moisture stress, and crop maturity, with symptoms often becoming prominent during the post-monsoon period and storage.

Management

- Use healthy, disease-free seed rhizomes for planting.
- Avoid mechanical injury to rhizomes during harvesting and handling.
- Treat seed rhizomes with Metalaxyl 8% + Mancozeb 64% WP (1.25 g/L), Propiconazole 25% EC (1 ml/L) and Imidacloprid 17.8 SL (1 ml/L) before storage and planting.
- Ensure proper curing and storage of rhizomes under dry, well-ventilated conditions.
- Avoid prolonged storage under high humidity.
- Follow crop rotation and avoid repeated planting of ginger in the same field.
- Spray and drench Propiconazole or Tebuconazole (1 ml/L) or Carbendazim + Mancozeb (0.2%) if early yellowing symptoms are observed in the field.

Table 5. Indicative Disease Management Schedule for Ginger

Disease	Management Practice	Time of Application
Soft rot	Seed rhizome treatment + soil application of *Trichoderma* + need-based drenching with approved fungicides	Before planting and during monsoon
Bacterial wilt	Seed treatment, soil solarization, biological agents and calcium chloride drenching	Before planting and during crop growth
Leaf spots	Hexaconazole (0.1%) or Propiconazole (0.1%)	At disease initiation; repeat at 20-day intervals
Leaf blight	Tebuconazole (0.1%) or Mancozeb (0.2%)	At disease initiation; repeat at 15-day intervals
Leaf blast	Propiconazole or Tebuconazole (1 ml/L)	Prophylactic sprays at 3–4 months after planting. At symptom appearance; repeat after 10–15 days

Note: (i) The schedule is intended as a general guide. Plant protection measures should be adopted based on pest and disease incidence, prevailing weather conditions and currently approved recommendations. Users should verify the latest CIB&RC-approved labels and registrations before use.

(ii) The plant protection measures listed in this schedule are intended as general guidance based on available research findings and recommendations. Pesticide registrations and recommendations are subject to change.

17. Insect Pests of Ginger

Several insect pests infest ginger and cause damage to leaves, pseudostems and rhizomes, resulting in yield loss and reduction in planting material quality. Adoption of integrated pest management practices involving field sanitation, monitoring and need-based application of approved insecticides is essential for effective pest management.

17.1 Shoot Borer

Shoot borer *(Conogethes punctiferalis)* is the most important insect pest of ginger. The larvae bore into pseudostems and feed on internal tissues, causing yellowing and drying of leaves.

Symptoms

Typical symptoms include:

- Initial feeding symptoms appear as whitish streaks or patches along the margins of the topmost leaves.
- Bore holes on pseudostems
- Extrusion of frass through entry holes
- Yellowing and drying of leaves
- Withering of the central shoot

Damage symptom on pseudostem

The pest incidence is generally higher during September–October.

Management

- Monitor the crop regularly for early symptoms of infestation.
- Initiate control measures when feeding symptoms appear on the margins of the topmost leaves.
- Spray Chlorantraniliprole (0.01%), Flubendiamide (0.02%) or Spinosad (0.0225%) for effective management.
- Alternatively, apply Chlorantraniliprole (0.01%) and Spinosad (0.0225%) alternately at 15–21-day intervals.
- Begin spraying from the second fortnight of July (or about 45 days after planting) and continue up to the first fortnight of November, depending on pest incidence.
- Spray neem oil @ 5 ml L^{-1} along with recommended cultural practices as part of an integrated pest management approach.

17.2 Rhizome Scale

Rhizome scale *(Aspidiella hartii)* infests ginger rhizomes both in the field and during storage. The pest feeds on plant sap, causing shrivelling and desiccation of rhizomes, thereby reducing sprouting and germination.

Infestation by ginger scale insects

Symptoms

Typical symptoms include:

- Brown to grey scale encrustations on rhizome surface
- Shrivelling of rhizomes
- Desiccation of seed rhizomes
- Poor sprouting and reduced germination

Management

- Harvest the crop at the appropriate stage and discard heavily infested rhizomes.
- Treat seed rhizomes with imidacloprid 17.8% SL (1 ml/L) for 20–30 minutes before storage and planting.
- Storage of ginger seed rhizomes using sand, sawdust, neem leaves, and *Strychnos nux vomica*) leaves is a traditional method adopted to maintain moisture balance and reduce storage losses. In this method, rhizomes are layered alternately with clean, dry sand or sawdust, along with botanicals such as neem leaves and *Strychnos* leaves, which help in repelling pests and suppressing microbial growth. This storage practice maintains adequate aeration, minimizes desiccation, and reduces the incidence of rotting during the storage period, thereby ensuring better seed quality for planting.

17.3 Leaf Roller

Leaf roller *(Udaspes folus)* is a minor pest of ginger. The larvae fold leaves and feed from within the folded portions.

Symptoms

- Typical symptoms include:
- Folding and rolling of leaves
- Feeding damage within folded leaves
- Reduction in photosynthetic area under severe infestation

The pest is commonly observed during the monsoon season.

Management

- Remove and destroy severely infested leaves.
- Maintain field sanitation and regular crop monitoring.
- Management practices recommended for shoot borer are generally effective against leaf roller infestations.

Table 6. Indicative Insect Pest Management Schedule for Ginger

Pest	Management Practice	Period
Shoot borer	Chlorantraniliprole (0.01%), Flubendiamide (0.02%) or Spinosad (0.0225%)	July–November based on incidence
Rhizome scale	Seed rhizome treatment before storage and planting	Before storage and planting
Leaf roller	Management practices recommended for shoot borer	As and when observed

18. Nematode Pests

Plant-parasitic nematodes are important soil-borne pests of ginger and can cause significant reductions in rhizome yield and quality. The major nematode species associated with ginger are root-knot nematodes (*Meloidogyne* spp.), burrowing nematode (*Radopholus similis*) and lesion nematodes (*Pratylenchus* spp.). Nematode infestation predisposes plants to secondary infections by soil-borne pathogens and increases the incidence of rhizome rot.

Symptoms

Typical symptoms include:

- Stunted plant growth
- Yellowing and chlorosis of leaves
- Poor tillering and reduced vigour
- Root galls and lesions
- Damaged feeder roots
- Reduced rhizome development and yield

Nematode infested root of ginger

Management

- Use healthy seeds from plots free of nematode Infestation.
- Treat seed rhizomes in hot water at 50°C for 10 minutes before planting.
- Solarize nursery and planting beds for about 40 days before planting.
- Grow tolerant or resistant varieties such as IISR Mahima in nematode-prone areas.
- Apply *Pochonia chlamydosporia* @ 20 g per bed at planting.
- Incorporate neem cake and organic manures to improve soil health and suppress nematode populations.
- Follow crop rotation with non-host crops to reduce nematode build-up in the soil.

Nematode affected ginger field

19. Harvesting

Ginger attains full maturity in about 210–240 days after planting. For dry ginger production, harvesting is carried out at full maturity when the leaves turn yellow and begin to dry. Irrigation should be withheld about one month prior to harvest to facilitate proper curing of rhizomes.

The rhizome clumps are carefully lifted using a spade or digging fork, and in large-scale cultivation, mechanical harvesters may also be used. After harvesting, roots, dried leaves and adhering soil are removed manually.

In India, fresh green ginger is primarily consumed in the domestic market, whereas bleached and unbleached dry ginger are produced mainly for processing and export. The suitability of rhizomes for different end uses depends on fibre content, volatile oil content and pungency, which are influenced by the stage of harvest.

Farmers sometimes practice delayed harvesting in ginger, as the crop can remain in the field for a few additional months without significant deterioration in rhizome quality. This provides flexibility in harvest scheduling according to market demand. During the extended field period, plant protection measures are important to prevent rhizome infections. Application of *Trichoderma*-based biocapsule solution on the dried foliage helps suppress soil-borne and fungal pathogens. In addition, light irrigation may be provided at intervals to maintain adequate soil moisture and prevent excessive drying and stress to the rhizomes.

Table 7. Stage of harvest of ginger for different end uses

End use	Stage of harvest (months after planting)
Vegetable purpose and preparation of ginger preserve, candy, soft drinks, pickles and alcoholic beverages	5-6
Dried ginger and preparation of ginger oil, oleoresin, dehydrated and bleached ginger	7-8

20. Post-Harvest Handling and Processing

20.1 Cleaning and Grading

After harvest, rhizomes are cleaned by removing roots and adhering soil, followed by thorough washing. The rhizomes are then sorted and graded based on size, quality and physical appearance to ensure uniformity for processing and marketing.

20.2 Preparation of Dry Ginger

Dry ginger preparation mainly involves peeling and drying of mature rhizomes. The outer skin is removed by gentle scraping using bamboo splits or similar tools. Deep scraping with knives should be avoided as it damages oil-bearing cells beneath the skin and reduces essential oil content.

In India, most dry ginger is prepared as rough-peeled (unbleached) ginger, where only the flat surfaces are lightly scraped before drying.

20.3 Drying

Fresh ginger contains about 80–82% moisture, which is reduced to approximately 12% during drying for safe storage.

The rhizomes are spread in a single layer and sun-dried for about 8–10 days until they attain a characteristic brown colour and wrinkled appearance. Dry ginger recovery generally ranges from 19–25% of fresh rhizome weight, depending on variety and climatic conditions.

20.4 Polishing and Bleaching

Polishing is carried out by rubbing dried rhizomes against a hard surface to remove wrinkles and loose skin, thereby improving appearance and market value.
Bleached ginger is prepared by dipping scraped rhizomes in slaked lime slurry (1 kg lime in 120 kg water), followed by sun drying. The process is repeated until the rhizomes attain a uniform white colour. This process improves visual appearance and enhances resistance to insect infestation during storage and transport.

21. Storage and Quality Standards

Storage

- Fresh ginger

Cold storage is an effective method for preserving fresh ginger for long periods. The optimum storage conditions are a temperature of about 15°C and relative humidity of around 65%, under which ginger can be stored for up to 200 days. Rhizomes are harvested, cleaned to remove adhering soil, and then shade-dried before storage. Pre-cooling at about 17°C is recommended before storage, and ginger should be packed in ventilated bags or containers to avoid damage.

During storage, quality deterioration may occur due to peeling, shrinkage, softening, purple skin development, and sprouting.

Hence, regular monitoring of temperature, humidity, and rhizome condition is essential, along with timely removal of spoiled material and proper maintenance of storage hygiene.

- Dry ginger

Dry ginger should be stored only after adequate drying to a safe moisture level. Fully dried rhizomes are preferably packed in moisture-proof containers such as HDPE bags and stored in a clean, dry storage rooms. Dry ginger stored in gunny bags may be attacked by the cigarette beetle (*Lasioderma serricorne*). Proper storage helps preserve quality, aroma and pungency. Prolonged storage beyond two years may result in deterioration of flavour and reduction in volatile oil content.

Quality Standards

Dried ginger and ginger powder intended for domestic and export markets should conform to the quality standards prescribed by the Food Safety and Standards Authority of India (FSSAI).

Table 8. FSSAI standards for dried ginger (whole)

S.No.	Descriptions	Value
i.	Extraneous matter	Not more than 1.0 percent by weight
ii.	Moisture	Not more than 12.0 percent by weight
iii.	Total ash on dry basis	
	(a) Unbleached	Not more than 8.0 percent by weight
	(b) Bleached	Not more than 12.0 percent by weight
iv.	Calcium as Calcium oxide on dry basis	
	(a) Unbleached	Not more than 1.1 percent by weight
	(b) Bleached	Not more than 2.5 percent by weight
v.	Volatile oil content on dry basis	Not less than 1.5 percent by v/w
vi.	Insect damaged matter	Not more than 1.0 percent by weight

Table 9. FSSAI standards for ginger powder

S.No.	Descriptions	Value
i.	Moisture	Not more than 12.0 per cent by weight
ii.	Total ash on dry basis	
	(a) Unbleached	Not more than 8.0 per cent by weight
	(b) Bleached	Not more than 12.0 per cent by weight
iii.	Calcium as Calcium oxide on dry basis	
	(a) Unbleached	Not more than 1.1 per cent by weight
	(b) Bleached	Not more than 2.5 per cent by weight
iv.	Volatile oil content on dry basis	Not less than 1.0 per cent by weight
v.	Water soluble ash on dry basis	Not less than 1.7 per cent by weight
vi.	Acid insoluble ash on dry basis	Not more than 1.0 per cent by weight
vii.	Alcohol (90% v/w) soluble extract on dry basis	Not less than 5.1 per cent by weight
viii.	Cold water-soluble extract on dry basis	Not less than 10.9 per cent

22. GAP Checklist for Ginger Farmers

Before and during crop production, farmers should ensure compliance with the following Good Agricultural Practices (GAP):

- ✓ Use healthy, disease-free and certified seed rhizomes.
- ✓ Treat seed rhizomes before storage and planting to minimize seed- and soil-borne diseases.
- ✓ Select well-drained soils and avoid waterlogging.
- ✓ Follow recommended planting season, spacing and planting methods.
- ✓ Apply organic manures, biofertilizers and fertilizers based on soil test recommendations.
- ✓ Maintain proper drainage and adopt soil and water conservation measures.
- ✓ Practice timely mulching, weeding, earthing up and other intercultural operations.
- ✓ Follow crop rotation with suitable non-host crops and avoid continuous cultivation of ginger in the same field.
- ✓ Adopt integrated pest, disease and nematode management practices.
- ✓ Use only approved pesticides and follow recommended dosages and waiting periods.
- ✓ Wear appropriate personal protective equipment (PPE) while handling agrochemicals.
- ✓ Maintain records of fertilizer application, pesticide use and harvesting operations.
- ✓ Harvest rhizomes at the appropriate maturity stage for the intended end use.
- ✓ Follow recommended post-harvest handling, drying and processing practices.
- ✓ Store rhizomes and dry ginger under clean, dry and hygienic conditions.
- ✓ Maintain traceability records to ensure quality assurance and market compliance.

Adoption of these Good Agricultural Practices helps improve productivity, enhance rhizome quality, ensure food safety and promote sustainable ginger cultivation.

Annexure I. Soil Sampling Procedure

Soil testing is an important component of Good Agricultural Practices (GAP) and helps in assessing soil fertility status and nutrient availability. Representative soil samples should be collected carefully, preferably before planting or fertilizer application.

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Annexure II. Preparation of Bordeaux Mixture and Mass Multiplication of Trichoderma

A. Preparation of Bordeaux Mixture (1%)

(AI generated image)

B. Mass Multiplication of Trichoderma (On-Farm Method)

1. Powder dry neem cake and well-decomposed cow dung separately.
2. Mix neem cake and cow dung in a 1:9 ratio.
3. Sprinkle water uniformly to obtain adequate moisture (i.e., it becomes moist but not dripping, and a handful of mixture holds together without releasing water)
4. Add commercial Trichoderma formulation @ 1–2 kg per 100 kg of substrate mixture.
5. Mix thoroughly to ensure uniform distribution.
6. Cover the mixture with perforated polyethylene sheet or newspaper and keep under shade.
7. Turn the mixture once after 7 days to facilitate aeration and uniform fungal growth.
8. The enriched bio-product becomes ready for use after about 15 days.

The enriched Trichoderma formulation may be applied to nursery beds, planting pits or crop beds as part of an integrated disease management programme for suppression of soil-borne pathogens.

Annexure III. Worker Safety, Hygiene and Safe Use of Pesticides

(AI generated image)

Annexure IV. Measures to Minimize Pesticide Residues in Ginger

To ensure residue-safe ginger production and compliance with domestic and export market requirements, farmers should adopt the following practices:

- Follow Integrated Pest Management (IPM) principles.
- Use only approved pesticides at recommended dosages.
- Avoid unnecessary and repeated pesticide applications.
- Rotate pesticides with different modes of action whenever possible.
- Observe recommended waiting periods before harvest.
- Prefer spot treatment rather than blanket spraying.
- Maintain field sanitation and remove infected plant parts promptly.
- Calibrate spraying equipment regularly.
- Maintain records of pesticide applications including product used, dosage, date of application and harvest date.
- Use clean water for preparation of spray solutions.
- Prevent contamination of harvested produce during handling, processing and storage.

Adoption of these practices helps minimize pesticide residues and enhances market acceptability of ginger in domestic and export markets.

Annexure V. Pesticides Approved for Use in Ginger

S. No.	Recommended pesticide	Target disease	Dosage (ml ha^{-1})	Waiting period (days)	Toxicity class
1	Metalaxyl M 3.3% + Chlorothalonil 33.1% SC	Rhizome rot (soil drench)	2000	193	Blue

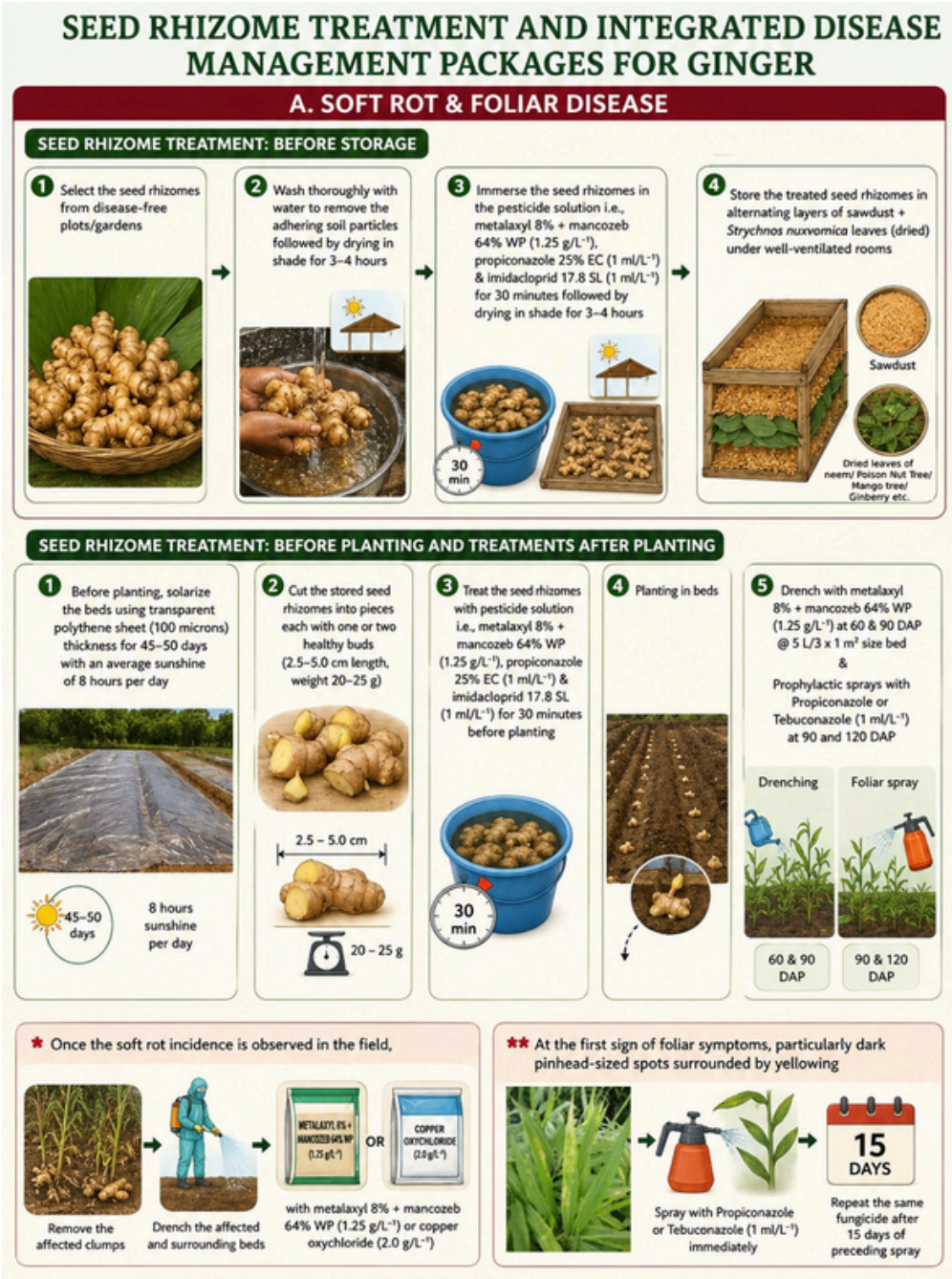
Note: At present, only a limited number of pesticides are registered specifically for use in ginger. Users are advised to consult the latest CIB&RC notifications and recommendations issued by ICAR institutes, State Agricultural Universities and State Departments of Agriculture before use.

Annexure VI. Nutrient Deficiency Symptoms and Corrective Measures in Ginger

Nutrient	Deficiency symptoms	Corrective measures
Nitrogen (N)	Yellowing of lower leaves, poor growth, small leaves, delayed maturity	Apply recommended nitrogen fertilizers based on soil test results; foliar spray of urea @ 10 g/L at 15-day intervals if required
Phosphorus (P)	Purpling of leaf underside, poor root growth, small rhizomes	Apply SSP, rock phosphate or bone meal; maintain soil pH 6.5–7.5; use PSB
Potassium (K)	Marginal yellowing and scorching, necrotic spots, wilting	Apply MOP in split doses; incorporate organic matter; foliar spray SOP @ 10 g/L
Calcium (Ca)	Deformed young leaves, weak roots	Apply lime or gypsum as appropriate; maintain adequate boron availability
Magnesium (Mg)	Interveinal chlorosis of older leaves	Apply magnesium sulphate or dolomite
Sulphur (S)	General yellowing, reduced aroma, delayed maturity	Apply sulphur-containing fertilizers such as SSP or ammonium sulphate
Boron (B)	Death of growing point, curled leaves	Apply borax through soil or foliar spray
Iron (Fe)	Interveinal chlorosis of young leaves	Apply ferrous sulphate
Manganese (Mn)	Mottled chlorosis in young leaves	Foliar spray manganese sulphate @ 5 g/L
Zinc (Zn)	Small leaves, rosetting, interveinal chlorosis	Apply zinc sulphate and avoid excessive phosphorus application

Annexure VII. Seed Rhizome Treatment and Integrated Disease Management Packages for Ginger

A. SOFT ROT & FOLIAR DISEASE



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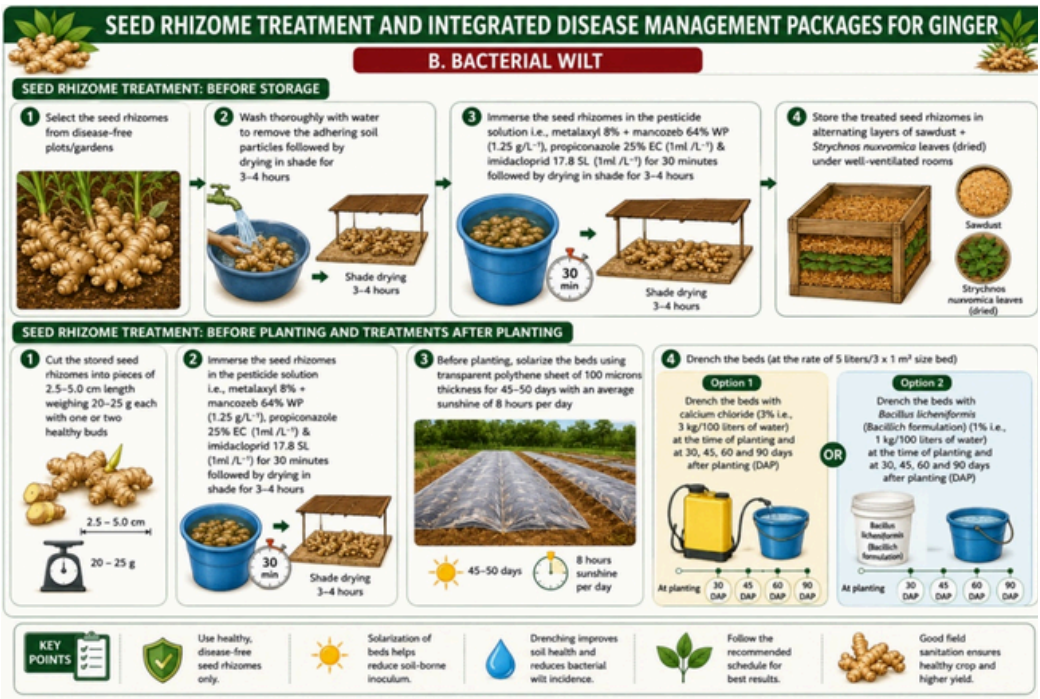
*Once the soft rot incidence is observed in the field, remove the affected clumps and drench the affected and surrounding beds with metalaxyl 8% + mancozeb 64% WP (1.25 g/L^{-1}) or copper oxychloride (2.0 g/L^{-1})

**At the first sign of foliar symptoms, particularly dark pinhead-sized spots surrounded by yellowing spray with Propiconazole or Tebuconazole (1ml /L^{-1}) immediately and repeat the same fungicide after 15 days of preceding spray.

B. BACTERIAL WILT



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C. SOFT ROT – ORGANIC PACKAGE

Apply *Trichoderma* capsules in FYM @ 5kg / 3x1 m bed
(one capsule in 10 L of water, mix this with 100 kg FYM)

⬇

Cut the stored seed rhizomes into pieces each with one or two healthy buds
(2.5-5.0 cm length, weight 20-25 g)

⬇

Treat the rhizomes with [a]*Bacillus amyloliquefaciens* (GRB 35) capsule
at the time of planting

⬇

Planting in beds

⬇

[b]30 DAP- Drench with Bacillich capsules
(One capsule in 200L water, 5 L/bed)

⬇

[c]45 DAP -Drench with *Trichoderma asperellum* capsules
(@ One capsule in 200L water, 5 L/bed)

⬇

60 DAP- Drench with Bacillich capsules
(@One capsule in 200L water, 5 L/bed)
&
Foliar spray of micronutrient mixtures (5g/L)

⬇

[d]90 DAP - Drench with Bacillus amyloliquefaciens -GRB 35
(@One capsule in 200L water, 5 L/bed)
&
Foliar spray of micronutrient mixtures (5g/L)

⬇

120 DAP -Drench with Trichoderma asperellum capsules
(@ One capsule in 200L water, 5 L/bed)
Repeat drenching with Trichoderma asperellum capsules
at 150 & 180 DAP (OPTIONAL)

[a]Seed treatment with GRB 35 capsule

- Activate GRB 35 capsule in 1 litre of boiled and cooled water.
- Incubate the solution for 6-8 h with intermittent stirring (2-3 times).
- Dilute the stock solution with 50 L of normal water.
- Soak the rhizomes (25kg) in the above suspension for 30 minutes, dry under shade and store. The same solution can be used thrice.

[b&d] Soil drenching with Bacillich /*Bacillus amyloliquefaciens* GRB 35

- Activate 1 capsule in 1 litre of boiled and cooled water.
- Incubate the solution for 6-8 h with intermittent stirring (2-3 times).
- The resultant stock solution can be diluted to 200 L of normal water.
- Drench ginger beds @ 5L per bed

[c]Soil drenching with *Trichoderma asperellum* capsules

- Dissolve one Trichoderma capsule in 1litre of sterile water (Water boiled and then cooled to room temperature).
- Then dilute the 1L solution to 200 times using normal water.
- Drench ginger beds 5L per bed 3 x1 m2 bed.
- The prepared solution can be applied as soil drench to the base of plants in required quantity within 2h of preparation.

For Further Information

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