

7. Keep the field weed free. After every weeding, earthing up should be done. No rhizome should be exposed to direct sunlight.
8. Suitable intercropping with soybean, French bean, cowpea, and chilli may be practiced.
9. Apply only well-decomposed cow dung compost. If white grub (*Khumley*) attack is noticed, apply neem cake or *Bacillus thuringiensis* or *Metarrhizium anisopliae* @ 3.0 g/l water as soil drench.
10. Select fully mature seed rhizomes for storage free from insects and diseases attack.
11. One should adopt Integrated Pest Management (IPM) strategies as a rule for the overall management of insect pests and diseases in this hilly state. Encourage natural bio-control agents and other cultural practices for the management of the insect pest and diseases.
12. As soon as insect-pest or disease appear farmers should immediately inform the nearest resource/developmental agencies.
13. Local varieties are very promising but their regular cultivation may pose some degeneration problem, therefore, selection of healthy and bold rhizomes should be mandatory and regular practice.

HARVESTING, YIELD AND STORAGE

Ginger as fresh crop should be harvested before attaining full maturity means when rhizomes are still tender, low in pungency and fibre content, usually from fifth month onwards after planting. Harvesting for the preserved ginger should be done after 5-7 months of planting while harvest for dried spices and oil is best at full maturity *i.e.*, between 8-9 months after planting when the leaves start yellowing. Rhizomes to be used for planting material should be harvested after the leaves become completely dry. After digging, rhizomes should be dried in shade and stored in pits covered with 20 cm layer of sand alternating every 30 cm layer of rhizomes. These pits should be dug under thatched roof to protect the rhizomes from rain, water and direct sun. Average yield varies from 12-15 tonnes per hectare. However, recovery of dry ginger varies from 20-22 per cent. Presently, the average productivity in the state is a lowly 4.96 t/ha which provides ample opportunities to more than double the production in view of the yield potential.



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ORGANIC GINGER PRODUCTION TECHNOLOGY

Under Tribal Sub Plan



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INTRODUCTION

Ginger (*Zingiber officinale*) locally known as "Adua" is an important cash crop grown in Sikkim. Ginger is predominantly cultivated in all the districts of Sikkim in mandarin-ginger, maize-ginger, beans-ginger and various other cropping systems. In Sikkim, ginger is marketed mostly as fresh rhizome and processing industry is in infancy stage. However, different products like ginger oil, powder, paste and ginger oleoresin can be prepared on large scale for export which is very common in the developed countries.



CLIMATE

Ginger is a tropical plant and requires warm humid climate for its cultivation. Ginger is grown from 300-1500 m amsl in Sikkim, where the temperature remains higher during the growing period. Well distributed rain during growing season *i.e.*, from April to October is ideal for its cultivation. Dry weather with average temperature range of 28-30°C for about a month before harvesting produces good yield of ginger.

SOILS

Ideally, for ginger cultivation good garden soil, rich in humus, light, loose, friable, with good drainage and aeration with at least 30 cm depth is preferred. It grows well in sandy loam soils with pH of 6-7.5 however, rhizome growth is better on slightly acidic soil. Preparation of land starts with the receipt of early rain. Generally 2-3 ploughing is recommended or the land is dug 2-3 times to obtain bed fine tilth before sowing. Beds of about 75-100 cm in width raised about 15-20 cm should be used for sowing. Raised beds with gentle outward slope avoid water-logging in the ginger field.

CULTIVARS

The important local cultivars grown in the state are *Bhaise*, *Gorubathane* and *Majhauley*



Bhaise



Gorubathane



Majhauley

SEED RATE AND SOWING

Ginger is propagated by portions of the rhizome known as seed rhizomes. Carefully preserved seed rhizomes selected from the previous season through morphological diseases and insect pest-free appearance are cut into small pieces of 2.5-5 cm length weighing 40-50 g each having one or two good buds are suitable for planting. In Sikkim, seed rate is very high because farmers use seed rhizomes of around 150 g. At higher altitudes the seed rate may vary from 2000 to 2500 kg per ha.

Sowing starts from last week of February to early-March and continues till April. Ginger seed rhizomes are line sown in shallow rows on raised beds with a hand hoe and covered with thin layer of soil and leveled. Before sowing the seed rhizomes should be treated with 47°C hot water, biocontrol agents (*Trichoderma viride* @ 2 per cent) for 30 min., drained and then planted at spacing of row to row 30-45 cm and plant to plant 15-20 cm. Depending on the width of the bed, ginger is sown in 2-4 lines. When the crop is intercropped with maize, the planting distance of 60-90 cm between rows is maintained and maize is sown in between the rows of ginger.

ORGANIC NUTRIENT MANAGEMENT

At the time of planting, well-decomposed farmyard manure or compost @ 40-50 t/ha, neem cake @ 2 t/ha, biofertilizer (*Azospirillum* + PSB) @ 5-6 kg/ha applied in rows at the time of planting helps in reduced incidence of rhizome rot and increases the yield. Two months after planting, vermicompost @ 5 t/ha should also be applied for better growth and production. Prior to planting of the seed rhizome in the soil, six-inch cushion of leaves increases the production of ginger by the loosening of soil texture around seed rhizome at later stages.



TIME SCHEDULE OF AGRONOMIC ACTIVITIES IN GINGER PRODUCTION

#	Activity	Time
1.	Collection of dry leaf for mulching and cushioning	Dec.-Jan.
2.	Field preparation and FYM application	Jan.-Feb.
3.	Planting rhizomes on ridges and mulching immediately after planting	Mar.-Apr.
4.	Making drainage channels to drain off the excess water during rain	Mar.-Apr.
5.	Removal of weeds and application of additional FYM and manure followed by mulching	May-June
6.	Application of Bordeaux mixture (1:1:10) at 15 days interval or at the first appearance of initial symptom of bacterial wilt or soft rot	Jul.-Sept.
7.	Water application to be stopped one month before harvest	
8.	Harvesting	Oct.- Mar.

SUGGESTIONS FOR BETTER PRODUCTION

1. Procure ginger seed from the areas/fields with no disease incidence.
2. Always use healthy rhizomes for sowing.
3. Always use well-decomposed cow dung manure/FYM/compost in the field.
4. Follow crop rotation of at least 3-4 years and avoid water-logging in the ginger field.
5. Try to avoid removal of mother rhizomes (*mau*) as it enhances disease incidence and intensity.
6. After sowing the rhizomes cover the beds with dry leaves of *Schima wallichii* (*Chilaune*) / and other suitable organic mulching materials.