



### Good Agricultural Practices (GAP) for Quality Ginger Production

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Ginger is an important underground spice crop and India is the largest producer of dry ginger in the world. It has medicinal use since ancient time. It is an annual and herbaceous plant. The underground rhizome grows horizontally and has thick, flattened, branched, covered with small scale leaves and fibrous roots. Shoots get dry within a year, however, underground rhizome again sprouts under occurrence of suitable climatic condition. It is used in many ways like fresh ginger, fried ginger and extracted oil.

#### Introduction

Ginger (*Zingiber officinale* R. family Zingiberaceae) has been cultivated since ancient period in many parts of the world. It is believed to be originated in South East Asia especially in India. It is a tropical crop and commercially cultivated in Kerala, Karnataka, Orissa, Andhra Pradesh, Maharashtra, Madhya Pradesh and North Eastern States. It is grown as sole or as inter-cropping with coconut, arecanut, black pepper and fruit orchard. Fresh ginger is exported mainly to USA, UAE, Japan, Netherland, Germany, Pakistan etc. which provides good foreign currency to the government. Cochin ginger is very much demanded for export purpose. One third of the production of ginger in the country is exported. Kerala is the largest producer of ginger accounting for more than 40% of the total countries production. In Madhya Pradesh, Tikamgarh, Chindwara, Khargone, Devas and Sagar are the major ginger producing districts.

#### Nutritional Value of Ginger

The quality of ginger is mainly determined by its essential oil content for aroma, nonvolatile compound like gingerol for pungency and fiber content. The nutritional value per 100 g of edible portion is as follows:

| Nutrients    | Quantity | Nutrients  | Quantity |
|--------------|----------|------------|----------|
| Moisture     | 80.9 g   | Protein    | 2.3 g    |
| Minerals     | 1.2 g    | Fiber      | 2.4 g    |
| Carbohydrate | 12.3 g   | Energy     | 67 kcal  |
| Calcium      | 20.0 mg  | Phosphorus | 60.0 mg  |
| Iron         | 3.5 mg   | Carotene   | 40.0 µg  |
| Riboflavin   | 0.03 mg  | Niacin     | 0.6 g    |
| Vitamin C    | 6.0 mg   |            |          |

### Medicinal Value of Ginger

Ginger is found to be more effective for treating nausea caused by seasickness, morning sickness, and chemotherapy. Ginger contains very potent anti-inflammatory compounds called *gingerols*. These substances are believed to explain why so many people with osteoarthritis or rheumatoid arthritis experience reductions in their pain levels and improvements in their mobility when they consume ginger regularly. Ginger's beneficial effect is the free radical protection afforded by one of its active phenolic constituents, 6-gingerol. Ginger also showed to suppress the pro-inflammatory compounds (cytokines and chemokines) produced by synoviocytes (cells comprising the synovial lining of the joints), chondrocytes (cells comprising joint cartilage) and leukocytes (immune cells). Gingerols, the main active components in ginger and the ones responsible for its distinctive flavor, may also inhibit the growth of human colorectal cancer cells.

### Crop Requirements

#### Climate

Ginger is mainly grown in tropical and subtropical areas up to 1500 m above mean sea level. Warm and humid climate is good for cultivation. High temperature more than 32°C and low temperature with low humidity is not desirable for ginger. It is also sensitive to frost which reduces the storage capacity. It grows well in area of 150-200 cm annual rainfall, having well distribution of rains.

#### Soil

Ginger is grown in all type of soil. Well drained and sandy loam soil is best for cultivation. Soil pH should be in range of 6-7. Saline soil is not suitable. Ginger should not be cultivated in the same piece of land as these places may have increased soil borne diseases.

### Improved Varieties of Ginger

Several cultivars of ginger are being cultivated at different ginger growing areas in India. The varieties differ in size, fibre and moisture content of the rhizomes and yield. The varieties of ginger are as follows:

**Rio-de-Janerio:** It is an early variety which becomes ready in 190 days. Rhizomes contain 5.6% fiber, 10.5% oleoresin and 2.3% oil. Average yield is 17.5 t/ha of which 20% dried ginger is obtained. It is an introduction of Brazil.

**Suprabha:** It has profuse sprouting. Rhizomes are long, bright gray colour. It contains 4.4% fiber, 1.9% oil and 8.9% oleoresin. It is being used for both fresh and dry ginger. It is a medium maturity variety. Average yield is 34 t/ha of which 20.5% dried ginger is recovered.

**Suruchi:** Its rhizome is greenish yellow colour. Rhizome contains 3.8% fibre, 2% oil and 10% oleoresin. It is a medium duration variety and having 27.2 t/ha yields of which 23.5% dried ginger is recovered.

**Suravi:** It is developed through mutation. Rhizome has more brightness and branches. It contains 4% fiber, 2.1% oil and 10.2% oleoresin. It is a medium duration variety and yielding about 40 t/ha of which 23.5% dried ginger is recommended.

**Hingiri:** It is a medium duration variety. Rhizome has 6.4% fiber, 4.3% oleoresin and 1.6% oil. Average yield is 22.6 t/ha of which 20.7% dried ginger is recovered.

**Varda:** It is early duration variety. Rhizome has 4.5% fiber, 6.7% oleoresin and 1.8% oil. Average yield is 22.6 t/ha of which 20.7% dried ginger is recovered.

**Seed Rhizome**

Mother rhizomes or finger rhizomes @ 12-15 q/ha are required for planting. Rhizomes should be free from diseases, having 4-5 cm size and 25-30 g weight with 2-3 eyes suitable for sowing.

**Manures and Fertilizers**

Ginger is generally a long duration crop which requires more manures and fertilizers. About 25-30 t/ha FYM or compost should be sprayed before planting. Nitrogen 75 kg, phosphorus and potash 50 kg each per hectare is recommended. To prevent rhizome rot or any soil borne diseases neem cake @ 2t/ha should be applied to the field before planting.

**Agricultural Technology**

**Preparation of field:** Field preparation should be started during summer. Deep ploughing should be done in summer season. After that 25-30 t/ha FYM or compost should be uniformly mixed to the field. Ginger is planted directly on the ridges or on plain beds. The size of beds should be kept 1.5-2 m width, 15 cm height, 3-5 m length and having 40 cm distance between the beds. It requires more nutrients therefore crop rotation should also be adopted judiciously.

**Application of manures and fertilizers:** Well rotten FYM or compost should be applied uniformly at the time of first ploughing. Full quantity of phosphorus and half quantity of potash along with 2 t/ha neem cake should be applied as basal dose at the time of last ploughing. Remaining quantity of potash and full quantity of nitrogen are divided into two equal parts and applied at 45 days and 90 days after ginger planting. After 90 days of the crop earthing up is beneficial. Fertilizers should be applied at right stage when field has sufficient moisture content.

**Planting/sowing time:** Ginger rhizome is planted from 15<sup>th</sup> April to 15<sup>th</sup> June as per availability of resources. In irrigated area it is planted during April-May, whereas in rainfed areas planting should be done at the onset of monsoon. Sowing time is very critical as it directly affects the yield of the crop.

**Seed rhizome treatment:** Seed rhizomes are treated with Metalyxyl and Mancozeb (3g) or Thirum + Carbendazim (3 g) or Mancozeb (3 g) + Quinolphos (0.1%) solution for 30-60 minutes and then dried at shade places. The treatment is essential for disease and insect prevention.

**Seed rhizome planting:** Seed rhizomes are kept at normal temperature before planting if cold stored. Ginger rhizomes are planted by two methods:

1. Raised Bed Method – this method is good for rainfed areas. Beds of 15 cm height, 1-2 m width and of desirable length are prepared. Rhizomes are planted at 40 cm row to row and 15-20 cm between rhizomes. The depth should be 4-5 cm.
2. Ridge-Furrow Method – This is suitable for less rainfall area or irrigated area. Ridges are made at 30-40 cm distance and then rhizomes are planted at 15-20 cm distance.

**Mulching:** After planting mulching is an essential cultural practice. This improves the germination and restricts soil cracking along with moisture conservation for longer period. Mulching also minimizes the weed incidence and increase organic matter into soil. Mulching is done three times during the growth period. First mulching is done just after the planting @ 12.5 t green leaves per hectare. Second and third mulching is done @ 50 q green leaves per hectare after 45 and 90 days of planting. In many areas of Madhya Pradesh , *Palash* leaves are used for mulching.

**Shade requirement:** Ginger is slightly shade loving plant. Caster or pigeon pea as intercrop is good for providing shade. Guava and mango fruit orchards are also good if ginger is planted

within the space provided. In South India, ginger is preferred to plant in coconut, arecanut and palm trees plantation.

**Irrigation and drainage:** Irrigation is required during non-rainy days. About 4-6 irrigations are required during the cropping period. In rainfed areas it is important to have proper drainage system. Water logging is undesirable otherwise rhizome rot and yellowing disease incidence increases.

**Weed management and earthing up:** Although weeds do not pose major problem if mulching is done properly. However, if weeds emerge, manually weeds should be uprooted. Earthing up is essential practice which should be performed after 3 months of planting. It improves the plant growth and increase the rhizome size.

### Plant Protection

- 1. Rhizome rot:** This is a fungal disease caused by *Pythium* spp. The leaves of the diseased plant become yellow at the margin and later droop down and dried. New shoots are mainly infected and collar region becomes soft and rotten. Rhizomes become dirty, slowly start rotting and break easily. This disease is also called as soft rot. The following control measures should be adopted:
  - Deep ploughing during summer and soil solarization is essential.
  - Healthy mother rhizome, suitable crop rotation and drainage system minimize the incidence.
  - Seed rhizomes should be treated with mancozeb (2.5 g) + carbendazim (1 g) solution or copper oxychloride (3 g) solution in one liter of water for 60 minutes and then dried under shade. Such treatment is good at the time of planting or even before storage.
  - In standing crop, diseased plants should be removed from the field and sprayed with 1% Bordeaux mixture or 0.3% Mancozeb or copper oxychloride.
  - Seed treatment with *Trichoderma herzianum* @ 5 g/kg of seed rhizome is good for control.
- 2. Yellowing:** This disease is caused by *Fusarium oxysporum* v. *zingiberi* fungus. Lower surface of leaves starts yellowing and then spread to whole leaves. Plants start withering, shoots rotting at collar region wherefrom it reaches to rhizome. The similar control measures should be adopted as of rhizome rot.
- 3. Bacterial wilt:** This is due to *Pseudomonas solanacearum* bacteria. Stem and leaves show copper-yellow colouration. Withering of plants, fuzzy and bacterial oozing out of rhizome while pressing, smell of rotting are the major symptoms of this wilt. The following control measures should be adopted:
  - Crop rotation and use of healthy rhizome.
  - Deep ploughing in summer and soil solarization.
  - Seed rhizome treatment with streptomycin @ 200 ppm for 30 minutes and then dried under shade besides the fungicidal treatment.
  - Copper oxychloride or Mancozeb @ 2.5g/lit of water can be sprayed to plant and also drench into the soil.
- 4. Nematodes:** Meloidogyne and Rhodophyllus also damage the crop. They restrict the growth, reduce the number of shoots and develop brown water soaked lesions on the surface of rhizome. Phorate or carbofuron @ 1-1.5 kg a.i./ha should be sprayed before planting or even at the standing crop. Neem cake @ 2 t/ha should be mixed with soil. Marigold as a trap crop can also be used to minimize the incidence.

5. **Shoot borer:** It bores in to shoots and thus middle portion becomes dry. It can be controlled by Phorate or Carbofuron @ 1-1.5 kg a.i./ha before planting or on standing crop. Dimethoate (0.04%) or methyl demetan (0.05%) or methomyl (0.075%) in 500-700 liter of water spray in the crop at 15 days interval is good for control.
6. **Rhizome scale:** It infests at field and storage level. Insect suck the sap of rhizome which also increase the infection of many diseases. Treating seeds with Quinalphos @ 0.1% before storage and planting can minimize the infestation.

### Harvesting of Ginger

It gets ready in 8-10 months for harvesting. The sign of maturity is drying and yellowing of leaves. If there is no sufficient moisture in the field, light irrigation is provided for easy uprooting of ginger. Care should be taken during uprooting. It should not be broken. Clean, wash and dry the ginger after harvesting. This is called the unbleached ginger.

### Yield

Fresh ginger yield is about 15-25t/ha, however, dried ginger recovery is about 20-25 q/ha.

### Storage of Seed Rhizomes

Rhizomes are stored in pits under shade. Healthy rhizomes are properly treated with Quinalphos (0.1%) + Mancozeb (0.3%) solution for 30-60 minutes. One liter solution is sufficient for 1 kg rhizome. After treatment they are dried under shade. Pits are also thoroughly treated with the same chemicals. Pits are then filled with layer of sand and rhizome. The top 15 cm portion is left for filling it with dried grass and then covered with wooden plate. On top, pit is plastered with mud soil. Thus ginger can be stored for next season planting.

### Method of Dry Ginger Preparation

After harvesting, ginger is cleaned and washed thoroughly to get rid of any inert material. Cleaned ginger is then carefully peeled by bamboo scrap. Deep peeling should be avoided which may cause loss of essential oil in it. Iron knife is also not used for peeling. Now, rhizomes are again cleaned and washed and then dried for one week to make dried ginger. Commercially, peeling and drying is done by machine. This dried ginger is mainly used for export purpose. There are majorly two grades of ginger, first is fibrous Calicut ginger and second is non-fibrous Cochin ginger. The demand of Cochin ginger is more in foreign countries. Thus ginger is used in many ways like fresh ginger, dried ginger and extracted oil.

### Preparation of Bleached Ginger

Dried ginger is comparatively dull colour. To improve the brightness, dried ginger is treated with 2% lime water for 6 hrs and then dried properly. This brighten ginger is called bleached ginger. In local market, the demand of bleached ginger is very high.

### Conclusion

Ginger is an important spice crop and has medicinal and nutritional value. Ginger is grown mainly in tropical and subtropical regions in all types of soil. The quality and quantity of ginger production can be improved by adopting good agricultural practices. The dry ginger can also be prepared for export purpose. In order to improve the brightness of dried ginger, it should be treated with lime which is called as bleached ginger which in turn has better market value.