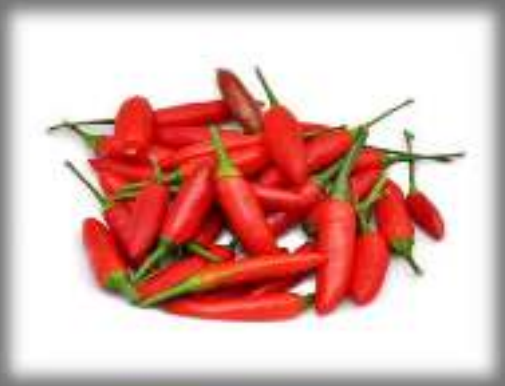
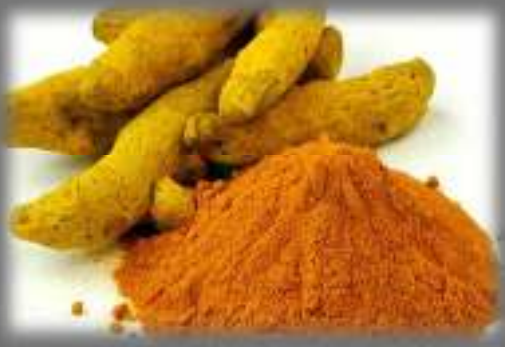
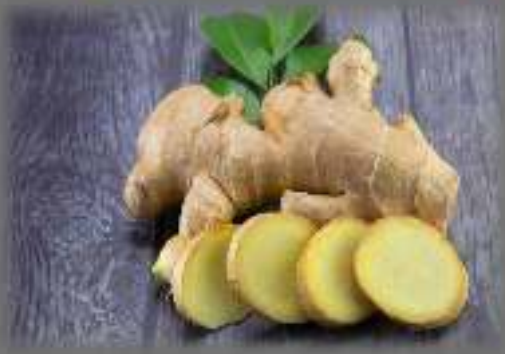
2020-21

Guidelines for Value Chain Development

IFAD – FOCUS







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INTRODUCTION

A value chain study carried out as part of the project design process has identified a number of sub-sectors with potential for value chain intervention. These are spices (ginger, chilli and turmeric). Based on the potential benefits from improving marketing linkages, the project will initially work on these spices – once dried these are non-perishable, low volume and high value products that can stand the cost of transport to distant market. With closer proximity to markets and more developed horticultural sector, the potential for value chain market development is greater in Mizoram and here, the project will also support the establishment of small marketing units in the Department of Horticulture to provide support on policy, marketing intelligence and planning issues.

Production support under Value Chain component is to further increase marketable volume and the marketing support will facilitate aggregation, value addition and linkage to outside markets. The beneficiaries under Value Chain and Market access will be a subset of beneficiaries under jhum improvement and settled agriculture. Horticulture crops are the key cash crops in Mizoram in terms of providing employment generation and cash income to the farmers in the rural areas.

OBJECTIVES OF VALUE CHAIN DEVELOPMENT

The main objective of the value chain development is to improve the farm gate prices to the producers. This objective will be achieved by:

- Organising the producers into marketing groups/producer companies essentially to achieve the economies of scale to take up collective marketing.
- Eliminating or reducing the role of middlemen and letting the organised producers sell directly to processors, exporters and terminal markets.
- Facilitate integration of producer with larger value chain market systems so that the poor producers maximize their earnings and remain relevant players in the value chains.
- Focusing on creating additional value/income by introducing better production practices, simple value addition in terms of aggregation, sorting, grading and processing, and collective marketing.
- Capacitating producers on value chain development and marketing
- Establishing linkages with potential private players, processors and bulk traders

INSTITUTIONAL ARRANGEMENT

1. The project at district level shall be supervised by District Project Manager who is the District Agricultural Offer and the district staffs under the project.

2. Cluster approach shall be adopted for selected value chain commodities wherein at least four villages form a cluster, which ensures economies of scale in terms of availability of a minimum of a truck load of produce for selling.

3. At village level Community Resource Person (CRP) identified from the concerned village shall be the responsible for development and supply of planting materials for value chain. CRPs shall be supported by the project for establishment of nurseries and other requirements. A CRP shall be responsible for supervising 2 villages from a cluster.

4. 30 clusters are to be formed consisting of about 120 villages covering 1200 ha for each crop covering 2400 household.

5. The project would buy good quality planting materials from CRPs and make it available free of cost to value chain FIGs.

6. Project will also utilize CRPs for transferring knowledge and information related to technical aspect of crop production.

Capacity building: Capacity building support shall be provided through trainings and demonstrations which should be based on the needs of commodity clusters and community members engaged in it. Generalise and commodity wise technical training, and business and marketing training module should be developed. Integrating indigenous traditional knowledge and practices is critical for better acceptability. Advance skills modules on business management and entrepreneurship should be planned for members already having basic skills.

IDENTIFICATION OF MARKETS AND MARKET TIE-UPS

Market and market tie ups for value chain products and value addition can be done through tie ups with Societies / organization within the states dealing with commodities that encompass crops and products under the value chain crops under the project. Clusters for Value chains shall have Aggregation Centres within each cluster where farmers from different villages shall bring their products. At Aggregation Centres, the following common facilities are likely to be funded:

1. Wet and dry storage with facilities
2. Drying provision
3. Cleaning/Sorting provision
4. Processing machines (Value addition)
5. Market intelligence facilities
6. Packaging facilities
7. Farmer Producer Organisation (FPO) office
8. Auction platform

Farmers from different villages can bring their produce from their villages to the Aggregation Centre. From here, links can be made for export/out source of their products. Entrepreneurs and organizations dealing with such products from within the states who can accept both partially processed and raw products can be identified. Such organizations/entrepreneur like Agricon.pvt.ltd, Mizofed, Zoram Mega Food Park etc. can be linked for market tie-ups and other marketing purpose.

IDENTIFICATION OF VALUE CHAIN CLUSTERS

Project shall adopt cluster approach for select value chain commodities wherein at least four villages form a cluster, which ensures economies of scale attractive enough for marketing players to get into business partnership with commodity farmers. The clusters / villages will be selected based on farmers' interest, participation and ability to invest in labour to ensure establishment of the selected crops. Cluster ensures that collective procurement of agriculture inputs and business development services i.e. transportation and logistics services, become economical for farmers. Clusters shall be develop around strategically located villages with comparative advantages in terms of presence of motorable road and transportation access, banking services, collection centres and processing units.

Block and village level project staffs shall be responsible for undertaking participatory cluster planning exercise in villages. One cluster can have minimum four villages. Compact lands should be

selected for better monitoring and management. Therefore, area based commodity clusters, for ensuring economies of scale, need to be identified under the project.

SELECTION OF CRPS, TRAINING OF CRP AND ENGAGEMENT

Project shall place Community Resource Persons (CRPs) in villages to develop and supply planting materials for value chain and other major crops supported by the project. District level project staffs, mainly from block/circle and villages, shall be responsible for identifying CRPs from their local areas of operation. The qualification of a CRP shall include an existing progressive farmer, 12th standard or a graduate in agriculture/horticulture/extension, native of concern circle/block, having entrepreneurial bent of mind, interested in nursery development and horticulture. DMU team (technical and marketing team) shall conduct interviews at the state level to select CRPs.

District and circle/block level officers would train the CRPs in technical aspects related to good package of practices for selected and other major crops, and plant disease identification and solutions. These trainings would be organised at the district level in local language and would have a mix of class room training and field visits. CRPs would also be provided with reference materials that they can use for transferring knowledge and extending technical support to value chain farmers.

SUPPORT TO CRP FOR PRODUCTION OF IMPROVED PLANTING MATERIALS

Project shall provide support to CRPs in the establishment of small scale nurseries that include procurement of mother stocks of planting materials, shed-nets, green house, tools/equipment, technical training, and package of practices. CRPs would raise and manage the nursery for selected value chain commodities (mizo chili, ginger and turmeric) and also other local plants in demand. The project would buy quality planting materials from CRPs for supplying to FIGs. CRPs would remain in touch with FIGs and become the source for transferring technical knowledge on good package of practices to FIG members. CRPs would become village level contacts for project to pass on technical information to FIGs.

FORMATION OF VALUE CHAIN FARMERS INTEREST GROUP

1. Farmer Interest Group consisting of farmers who are to practice cultivation of value chain crops and with common interest of large scale production and marketing shall be formed commodity wise by staffs at village and circle level.
2. One FIG can have a maximum of 20 members along with a number of associate members.
3. Each FIG should have a separate bank account.
4. FIGs would be introduced to innovative model of digital delivery of extension, support for organic certification or sustainable/good agriculture practices.
5. Potential and capable FIGs would be supported to start agro processing units in project locations.
6. Project would also facilitate, keeping in mind the needs of value chain farmers, a number of marketing interventions such as buyer seller meets, market exposure visits, participation in trade fairs and exhibition, linkage with market players.
7. Provision of Rs 30000 for FIG functioning. This can be utilized for functioning cost and performance on the utilization of this amount shall be recorded by the FIGs for evaluation.

UNIT COST GUIDANCE FOR PLANTING MATERIAL PURCHASED BY THE FIGS

Mizo Chilli

Sl no	Items/Activity	Unit	Rate	Quantity (kg)	Amount (Rs)
1	2	3	4	5	6
A	**Cost of crucial inputs**				
	Cost of Seeds	Household	Rs 400/kg	3.1	1,250.00
	Trichoderma for seed treatment (to be obtained from Clovers)	Household	1 kg	1	250.00
	Sub-Total of A				**1,500.00**
B	**Cost of Field Operations**				
	Inter-cultural Operations (Beneficiary contribution)	LS	Rs 500.00	3	1,500.00
	Plant Protection Measures (Beneficiary contribution)		2,000	-	2,000.00
	Sub-Total of B				**3,500.00**
	Sub-Total of A + B				**5,000.00**

Total Cost to be borne by the Project = Rs 1,500.00

Beneficiary Contribution = Rs 3,500.00

Turmeric

Sl no	Items/Activity	Unit	Rate	Quantity (kg)	Amount (Rs)
1	2	3	4	5	6
A	**Cost of crucial inputs**				
	Cost of Seeds	Household	Rs 18/kg	69.5	1,250.00
	Trichoderma for seed treatment (to be obtained from Clovers)	Household	1 kg	1	250.00
	Sub-Total of A				**1,500.00**
B	**Cost of Field Operations**				
	Inter-cultural Operations (Beneficiary contribution)	LS	Rs 500.00	3	1,500.00
	Plant Protection Measures (Beneficiary		2,000	-	2,000.00

	contribution)				
	Sub-Total of B				**3,500.00**
	Sub-Total of A + B				**5,000.00**

Total Cost to be borne by the Project = Rs 1,500.00

Beneficiary Contribution = Rs 3,500.00

Ginger

Sl no	Items/Activity	Unit	Rate	Quantity (kg)	Amount (Rs)
1	2	3	4	5	6
A	**Cost of crucial inputs**				
	Cost of Seeds	Household	Rs 35/kg	193	6,750.00
	Trichoderma for seed treatment (to be obtained from Clovers)	Household	1 kg	1	250.00
	Sub-Total of A				**7,000.00**
B	**Cost of Field Operations**				
	Inter-cultural Operations (Beneficiary contribution)	LS	Rs 500.00	3	1,500.00
	Plant Protection Measures (Beneficiary contribution)		2,000	-	2,000.00
	Sub-Total of B				**3,500.00**
	Sub-Total of A + B				**10,500.00**

Total Cost to be borne by the Project = Rs 7,000.00

Beneficiary Contribution = Rs 3,500.00

FIG plans for planting and budget planning for procurement of planting materials with project support

Proper business planning is key to minimising market risks and making right marketing decisions. This is to be done in collaboration with FAO who will have a systematic study of the value chain clusters. Project field staffs, in collaboration with communities, would undertake a participatory advance planning, within couple of weeks of sowing, to prepare commodity-wise area under production and estimated production quantity. This would provide sufficient time to identify interested market players, discuss terms of trade, plan logistics, and post-harvest management.

Each FIGs shall select beneficiaries and according to the number of beneficiaries and land/resource availability, each FIG from each district must plan a budget for procurement of planting materials. This must be approved by the DMU and submitted to the PMU who upon approval shall release funds.

TRAINING PROGRAMMES TO BE CONDUCTED BY FOCUS

The District team, consisting primarily of village and circle level staffs shall be responsible for conducting training in the villages. The team shall make a village visit plan, inform village council and villagers in advance about the pre-scheduled meeting dates in villages. In the village training of FIGs, the project team needs to share objectives of the project, roles and responsibility of FIGs, project support. The project team needs to clarify the doubts or expectations the villagers may have. Lectures and discussions should be conducted regarding the purpose and role of clusters, market access and Value Chain Development. The village meetings should be moderated in such a manner that villagers' expectations are managed within the project mandate.

District and circle/block level officers would train the CRPs in technical aspects related to good package of practices for selected and other major crops, and plant disease identification and solutions. These trainings would be organised at the district level in local language and would have a mix of class room training and field visits. CRPs would also be provided with reference materials that they can use for transferring knowledge and extending technical support to value chain farmers.

RELEASE OF APPROVED FUNDS BY THE PROJECT FOR PURCHASE OF PLANTING MATERIALS

After budget plans of FIGs are approved by the DMU, budget plans shall be submitted to PMU. The PMU after scrutiny shall release funds to the DMUs. DMUs are then responsible for release of funds to the submitted Bank Accounts of each FIGs who shall utilized the funds for procurement of planting materials under the supervision of project staffs. Funds released to be used as revolving fund within the FIG.

PROCEDURES FOR FIGS TO PROCURE PLANTING MATRIALS, DISTRIBUTE TO MEMBERS AND COMPLETE PLANTING

a. Procurement is to be done by the Community (Community Procurement)
b. Every FIG has to be mobilized and participate in the procurement of planting materials and will also be responsible agency.
c. FIGs shall procure planting materials as per budget plans.
d. Project staffs shall be present during the procurement and shall be responsible for supervising the procedure, the planting materials and its distribution.
e. Distribution of planting materials shall be as per approved plans from each FIG.
f. Each FIG member/beneficiary is responsible for completion of planting as allotted by the FIG.
g. District Project Manager may provide necessary assistance if necessity arises.

PROJECT BENEFIT

- To develop a commercially & economically viable marketing structure for production and supply of spices (ginger, turmeric and chilli).
- To increase farmers income and provide a perpetual source of income through farming.
- To promote locally produced agricultural products.
- Social benefits and economic upliftment of rural livelihood.

MARKETING

Establishment of a Marketing Unit: The major constraints to value chain development of traditional spice, and agricultural and horticultural crops are related to marketing. They include: (i) limited aggregation for achieving economies of scale in cost effective collection, transportation and storage; (ii) insufficient investment in post-harvest management practices, including primary processing to add value and to reduce volume for transportation; (iii) inadequate data on marketable quantity to feed into supply chain, (iv) inadequate linkage with premium markets on account of issues related to compliance of certification and quality standards; and (v) limited access to market players from outside the Mizoram state. The project's marketing efforts will be directed not only towards the commodities/crops that will be promoted in a value chain mode but also other commodities and crops promoted under jhum improvement and settled agriculture that offer economies of scale for market entry to be viable.

The project shall establish a marketing unit to be housed in the Horticulture Department and manned by competent staffs. This unit will produce market intelligence reports, conduct (or commission) market studies, and policy reforms required for implementing APMC Act. This will enable the line departments plan production based on market intelligence and inputs from the marketing section. In addition, this unit will act as focal point to identify market linkage partners and to facilitate market support activities of the project.

VALUE CHAIN DEVELOPMENT TARGET/PLANS

Value Chain commodity	Cluster and villages	Area (Ha)	Farmer households	FIGs to be formed	Project support
Turmeric	30 clusters and 120 villages	1200	2400	120	FIG formation Planting materials Package to practices Technical support Marketing support
Mizo Chilli		1200	2400	120	
Ginger		1200	2400	120	
Other major crops, if any	Need based as emerged during the implementation phase				Marketing support

Infrastructure creation in clusters: Cluster development would involve creating common marketing infrastructure for simple value addition such as cleaning, sorting and aggregation. For this, project shall facilitate creation of Aggregation Centres, a common facility centre in one of cluster villages connected by a motorable road and transport facility, also having presence of support services such as postal and banking service, and communication facilities.

Management of commodity clusters: FIGs from villages where common facility centres are established shall be responsible for day-to-day management of these commodity centres with support from concern project staffs at circle/block and village level. For commodities identified under a cluster, a separate, commodity-wise management and marketing plan needs to be prepared.

VALUE ADDITION

Organic certification: Project team, based on market and stakeholders' analysis, may decide to promote organic certification, good agriculture practices or sustainable agriculture practices, provided a cost-benefit analysis clearly shows additional benefits to farmers and assured market linkages. The project may promote such practices in around one third of the area selected for production support for value chain commodities. Project needs to identify reputed players who offer such services and provide assured market linkages for commodities produced using sustainable practices. Project may enter into an agreement with selected player(s) and jointly draw up an annual action for field implementation including training and support to farmers.

Project can also converge with a Mission Organic Value Chain Development for North Eastern Region (MOVDNER), a CSS that also aims to promote ginger, turmeric, chilli and sugarcane in 7000 Hectare in the Mizoram state. The scheme plans to support FIGs/FPOs/FPCs for pre-harvest and postharvest crop management, and marketing support for setting up functional infrastructure for collection, aggregation and grading units, integrated processing unit, integrated pack house, refrigerated transport vehicle, pre-cooling/cold stores/repining chambers and organising NE organic bazars.

Setting up agro-processing units: The project would facilitate setting up agro-processing units in project locations by supporting capable FIGs. However, care should be taken that such units are promoted only after doing a cost benefit analysis that ensures higher income and profit margins to farmers when compared with their existing income from the activity. Such units should be promoted when market linkages are assured. Project team should identify and initiate discussion with interested market players to forge partnership. Project team will help develop proper business plan that include a financial plan indicating cash flows and key financial indicators. Interested FIGs would be provided relevant training and capacity building support.

ACTIVITIES AND RESPONSIBILITIES

	Who will implement	**How to implement**	**Where to implement**
Procurement of planting materials	FIGs will be responsible for procurement of planting materials	With assistance from DPM and DMU staffs.	Procurement should be done at District level and distributed to cluster villages as allotted.
Cultivation	Farmers under FIGs	Planting must be done under Organic conditions	In allotted land appropriate for Organic Cultivation
Marketing of produce	FIGs with aid from marketing cell should arrange the sales of produce to available markets	A buyer for estimated amount of yield should be consulted in advance and arrangement should be made for sales of produce.	Sales may take place in farmers' field, village centres or other locations where transport and other requirements is easily met.
Organic certification	FOCUS staffs PMU and DMU with aid from Organic Certifying Agencies along with FIGs	As per the requirements and guidelines provided by Organic Certifying Agencies.	In clusters that has been set up and

Annexure 1

TURMERIC CULTIVATION

Turmeric (Curcuma longa) (Family: Zingiberaceae) is used as condiment, dye, drug and cosmetic in addition to its use in religious ceremonies. India is a leading producer and exporter of turmeric in the world. Mizoram has a high productivity and potential for this crop.

Table 1. Statewise Area, production and productivity of turmeric in India (2005-06)

State	Area (ha)	Production (tonnes)	Productivity (tonnes/ha)
Andhra Pradesh	69,990	518,550	7.41
Tamil Nadu	25,970	143,358	5.52
Orissa	24,020	57,090	2.38
West Bengal	11,844	25,049	2.11
Assam	11,700	8,400	0.72
Maharashtra	6,760	8,427	1.25
Karnataka	5,410	26,380	4.88
Bihar	3,533	3,383	0.96
Kerala	3,384	8,237	2.43
Himachal Pradesh	1,640	1,140	0.70
Gujarat	1,400	16,510	11.79
Tripura	1,108	3,750	3.38
Uttar Pradesh	979	4,364	4.46
Meghalaya	850	9,000	10.59
Nagaland	850	9,000	10.59
Chhattisgarh	740	640	0.86
Madhya Pradesh	670	610	0.91
Sikkim	670	3,600	5.37
Uttarakhand	466	3,970	8.52
Arunachal Pradesh	427	1,631	3.82
Manipur	200	140	0.70
Mizoram	200	1,650	8.25
Andaman & Nicobar	92	642	6.98
Rajasthan	90	230	2.56
Jammu & Kashmir	12	12	1.00
TOTAL	173,005	855,763	4.95

Source : Spices Board

Climate and soil

Turmeric can be grown in diverse tropical conditions from sea level to 1500 m above sea level, at a temperature range of 20-35^{o}C with an annual rainfall of 1500 mm or more, under rainfed or irrigated conditions. Though it can be grown on different types of soils, it thrives best in well-drained sandy or clay loam soils with a pH range of 4.5-7.5 with good organic status.

Varieties

A number of cultivars are available in the country and are known mostly by the name of locality where they are cultivated. Some of the popular cultivars are Duggirala, Tekurpeta, Sugandham, Amalapuram, Erode local, Alleppey, Moovattupuzha, and Lakadong.

Preparation of land

The land is prepared with the receipt of early monsoon showers. The soil is brought to a fine tilth by giving about four deep ploughings. Immediately with the receipt of pre-monsoon showers, beds of 1.0 m width, 15 cm height and of convenient length are prepared with spacing of 50 cm between beds. Planting is also done by forming ridges and furrows.

Planting

The crop can be planted during April-May with the receipt of pre-monsoon showers.

Seed material

Whole or split mother and finger rhizomes are used for planting and well developed healthy and disease free rhizomes are to be selected. Small pits are made with a hand hoe on the beds with a spacing of 25 cm x 30 cm. Pits are filled with well decomposed cattle manure or compost, seed rhizomes are placed over it then covered with soil. The optimum spacing in furrows and ridges is 45-60 cm between the rows and 25 cm between the plants. A seed rate of 2,500 kg of rhizomes is required for planting one hectare of turmeric.

Manuring and fertilizer application

Farmyard manure (FYM) or compost @ 30-40 t/ha is applied by broadcasting and ploughed at the time of preparation of land or as basal dressing by spreading over the beds or in to the pits at the time of planting. Fertilizers @ 60 kg N, 50 kg P_2O_5 and 120 kg K_2O per hectare are to be applied in split doses. Zinc @ 5 kg/ha may also be applied at the time of planting and organic manures like oil cakes can also be applied @ 2 t/ha. In such case, the dosage of FYM can be reduced. Integrated application of coir compost (@ 2.5 t/ha) combined with FYM, biofertilizer (Azospirillum) and half recommended dose of NPK is also recommended.

Mulching

The crop is to be mulched immediately after planting with green leaves @ 12-15 t/ha. Mulching may be repeated @ 7.5 t/ha at 45 and 90 days after planting after weeding, application of fertilizers and earthing up.

Weeding and irrigation

Weeding has to be done thrice at 60, 90 and 120 days after planting depending upon weed intensity. In the case of irrigated crop, depending upon the weather and soil conditions, about 15 to 23 irrigations are to be given in clayey soils and 40 irrigations in sandy loams.

Mixed cropping

Turmeric can be grown as an intercrop in coconut and arecanut plantations. It can also be raised as a mixed crop with chillies, colocasia, onion, brinjal and cereals like maize, ragi, etc.

Harvesting

Depending upon the variety, the crop becomes ready for harvest in 7-9 months after planting during January-March. Early varieties mature in 7-8 months, medium varieties in 8-9 months and late varieties after 9 months.

The land is ploughed and the rhizomes are gathered by hand picking or the clumps are carefully lifted with a spade. The harvested rhizomes are cleared of mud and other extraneous matter adhering to them.

Processing

Curing

Fresh turmeric is cured for obtaining dry turmeric. The fingers are separated from mother rhizomes. Mother rhizomes are usually kept as seed material. Curing involves boiling of fresh rhizomes in water and drying in the sun.

In the traditional method of curing, the cleaned rhizomes are boiled in water just enough to immerse them. Boiling is stopped when froth comes out and white fumes appear giving out a typical odour. The boiling should last for 45-60 minutes when the rhizomes turn soft. The stage at which boiling is stopped largely influences the colour and aroma of the final product. Over cooking spoils the colour of the final product while under-cooking renders the dried product brittle.

100 litres of water is poured into the trough so as to immerse the turmeric fingers. The whole mass is boiled till the fingers become soft. The cooked fingers are taken out of the pan by lifting the trough and draining the water into the pan. The water used for boiling turmeric rhizomes can be used for curing fresh samples. The processing of turmeric is to be done 2 or 3 days after harvesting. If there is delay in processing, the rhizomes should be stored under shade or covered with sawdust or coir dust.

Drying

The cooked fingers are dried in the sun by spreading them in 5-7 cm thick layers on bamboo mats or drying floor. A thinner layer is not desirable, as the colour of the dried product may be adversely affected. During night time, the rhizomes should be heaped or covered with material which provides aeration. It may take 10-15 days for the rhizomes to become completely dry. Artificial drying, using cross-flow hot air at a maximum temperature of 60oC also gives a satisfactory product. In the case of sliced turmeric, artificial drying has clear advantages in giving a brighter coloured product than sun drying which tends to undergo surface bleaching. The yield of the dry product varies from 10-30% depending upon the variety and the location where the crop is grown.

Polishing

Dried turmeric has a poor appearance and a rough dull outer surface with scales and root bits. The appearance is improved by smoothening and polishing the outer surface by manual or mechanical rubbing.

Manual polishing consists of rubbing the dried turmeric fingers on a hard surface. The improved method is by using a hand operated barrel or drum mounted on a central axis, the sides of which are made of expanded metal mesh. When the drum filled with turmeric is rotated, polishing is effected by abrasion of the surface against the mesh as well as by mutual rubbing against each other as they

roll inside the drum. Turmeric is also polished in power operated drums. The yield of polished turmeric from the raw material varies from 15-25%.

Colouring

The colour of the processed turmeric influences the price of the produce. For an attractive product, turmeric powder (mixed with little water) may be sprinkled during the last phase of polishing.

Preservation of seed rhizomes

Rhizomes for seed purpose are generally stored by heaping in well ventilated rooms and covered with turmeric leaves. The seed rhizomes can also be stored in pits with saw dust, sand along with leaves of Strychnos nuxvomica (kanjiram). The pits are to be covered with wooden planks with one or two openings for aeration. The rhizomes are to be dipped in quinalphos (0.075%) solution for 15 minutes if scale infestations are observed and in mancozeb (0.3%) to avoid storage losses due to fungi.

Annexure II

GINGER CULTIVATION

Ginger (Zingiber officinale Rosc.) (Family: Zingiberaceae) is an herbaceous perennial, the rhizomes of which are used as a spice. India is a leading producer of ginger in the world and during 2012 - 13 the country produced 7.45 lakh tonnes of the spice from an area of 157839 hectares. Ginger is cultivated in most of the states in India.

Climate and soil

Ginger grows well in warm and humid climate and is cultivated from sea level to an altitude of 1500 m above sea level. Ginger can be grown both under rain fed and irrigated conditions. For successful cultivation of the crop, a moderate rain fall at sowing time till the rhizomes sprout, fairly heavy and well distributed showers during the growing period and dry weather for about a month before harvesting are necessary. Ginger thrives best in well drained soils like sandy loam, clay loam, red loam or lateritic loam. A friable loam rich in humus is ideal. However, being an exhausting crop it is not desirable to grow ginger in the same soil year after year.

Varieties

Several cultivars of ginger are grown in different ginger growing areas in India and they are generally named after the localities where they are grown. Some of the prominent indigenous cultivars are Maran, Kuruppampadi, Ernad, Wayanad, Himachal and Nadia. The exotic cultivar 'Rio - de - Janeiro' have also become very popular among cultivators. The improved varieties of ginger and their salient features are given below. The variety IISR Varada is suited for fresh ginger, dry ginger and making candy while, IISR Rejatha is rich in essential oil.

Season

The best time for planting ginger is during the first fortnight of May with the receipt of pre- monsoon showers. Under irrigated conditions, it can be planted well in advance during the middle of February or early March. Early planting with the receipt of summer showers results in higher yield and reduces disease incidence.

Land preparation

The land is to be ploughed 4 to 5 times or dug thoroughly with receipt of early summer showers to bring the soil to fine tilth. Beds of about 1 m width, 30 cm height and of convenient length are prepared with an inter-space of 50 cm in between beds. In the case of irrigated crop, ridges are formed 40 cm apart. In areas prone to rhizome rot disease and nematode infestations, solarization of beds for 40 days using transparent polythene sheets is recommended.

Planting

Ginger is propagated by portions of rhizomes known as seed rhizomes. Carefully preserved seed rhizomes are cut into small pieces of 2.5 - 5.0 cm length weighing 20 - 25 g each having one or two good buds. The seed rate varies from region to region and with the method of cultivation adopted. At higher altitudes the seed rate may vary from 2000 to 2500 kg/ha. The seed rhizomes are treated with mancozeb 0.3% (3 g/L of water) for 30 minutes, shade dried for 3 - 4 hours and planted at a spacing of 20 - 25 cm along the rows and 20 - 25 cm between the rows. The seed rhizome bits are placed in shallow pits prepared with a hand hoe and covered with well decomposed farm yard manure and a thin layer of soil and leveled.

Ginger transplanting

Though transplanting in ginger is not conventional, it is found profitable. A transplanting technique in ginger by using single bud sprouts (about 5 g) has been standardized to produce good quality

planting material with reduced cost. The yield level of ginger transplants is on-par with conventional planting system. The technique involves raising transplants from single sprout seed rhizomes in the pro - tray and planted in the field after 30 - 40 days. The advantages of this technology are production of healthy planting materials and reduction in seed rhizome quantity and eventually reduced cost on seeds.

Technology

- Select healthy ginger rhizomes for seed purpose
- Treat the selected rhizomes with mancozeb (0.3%) and quinalphos (0.075%) for 30 min and store in well ventilated place.
- One month before planting, the seed rhizomes are cut into single buds with small piece of rhizomes weighing 4-6 g.
- Treat the single bud sprouts (mancozeb 0.3%) for 30 min before planting.
- Fill the pro-trays (98 well) with nursery medium containing partially decomposed coir pith and vermicompost (75 :25), enriched with PGPR/Trichoderma 10g/kg of mixture.
- Plant the ginger bud sprouts in pro-trays.
- Maintain the pro-trays under shade net house.
- Adopt need based irrigation with rose can or by using sprinklers.
- Seedlings will be ready within 30-40 days for transplanting.

Manuring

At the time of planting, well decomposed cattle manure or compost @ 25-30 tonnes/ha has to be applied either by broadcasting over the beds prior to planting or applied in the pits at the time of planting. Application of neem cake @ 2 tonnes/ha at the time of planting helps in reducing the incidence of rhizome rot disease/ nematode and increasing the yield. The recommended blanket nutrient dosage for ginger for different states is given below.

Mulching

Mulching the beds with green leaves/organic wastes is essential to prevent soil splashing and erosion of soil due to heavy rain. It also adds organic matter to the soil, checks weed emergence and conserves moisture during the latter part of the cropping season. The first mulching is done at the time of planting with green leaves @ 10-12 tonnes/ha. Application of dried coconut leaves after removing the petiole or paddy straw (2-3 kg/bed) as mulch in ginger is also recommended for effective weed control. Green leaf mulching is to be repeated @ 7.5 tonnes/ha at 45 and 90 days after planting, immediately after weeding, application of fertilizers and earthing up.

Irrigation

Ginger is cultivated as rain fed crop in high rainfall areas (uniform distribution for 5 to 7 months) and irrigated crop in less rainfall areas where distribution is not uniform. Ginger requires 1300-1500 mm of water during its crop cycle. The critical stages for irrigation are during germination, rhizome initiation (90 DAP) and rhizome development stages (135 DAP). The first irrigation should be done immediately after planting and subsequent irrigations are given at intervals of 7 to 10 days in conventional irrigation (based on prevailing weather and soil type).Sprinklers and drip system can also be employed for better water use efficiency and enhanced yield.

Inter cultivation

Weeding is done just before fertilizer application and mulching; 2-3 hand weedings are required depending on the intensity of weed growth. Proper drainage channels are to be provided when

there is stagnation of water.Earthing up is essential to prevent exposure of rhizomes and provide sufficient soil volume for free development of rhizomes. It is done at 45 and 90 days after planting immediately after weeding and application of fertilizers.

Inter cropping and crop rotation

Crop rotation is generally followed in ginger. The crops most commonly rotated with ginger are tapioca, ragi, paddy, gingelly, maize and vegetables. Ginger is also grown as an intercrop in coconut, arecanut, coffee and orange plantations in Kerala and Karnataka. However, crop rotation using tomato, potato, chillies, brinjal and peanut should be avoided, as these plants are hosts for the wilt causing organism *Ralstonia solanacearum*.

Harvesting

Ginger attains full maturity in 210-240 days after planting. Harvesting of ginger for vegetable purpose starts after 180 days based on the demand. However, for making dry ginger, the matured rhizomes are harvested at full maturity i.e. when the leaves turn yellow and start drying. Irrigation is stopped one month before harvest and the rhizome clumps are lifted carefully with a spade or digging fork. In large scale cultivations, tractor or power tiller drawn harvesters are also used. The dry leaves, roots and soil adhering on the rhizomes are manually separated. Late harvest is also practiced, as the crop does not deteriorate by leaving it for some months underground. In India, domestic market prefers fresh green ginger for culinary use while two types of dried ginger i.e. bleached and unbleached are produced for export purpose. The most important criteria in assessing the suitability of ginger rhizomes for particular processing purposes is the fibre content, volatile-oil content and the pungency level. The relative abundance of these three components in the fresh rhizome is governed by its state of maturity at harvest.

Stage of harvest of ginger for various 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

Processing of ginger

Processing of ginger to produce dry ginger basically involves two stages- peeling of the ginger rhizomes to remove the outer skin and sun drying to a safe moisture level.

Peeling

Peeling serves to remove the scaly epidermis and facilitate drying. Peeling of fully matured rhizomes is done by scrapping the outer skin with bamboo splits having pointed ends and this accelerates the drying process. Deep scraping with knifes should be avoided to prevent the damage of oil bearing cells which are present just below the outer skin. Excessive peeling will result in the reduction of essential oil content of the dried produce. The peeled rhizomes are washed before drying. The dry ginger so obtained is valued for its aroma, flavour and pungency. Indian dried gingers are usually rough peeled when compared to Jamaican gingers, which are clean peeled. The rhizomes are peeled only on the flat sides and much of the skin in between the fingers remains intact. The dry ginger so

produced is known as the rough peeled or unbleached ginger and bulk of the ginger produced in Kerala are of this quality.

Drying

The moisture content of fresh ginger at harvest is about 80-82 per cent which is brought down up to 10 per cent for its safe storage. Generally ginger is sun dried in a single layer in open yard which takes about 8 to 10 days for complete drying. The sun dried ginger is brown in colour with irregular wrinkled surface. The yield of dry ginger is about 19-25 per cent of fresh ginger depending on the variety and climatic zone.

Polishing, cleaning and grading

Polishing of dried ginger is done to remove the dry skin and the wrinkles developed on the surface during drying process. It is generally done by rubbing against hard surface. Cleaning of dry ginger is done manually to remove the extraneous matter and the light pieces. Once the ginger is cleaned and it is graded manually based on size of the rhizome, its colour, shape and the extent of residual lime (in the case of bleached ginger).

Storage

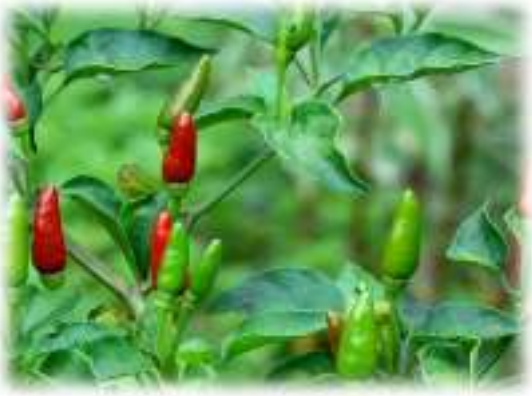
Dry ginger, packaged in gunny bags are highly susceptible to infestation by insects like Lasioderma serricone (cigarette beetle) during storage. Fully dried rhizomes can be stored in airtight containers such as high density polyethylene or similar packaging materials. Long term storage for more than two years would result in deterioration of its aroma, flavour and pungency.

Bleached ginger

Bleached ginger is produced by dipping scrapped fresh ginger in a slurry of slaked lime, Ca(OH)2, (1 kg of slaked lime/120 kg of water) followed by sun drying. As the water adhering to the rhizomes dry, the ginger is again dipped in the slurry. This process is repeated until the rhizomes become uniformly white in colour. Dry ginger can also be bleached by the similar process. Liming gives ginger a better appearance and less susceptibility to the attack of insect pests during storage and shipping.

Annexure III

MIZO CHILLI



Climate

Chilli is a tropical and sub-tropical plant requiring a combination of warm, humid yet dry weather. During the growth stage it needs a warm and humid weather with temperature range of 20^{o}-25^{o}C is ideal. Dry weather is suitable for fruit maturity.

High temperature at 37^{o}C or higher and in case of heavy rain the fruit development is affected and plant defoliates and starts rotting. However, in case of low moisture conditions during fruiting period the bud does not develop properly. Hence, the flower and fruit may drop off

- The species is intolerant of shade and frost, and fruits best in full sun and temperature above 7°C.
- These can be cultivated in areas that receive from 30 to 430cm of annual precipitation at elevations from near sea level to more than 2,000 meters.In Mizoram, Mizo Chilli is cultivated on hill slopes under shifting cultivation system or jhuming system.

Soil

Mizo chilli can grow on soils of all textures but moist, well-drained conditions and loose structure is best for rapid growth. Soil pH of 4.3 to 9.7 is tolerated by this species.

Cultivation

- It can be sown in the months of May to June for Kharif crop, September to October for Rabi crops and January-February for summer crop. It is a perennial plant that lives for 6 to 7 years. However, after 3 to 4 years' production may drop.
- Large tracts of hills are cleared by burning and land occupancy of short periods is done by crops alternating with long fallow periods. One-meter width raised beds also known as bum are made along the slopes and again covered with farm wastes, dried leaves etc. which are burnt before sowing of the seeds. This burning helps in checking the growth of weeds, soft rot diseases incidence and increase the availability of certain plant nutrients particularly potash.
- It is intercropped with paddy. Seeds are sown between paddy crops in the month of April before the onset of monsoon by broadcasting and dibbling method. Hmarchate are grown as rainfed crop in the state due to the occurrence of high rainfall spread over a period of six to eight months.

Water for Green Chilli Cultivation

- Mizo chilli is grown as a rainfed crop. However, heavy rainfall and stagnated water would result in rotting of the plants.
- In case of irrigated crops, watering should be done only when it is necessary. Frequent watering would result in shedding of flowers and a spurt of vegetative growth.
- If the leaves start drooping during day time it is an indication of water requirement. Similarly, if the flowers seem weak or exhibit not enough vigour, irrigating the crop would help. In general, irrigation can be provided if the soil moisture content drops below 25%.

Land Preparation

- The land for cultivation of chillies are ploughed 2-3 times and brought to a fine tilth. The gravel, stones and other such unwanted material present in the soil must be removed. If the seeds are being sown directly in the soil, then it is carried out along with the last ploughing cycle.

Soil Treatment for Organic Farming

If chillies are being planted in an organic farm, then the soil must be treated with Azotobacter or *Azospirillum*. 1 Kg of *Azotobacter* or *Azospirillum* is mixed with 50 Kg of farm yard manure. In addition, 2 tonnes of vermicompost is added on per acre basis.

Soil Treatment for Conventional Farming

In case of conventional farming, soil sterilization is carried out using formalin. 20 mL of formalin is mixed with a litre of water before applying directly on soil. After application, it is covered with

polyethylene sheet of 25-micron thickness for 1-1.5 days. Then they are aerated for 15 days. During the last ploughing, Heftaf @ 10-15 kg per acre is applied to the soil. This ensures protection from pests like white ants. After the soil treatment, ridges and furrows are dug with a spacing of 60 x 45 cm. In case of raised beds, they are built at a distance of 30 cm from each other and are 120 cm wide.

Propagation

- Chillies are propagated from seeds. At the time of cultivation, disease- free, good quality seeds must be chosen.
- 80 grams of seeds are required for sowing in one acre of land.

Seed Treatment

Seeds are treated with herbal fungicides. The seeds are treated with *Pseudomonas fluorescens* (10 grams per Kg of seeds). The seeds are then mixed with Azospirillum (200 grams per Kg) and shade dried for half hour.

Sowing in Nurseries

In nurseries, seedlings are raised and are transplanted. After sowing, the seeds are covered with coco peat and watered everyday till it germinates.The seedlings are transplanted once they are 35 days old.

Transplanting

The seedlings are dipped in 0.5% *Pseudomonas fluorescens* solution for half an hour and then transplanted in the main field. The intercrop distance is maintained at 45 cm during plantation.

Diseases Management

Chillies suffer from a variety of diseases like anthracnose, fruit rot, dieback, bacterial wilt, mosaic diseases, powdery mildew, leaf spot, etc. The affected plants must be removed immediately as soon as the disease is detected. Spraying *Trichoderma* and *Pseudomonas* species would help prevent disease spread.

Pest Management

Thrips, pod borers, grubs, nematodes, aphids, mites, etc. are the major pests of chilli farming Intercropping with onions would help prevent pest attack. 100 Kg neem cake per acre helps keep root grubs away. Some farmers keep grasses in heaps at designated spots on the field. Grubs gather in these heaps and the heap is burnt in the morning. This way, the life cycle is disturbed and likely grubs are destroyed. Neem Seed Kernel Extract is applied for controlling thrips and mites. Installing pheromone traps help control fruit borers.

Harvesting

Harvesting season for Mizo chilli starts from October and ends till December. The yield is normally low compared to other big size chilli varieties, which is about 1.36 MT/ha.Green chillies can be plucked 8-10 times while ripe ones are plucked 5-6 times.

Anexxure IV

Organic Production for Turmeric

Conversion plan

For certified organic production, at least 18 months the crop should be under organic management ie only the second crop of turmeric can be sold as organic. The conversion period may be relaxed if the organic farm is being established on a land where chemicals were not previously used, provided sufficient proof of history of the area is available. It is desirable that organic method of production is followed in the entire farm; but in the case of large extent of area, the transition can be done in a phased manner for which a conversion plan has to be prepared.

Turmeric as a best component crop in agri-horti and silvi-horti systems, recycling of farm waste can be effectively done when grown with coconut, arecanut, mango, Leucaena, rubber etc. As a mixed crop it can also be grown or rotated with green manure/ legumes crops or trap crops enabling effective nutrient built up and pest or disease control. When grown in a mixed cultivation system, it is essential that all the crops in the field are also subjected to organic methods of production.

In order to avoid contamination of organically cultivated plots from neighboring non-organic farms, a suitable buffer zone with definite border is to be maintained. Crop grown on this isolation belt cannot be treated as organic. In sloppy lands adequate precaution should be taken to avoid the entry of run off water and chemical drift from the neighboring farms. Proper soil and water conservation measures by making conservation pits in the interspaces of beds across the slope have to be followed to minimize the erosion and runoff. Water stagnation has to be avoided in the low lying fields by taking deep trenches for drainage.

Management practices

For organic production, traditional varieties adapted to the local soil and climatic conditions that are resistant or tolerant to diseases, pests and nematode infection should be used. All crop residues and farm wastes like green loppings, crop residues, grasses, cow dung slurry, poultry droppings etc. available on the farm can be recycled through composting, including vermicomposting so that soil fertility is maintained at high level. No synthetic chemical fertilizers, pesticides or fungicides are allowed under organic system. Farmyard manure may be applied @ 40 t/ha along with vermi compost @ 5-10 t/ha and mulching with green leaves @ 12- 15 t ha-1 at 45 days intervals. Based on soil test, application of lime/dolomite, rock phosphate and wood ash has to be done to get required quantity of phosphorus and potassium supplementation. When the deficient conditions of trace elements become yield limiting, restricted use of mineral/chemical sources of micronutrients by soil application or foliar spray are allowed as per the limits of standard setting or certifying organizations. Further, supplementation of oil cakes like neem cake (2 t/ha), composted coir pith (5 t/ha) and suitable microbial cultures of Azospirillum and phosphate solubilizing bacteria will improve the fertility and yield.

Use of biopesticides, biocontrol agents, cultural and phytosanitary measures for the management of insect pests and diseases forms the main strategy under organic system. Spraying Neemgold 0.5% or neemoil 0.5% during July-October (at 21 day intervals) is effective against the shoot borer.

Selection of healthy rhizomes, soil solarization and incorporation of Trichoderma, seed treatment and soil application of biocontrol agents like Trichoderma or Pseudomonas multiplied in suitable carrier media such as coir pith compost, well rotten cow dung or quality neem cake may be done at the time of sowing and at regular intervals to keep the rhizome rot disease in check. To control other foliar diseases spraying of Bordeaux mixture 1% may be done restricting the quantity to 8 kg copper

per hectare per annum. Application of quality neem cake mentioned earlier along with the bioagents Pochonia chlamydosporia will be useful to check the nematode population.

Certification

Under organic farming, processing methods also should be based on mechanized, physical and biological processes to maintain the vital quality of organic ingredient throughout each step of its processing. All the ingredients and additives used in processing should be of agriculture origin and certified organic. In cases where an ingredient of organic agriculture origin is not available in sufficient quality or quantity, the certification programme authorizes use of non organic raw materials subject to periodic re-evaluation.

Labelling should clearly indicate the organic status of the product as “produce of organic agriculture” or a similar description when the standards requirements are fulfilled. Moreover organic and non-organic products should not be stored and transported together except when labelled or physically separated.

Certification and labeling is usually done by an independent body to provide a guarantee that the production standards are met. Govt. of India has taken steps to have indigenous certification system to help small and marginal growers and to issue valid organic certificates through certifying agencies accredited by APEDA. The inspectors appointed by the certification agencies will carry out inspection of the farm operations through records maintained and by periodic site inspections. Documentation of farm activities is must for acquiring certification especially when both conventional and organic crops are raised. Group certification programmes are also available for organized group of producers and processors with similar production systems located in geographical proximity.

Annexure V

Organic production of Ginger

Conversion plan

For certified organic production of ginger, at least 18 months the crop should be under organic management i.e. only the second crop of ginger can be sold as organic. The conversion period may be relaxed if the organic farm is being established on a land where chemicals were not previously used, provided sufficient proof of history of the area is available. It is desirable that organic method of production is followed in the entire farm; but in the case of large extent of area, the transition can be done in a phased manner for which a conversion plan has to be prepared.

Ginger as a best component crop in agri-horti and silvi-horti systems, recycling of farm waste can be effectively done when grown with coconut, arecanut, mango, Leucaena, young rubber plantation etc. As a mixed crop it can also be grown or rotated with green manure/ legumes crops or trap crops enabling effective nutrient built up and pest or disease control. When grown in a mixed cultivation system, it is essential that all the crops in the field are also subjected to organic methods of production.

In order to avoid contamination of organically cultivated plots from neighboring non-organic farms, a suitable buffer zone with definite border is to be maintained. In smallholder groups, where the holdings are contiguous, the isolation belt is needed at the outer periphery of the entire group of holdings. Ginger grown on this isolation belt cannot be treated as organic. In sloppy lands adequate precaution should be taken to avoid the entry of runoff water and chemical drift from the neighboring farms. Proper soil and water conservation measures by making conservation pits in the interspaces of beds across the slope have to be followed to minimize the erosion and runoff. Water stagnation has to be avoided in the low lying fields by taking deep trenches for drainage.

Management practices

For organic production, traditional varieties adapted to the local soil and climatic conditions that are resistant or tolerant to diseases, pests and nematode infection should be used. All crop residues and farm wastes like green loppings, crop residues, grasses, cow dung slurry, poultry droppings etc. available on the farm can be recycled through composting, including vermicomposting so that soil fertility is maintained at high level. No synthetic chemical fertilizers, pesticides or fungicides are allowed under organic system. Farmyard manure may be applied @ 25-30 t/ha along with vermi compost @ 4 t/ha and mulching with green leaves @ 12-15 t/ha at 45 days intervals. Further, supplementation of oil cakes like neem cake (2 t/ha), composted coir pith (5 t/ha) and suitable microbial cultures of Azospirillum and phosphate solubilizing bacteria will improve the fertility and yield. Application of PGPR strain of Bacillus amyloliquifaciens (GRB 35) is also recommended for growth promotion and disease control. Based on soil test, application of lime/dolomite, rock phosphate and wood ash may be done to get required quantity of phosphorus and potassium supplementation. When the deficient conditions of trace elements become yield limiting, restricted use of foliar application of micronutrient mixture specific to ginger is recommended (dosage @ 5 g/L) twice, 60 and 90 DAP, for higher yield as per the limits of standard setting or certifying organizations. Use of biopesticides, biocontrol agents, cultural and phytosanitary measures for the management of insect pests and diseases forms the main strategy under organic system. Integrated strategy involving pruning and destroying freshly infested shoots during July- August (at fortnightly intervals) and spraying Neemgold 0.5% or neem oil 0.5% during September-October (at 21 day intervals) is effective against the shoot borer.

Selection of healthy rhizomes, soil solarization and incorporation of Trichoderma, seed treatment and soil application of biocontrol agents like Trichoderma, PGPR or Pseudomonas multiplied in suitable carrier media such as coir pith compost, well rotten cow dung or quality neem cake may be done at the time of sowing and at regular intervals to keep the rhizome rot disease in check. To control other foliar diseases spraying of Bordeaux mixture 1% may be done restricting the quantity to 8 kg copper per hectare per annum. Application of quality neem cake mentioned earlier along with the bioagents Pochonia chlamydosporia will be useful to check the nematode population.

Certification

Certification and labeling is usually done by an independent body to provide a guarantee that the production standards are met. Govt. of India has taken steps to have indigenous certification system to help small and marginal growers and to issue valid organic certificates through certifying agencies accredited by APEDA. The inspectors appointed by the certification agencies will carry out inspection of the farm operations through records maintained and by periodic site inspections. Documentation of farm activities is must for acquiring certification especially when both conventional and organic crops are raised. Group certification programmes are also available for organized group of producers and processors with similar production systems located in geographical proximity.