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सत्यमेव जयते

Directorate of Arecanut and Spices Development
Department of Agriculture, Co-operation & Farmers Welfare
Ministry of Agriculture & Farmers Welfare, Government of India
Calicut - 673005, Kerala, India

Use Quality Planting Materials from Accredited Cashew/Cocoa nurseries

Quality standards-Cashew Grafts

Characters	Standards
Age of the graft	6 months
Number of leaves	5-7 functional leaves
Height of the graft	30-45 cm
Height of the graft Joint	15 -20 cm from collar region.
Growth	Healthy and vertical growing
Graft joint	Perfect without any girdling or constriction.
Nature of Polythene bag	Intact and not torn
Side sprout	Free from side sprout from the root stock

Quality standards - Cocoa hybrid seedlings

Characters	Standards
Age of the seedling	5-6 months
Number of leaves	5-6 pairs
Height of the graft	45-50 cm
Growth	Vigorous seedlings growing straight at the middle of the poly-bag.
Jorquetting	No jorquetting

Directorate of Cashewnut and Cocoa Development (DCCD) Kochi is the national agency approved by Government of India for accreditation of cashew/cocoa nurseries.

भारत सरकार
Govt. of India

काजू और कोको विकास निदेशालय
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ARTICLES INVITED FOR INDIAN JOURNAL OF ARECANUT, SPICES AND MEDICINAL PLANTS

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The Journal contains popular articles on scientific cultivation, processing and marketing aspects of the above crops. Quarterly Market Reviews, Price Statistics, Forecast on Farm Operations etc. are also featured.

Instructions to contributors of Articles in the Journal

1. Articles may be sent in MS Word format in CD alongwith two sets of hard copy, which should not exceed 12 pages. All pages (including tables, legends and references) should be numbered consecutively.
2. The matter is to be arranged in the following order:
   - Title in capital letters.
   - Name of the authors.
   - Introduction highlighting the importance of the subject
   - Subject matter
   - Conclusion
   - Tables, Illustration, Photographs etc. should be cited in the text appropriately. Line drawings must be in black colour. Photograph in colour or black & white with title indicated clearly in JPEG (High resolution) format.
   - Author's full address to be given at the end of the first page.
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   Articles will be acknowledged immediately on receipt and acceptance or otherwise will be communicated within a quarter.

Articles selected for publication will be given honorarium

SPICES IN NORTH EAST INDIA: STRENGTH AND OPPORTUNITIES

Akoijam Ranjita Devi[1] and N. Mini Raj[2]

Introduction

Spices are high value and export oriented commodity crops, which play an important role in agricultural economy of the country. India is the principal source for supply of spices in the global market, though there are number of other countries *viz.* Indonesia, Malaysia, Pakistan, Australia, Spain, Egypt, Tanzania, etc., producing and exporting to the international market. Spices contributed 1.24 per cent of India's total export earnings. The share of spices in the export earnings from agricultural and allied products is 8.5 per cent. Status of export and import of spices during 2018-19 showed that the export quantity was 11,00,250 MT with value of Rs. 19,50,581 lakh, while we are also importing spices with value of Rs. 4,99,549 Lakh.This shows the need of increasing both area and production under spice crops (Spices Board, 2020).

Suitability of NER for spices

North Eastern region of India, comprise of the states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. The region is categorized by diverse agro climatic and geophysical features which makes it distinctive in many ways. Physiographically the entire NE India is divided into four well differentiated units: i) the eastern Himalayan region, ii) the eastern mountain region, iii) the Meghalaya- Mikir table land and iv) the Brahmaputra valley. The states harbour a rich flora and has abundant potential for the development of spice crops. The total geographic area of NE region is 2,62,180 square km which is nearly 8% of the total geographic area of the country (Yadav *et al.,* 2003). The region represents wide variation of climate, ranging from cold to warm pre-humid and receives mean annual rainfall exceeding 2000 mm per annum. The annual precipitation received in the region comes largely from south-west monsoon, which sets around middle of May and continues till the end of October. The greater part of the region has subtropical climate. However, the climate of NE region varies from near tropical in the plains of Assam, Tripura and south Mizoram to near alpine in the northern Sikkim and Arunachal Pradesh (Ngachan *et al.,* 2011). The soils of the region are usually rich in organic matter and acidic to strongly acidic (pH 4.5- 5.0) in reaction and thus suitable for growing different spice crops (Hnamte *et al.,* 2012). The North Eastern region faces vagaries of high rainfall and consequently nutrient depletion and the soil erosion occur. Of the total geographical area of Eastern Himalayan region, 35% lie in the elevation range of below 150 m, 26% between 150 - 1200 m

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and 18% between 600-1200 m. Agro-climatically the region is known for its wide diversity representing temperate, subtropical and tropical areas. The diversity within a single region provides ample scope for growing a large variety of crops. Vast scope exists for cultivation, particularly of ginger, chillies, black pepper, turmeric, tree spices like nutmeg, clove and cinnamon, garcinia etc.

Status of Spice production in NER

The status of spice production in NER region (2019-20) is presented in Table 1. An area of 2,28,950 ha is under spice production with an annual production 7,37,550 tonnes (DASD, 2020). Among the different spices grown in the region, the three commercial crops are ginger, turmeric and large cardamom. Ginger is grown in almost all the states of the region. Large cardamom farming as an under storey crop in hill slopes of Sikkim is a unique traditional production system. Black pepper is also showing promise and organic production is possible to a limited extent.

Major spices

Ginger

Among all spices, ginger is the main cash crop supporting the livelihood and improving the economic level of many ginger growers of north eastern region. Ginger is grown in almost all the states of the region but the leading states are Assam, Sikkim, Meghalaya and Mizoram. Ginger is already a well-established cash crop in Meghalaya and Mizoram with highest productivity in the country. Large scale seed production of improved variety like Nadia in Meghalaya and marketing support provided to farmers in Mizoram encouraged ginger cultivation to a great extent. There is still good scope for improving the productivity in ginger and some kind of processing support (dehydrated ginger of low fibre containing variety) can boost the crop further. Ginger cultivation should be encouraged in Assam and Arunachal Pradesh, where productivity is quite good. Sikkim has also come up well with ginger. Apart from improved varieties like Nadia, China, etc., a number of local cultivars exist in north eastern region. These varieties are high yielders as compared to standard cultivars like Nadia and Rio-De-Janeiro, but have more fibre content.

In North East region, ginger is rotated with French bean or soybean, which not only improves the physical condition of the soil but also give additional income to the farmers. One of the most significant features of the agriculture in the NE region is the prevalence of *jhum* cultivation. In the hills of the region, ginger is generally cultivated on raised bed (called bun) in the *jhum* fields.

Deka and Nath, (2009) reported the promising local genotypes of ginger in NER. Nadia and Tura local gave the least fibre content. Dry matter content was highest in Kachrai ginger and Maran. Gingerol content was highest in Nadia,while oil content was highest in Meghalaya local. Yield was highest in Nadia and Kachrai ginger. Yadav *et al.,* (2004) made a comparison of local varieties *viz* Nadia, Poona and Thingpui with high yielding variety Varada and found that the yield for Nadia was 30 t/ha while that of Varada was only 22 t/ha . Figure 1 presents the distribution of area under ginger in North eastern states. The area under

Table 1: Production of major spices in North-Eastern States (2019-20)

(in tonnes)

State	Pepper	Ginger	Red chillies	Turmeric	Garlic	Cardamom (large)	Coriander	Tejpat/ Cinnamon	Tamarind	Total
Assam	2,899	183,157	21,867	22,829	67,418		32,839			331,009
Mizoram	3	61,001	10,918	29,510	12		21		26	101,491
Sikkim		65,646		9,085		5,000				79,731
Meghalaya	781	66,286		3,314				5000		75,381
Arunachal Pradesh		39,112	2,886	3,375	5	2,038				47,416
Nagaland	29	35,773	1,804	1,857	2,385	2,308	82	2		44,240
Tripura	337	16,245	6,632	7,722						30,936
Manipur		17,902	3,927	5,511			3			27,343
Total	**4,049**	**485,122**	**48,034**	**83,202**	**69,820**	**9,346**	**32,945**	**5,002**	**26**	**737,546**

Source : DASD, 2020

cultivation in almost all the states have been increasing over the years. Figure 2 presents the production of ginger across these states. Production has been steadily increasing over the period of 1991-92 to 2014-15. It may be noted that average yield of ginger in most of the states of northeast region was much higher than the country average (Figure 3). High variability is especially noted in the states Nagaland, Mizoram and Tripura.

Unique traditional ginger cultivation in NER- Removal of mother rhizome

Mother rhizome removal, called *mau* extraction is an age old practice in Sikkim and Darjeeling (Rahman *et al.*, 2009). Almost all the farmers in Sikkim and Darjeeling adopt higher seed rate, *i.e.* 2-2.5 t of rhizome as against the normal rate of 1.5 t/ha. By the end of May or June, *i.e.* when ginger crop attains 60 days age or 3-4 leaves, farmers remove mother rhizome, leaving the sprouted piece of rhizome in the soil. The removed *mau* is sold in local market. Almost 10 q of *mau* are removed per hectare. This is a reason for planting large sized mother rhizome or high seed rate. This practice is believed to give proper space to the developing rhizome and although the quality of rhizome is inferior farmers get income due to off-season price advantage (this income is important, as it solves financial problems during the rainy season). Fifteen days after *mau* extraction, FYM is applied once again and earthed up.

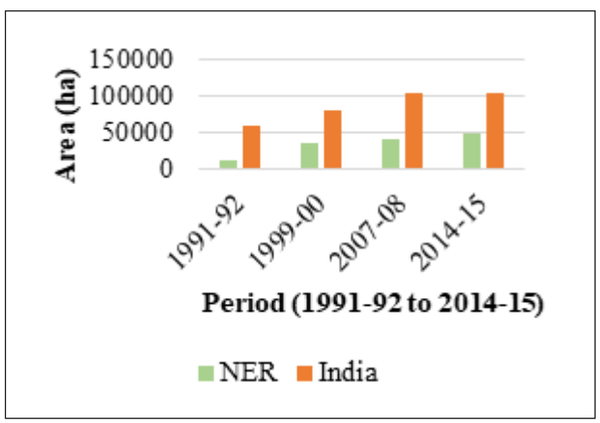


Figure 1: Trend in area of ginger in NER

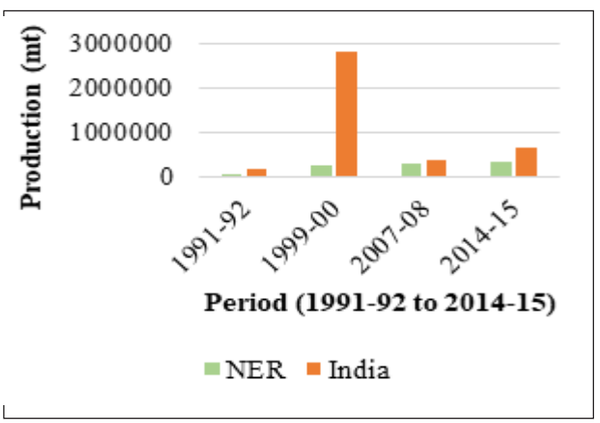


Figure 2: Trend in production of ginger in NER (Das, 2016)

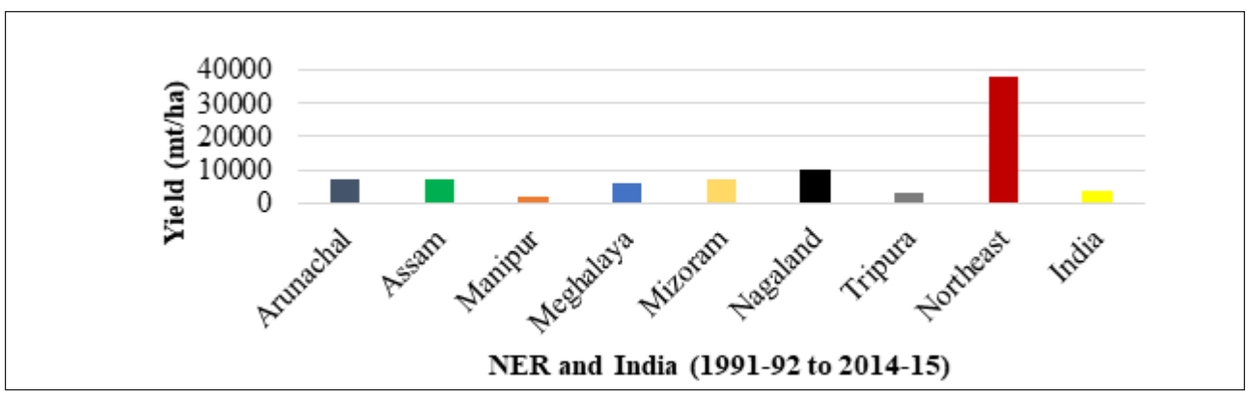


Figure 3: Trend in yield of ginger in NER

Turmeric

Turmeric (*Curcuma longa* L.) is one of the most widely cultivated spice crops in North-eastern region of India because of agro-climatic suitability, rich genetic diversity and high curcumin content. Apart from improved varieties like Lakadong and Megha Turmeric-1, a number of local cultivars exist in north eastern region. Singh and Ramakrishna (2014) revealed the dry matter and curcumin yield of local and promising cultivars of turmeric. The best performing genotypes in the experiment belong to NER ('Megha Turmeric-1' ranked first) for both traits of commercial importance (dry matter recovery and curcumin yield). Therefore, the NER genotypes should be given importance in the programmes of genetic enhancement and varietal improvement of turmeric (Singh and Ramakrishna, 2014).

Large cardamom

Amomum subulatum Roxb. is the greater Indian or Nepal cardamom which is also called large cardamom. The presence of several wild relatives and the tremendous variability within the cultivated species support the view of its origin in Sikkim (Sudharshan, 2009). Generally the cardamom is grown under agro-forestry system in the Himalayas either under the Himalayan alder (*Alnus nepalensis*) or mixed forest tree species. This has proved to be a sustainable land use practice supporting multiple functions and ecosystems. This system helps in the management of slopy land and helps in conserving soil and water and maintaining soil fertility by organic recycling. The production in Sikkim during 2018-19 was 21,797 ha with an annual production of 5,230 t. Apart from Sikkim and Darjeeling District of West Bengal, large cardamom is also cultivated to a limited extent in some of the other North Eastern states. The area, production and productivity in the Sikkim, West Bengal and India are given in Table 2. There is tremendous potential to increase the area, production and productivity in other NE states.

There are distinct cultivars suited to different altitudes and diverse agro-climatic situations, hence increasing the scope of introduction and area expansion of suitable cultivars in the NE states. Cultivars suited for high altitudes (>1515 m above MSL) are Ramsey, Varlangey and Ramla. Sawney is suited for mid (975 - 1515 m MSL) altitudes and cultivars Golsey and Seremna are suited for low (< 975 m MSL) altitude areas.

Table 2 : Area, production, productivity of large cardamom in Sikkim, West Bengal and India

State	Area (000'ha)		Production (000'tonnes)		Productivity (tonnes ha-1)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Sikkim	18.00	21.80	5.00	5.23	0.28	0.24
West Bengal	2.97	3.31	0.82	1.07	0.28	0.32
India	31.59	36.60	9.64	10.48	0.31	0.29

Source : DASD, 2020

Explorations for collection of germplasm of large cardamom has been carried out by Indian Cardamom Research Institute (ICRI), Regional Station, Gangtok at various tracts and a gene bank consisting of 220 accessions is established at Pangthang (East Sikkim). Based on the evaluation of the accessions, two selections ICRI Sikkim-1 and ICRI Sikkim-2, have been released for cultivation in Sikkim and Darjeeling District of West Bengal. Both the selections are from cultivar Sawney.

Chilli

Chilli (*Capsicum* spp.) is usually grown in warm to hot and humid climate in Manipur, Mizoram, Meghalaya, Nagaland, Tripura and Arunachal Pradesh. The chilli species like *C. annum* L. var. avicular , *C. annum* L. var. grossum , *C. annum* L. var longum , *C. chinense*, *C. eximium*, *C. frutescens*, *C. minimum* , and *C. pubescens* are available in this region. King chilli is the world's most pungent chilli (Guinness world record in September, 2006) originated in Northeast India particularly in Nagaland and is cultivated throughout the region. The Naga King Chilli is considered as India's hottest chilli and was previously acknowledged as the world's hottest chilli having Scoville heat units (SHU's) rating of 1,001,304. A number of variants of this chilli are noticed in the north-eastern region of India (Kumar *et al.*, 2011) with different local names such as Naga chilli in Nagaland, *Bhut Jolokia* in Assam, and *U-Morok* in Manipur.

Figure 4 presents the area under chilli cultivation in northeast states and that of the all India level. It is evident that unlike ginger, the share of northeast region do not hold a leading position in case of chilli with the regions share remains only 5.4 percent in 2014-15. At the same time the figure tends to suggest that while the share of chilli in the northeast region has been steadily increasing over time so also the area under cultivation. What is more important is that the increasing area under cultivation has been observed in almost all the states indicating the potential of the region towards increasing chilly production in the country.

Figure 5 presents data on production across northeast states. The share of the region in national production, unlike in area has not recorded a commensurate increase. After recording an increase in share up to 2007-08 the region's share in national production declined in 2014-15 and that its present share is lower than what was in 1991-92.

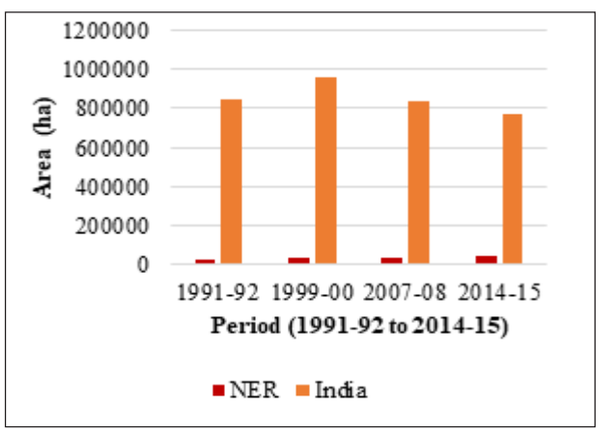
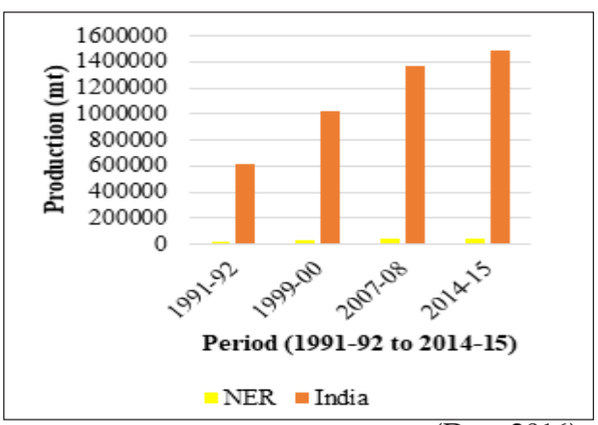


Figure 4: Trend in area of chilli in NER



(Das, 2016)

Figure 5: Trend in production of chilli in NER

The degree of pungency of Capsicum depends on the species and cultivars and the capsaicin concentration can be affected by factors like fruit development stage (Sukrasno and Yeoman, 1993), genetic character and agro-climatic conditions. Tiwari *et al.,* (2005) observed the decrease in the amount of capsaicin and dihydrocapsaicin of Naga chilli by around 50% when cultivated at Gwalior, India indicating that lower levels of humidity and rainfall were not favourable for this crop. Sanatombi and Sharma (2008) reported 2.06% capsaicin in 'Umorok' cultivar of chilli collected from Imphal (Manipur). In another study, Pandey *et al.,* (2009) recorded pungency level of 2,54,896 SHU when cultivated during kharif season of 2006-2007 at Pithoragarh (Uttarakhand) in western Himalayas. These observations allow us to suggest that the season and climatic conditions may have a pivotal role in affecting the pungency of Naga chilli.

Black pepper

Black pepper is a native of Western Ghats, India. India accounts more than 40% share of world area under pepper, contributes about 23% of the world output and is also one of the largest consumers. Black pepper is cultivated in small scale in the homestead gardens at north eastern India at present. Organized cultivation is yet to gain momentum in the region. The vast areas of hills, interspersed with fertile valleys and diverse agro-climatic conditions in north eastern region offers vast potential for cultivation of black pepper in this region. It is necessary to strengthen the production from the traditional tracts by using improved varieties with high yield, quality traits and disease/pest resistance.

The arecanut plantation in Garo hills of Meghalaya and Assam offers tremendous scope for black pepper cultivation in these regions. Further, there is a great scope for growing pepper in tea gardens using shade trees as standards. The shade trees of the tea estates are at present under exploited. Tea estates in North east can accommodate more than one million pepper stands. As per a conservative estimate one kg black pepper (dry) at the fifth year per standard is realizable. However, varieties of pepper suitable to high elevation area need to be identified and popularized for the states/ region. Deka *et al.,* (2016), in an experiment on dry yield and quality of black pepper as mixed crop in arecanut garden at Assam found that dry berry yield per vine were highest in Panniyur 5, Panniyur 1 and Subhakara. Oleoresin content was highest in PLD-2 and Piperine content was highest in Panniyur-2. The study concluded that under Assam condition, mixed cropping of black pepper with Panniyur-1, Panniyur-5, Subhakara, Pournami and Karimunda can be recommended for arecanut gardens.

Growing black pepper in tea gardens

Intercropping black pepper in tea gardens in Assam was started by erstwhile Tata Tea way back in 1989 in few tea estates and in between 1990 to 2000 on an experimental basis. But from 2009 onwards, Amalgamated Plantation (a Tata Enterprise) again started re-focusing on this crop and from 2012 onwards actual work of pepper started in all the 25 estates (Borgohain, 2018).

In 25 tea estates of APPL, there are almost 7.50 lakh shade trees, out of which 5.00 lakh shade trees have been planted with pepper vines and pepper planting in 100% shade trees is

planned in a couple of years. The current total black pepper production of APPL is 60 MT from 1 lakh mature vines and the production will increase in the years to come; as more number of younger vines will come into production.

A major advantage of black pepper is its suitability for intercropping, *i.e.* both tea and pepper can co-exist without interfering each other. Also, the efficient use of land and judicious deployment of labour can be achieved. Climate change has tremendously affected the tea industry. The price of tea in the global and domestic markets fluctuates. Intercropping is one of the option that can protect this industry from vagaries of these market fluctuations.

Tree spices

North eastern states have great potential for large scale cultivation of tree spices due to their varied agro-climatic region, topography and soil. This region can be the major exporting centres of these spices as the region act as a window of trades to the Eastern countries. Majority of the community feasts of NER which include vegetarian and non-vegetarian items require most of the tree spices and at present their requirement is met from other states. Tree spices like cinnamon, tejpat, nutmeg, curry leaf, allspice, and clove are found growing in small pockets in NER. The region where the temperature does not fall below 15^0C has immense potential of growing tree spices commercially. Moreover, NER is famous for the plantation crops like coconut, arecanut, coffee etc. Area under Arecanut in Assam (76.84 thousand ha), Arunachal Pradesh (1.02 thousand ha), Mizoram (10.70 thousand ha), Meghalaya (17 thousand ha), Nagaland (0.50 thousand ha), Tripura (4.70 thousand ha) and the area under Coconut in Assam (24.71 thousand ha), Arunachal Pradesh (0.07 thousand ha), Mizoram (0.04 thousand ha), Nagaland (0.33 thousand ha), Tripura (7.13 thousand ha) offer great scope for mixed/inter cropping with tree spices , thereby improving the unit area productivity. At present, most of these two plantation crops are under monocropping except in Assam where multi-storey cropping system is practiced. The space available under coconut and arecanut can be efficiently utilized by planting tree spices like nutmeg and clove which prefer partial shade for growth and production.

Cinnamomum tamala

Tejpat is an evergreen aromatic tree found in tropical and subtropical Himalayas up to an altitude of 2400m. It is more common in north eastern India and often find its place in majority of local markets. An essential oil (0.7%) obtained by hydro distillation of fresh leaves of *Cinnamomum tamala* cultivated in North Cachar Hills of North East India was examined by gas chromatography (Nath et al., 1994). It was reported to have high linalool content (60.73%).

Star anise

Star anise is grown only in Arunachal Pradesh. China is the largest producer of star anise. Most of the world's demand of shikimic acid currently comes from China. *Illicium graffithii,* locally known as *lissi* in Monpa dialect, grows in large numbers at an elevation of 2,500 metres and above in Tawang and West Kameng districts (Parthasarathy, 2018). The botanical Survey of India recently spotted it in Talle Valley

wildlife sanctuary of Lower Subansiri district. Studies suggest that this botanical marvel in Arunachal Pradesh has slightly higher levels of Shikimic acid than the plants used to extract this chemical in China. A 10.5 per cent level of shikimic acid is sufficient to support commercially viable production. The Arunachal Pradesh variety contains 12 to 14 per cent. This indicate the possibility of growing the commercial star anise in Arunachal Pradesh.

Seed spices

Presence of cloudy days and frost free cooler regions, are ideal for cultivation of fennel, fenugreek, and coriander but not for cumin which require drier climate. The colder NE region where frost is not a problem would be ideal to explore commercial cultivation of the said seed spices in this region.

Underexploited spices

Underexploited tree spices of NER

The NER also serve as the natural habitat of several lesser known tree spices. Zanthoxylum species commonly known as Sichuan pepper are the plants belonging to the family Rutaceae which has about 250 species distributed all over the world, of which 11 are reported from India. *Z. acanthopodium*, *Z. armatum* and *Z. oxyphyllum* are found in North Eastern India (Kala *et al.*, 2005). Among them, *Z. armatum* commonly known as Prickly Ash or Toothache Tree and locally as *Mukthrubi* (Manipur) is an erect shrub or a small tree. A perennial erect shrub with prickly stem, *Z. acanthopodium* is 250-300 cm tall with brown densely matted hairy branches (Yonzone and Rai, 2016). *Z. oxyphyllum* is a slender climbing shrub found in Upper Assam, Manipur and Meghalaya. Another species *Z. rhesta* is a deciduous tree, large crown toughened with sharp spines on the branches (Patiri and Borah, 2007). All these species of Zanthoxylum offer great scope for exploitation.

Even though *C. tamala* is the accepted source of tejpat, other species like *C. impressinervium Meissn.*, *C. bejolghota* and *C. sulphuratum* are used as tejpat in certain pockets of NER. The utilization of these species is still confined to NER and further research is needed for their popularization.

Garcinia atroviridis Griff ex T. Anderson is a medium-sized tree that belongs to the Gutiferae family, locally known as *Asam gelugor.* It is distributed in NER, mostly in Assam in which the unripe fruits are used in curries (Baruah and Borthakur, 2012). The cut and dried pieces of rind are used for souring curries and for dressing fishes as a substitute of tamarind.

Sichuan peppers, other cinnamon and garcinia species are famous elsewhere for their characteristic flavor and aroma. However, the utilization of the species in India is restricted to few local people in the NER. Recorded history shows that apart from being used as spices, they have medicinal properties too. There is urgent need for conserving these lesser known tree spice crops of the NER and research need to be geared up for their popularisation.

Underexploited herbal spices

Maroi nakuppi (Allium odorum) and *Maroi napaki (Allium hookeri)* are the species from onion family whose leaves are used a substitute of onion and garlic in Manipur for their mixed

flavour. *Meitei tilhou macha (Allium chinense)* forms an integral component of garnishing the indigenous chutney *Morok ametpa,* cuisine *Eromba* and also used as a substitute for big onion. These Allium species are resistant to biotic and abiotic stresses as compared to the commercially cultivated species. E*lsholtzia blanda* belonging to Lamiaceae family, is an erect herb found growing in Manipur, commonly known as *Lomba, Ban tulsi* in Assamese and *Jungle tulsi* in Nepali. Dried inflorescence is the economic part used for garnishing and flavouring. *Toning-khok (Houttuynia cordata)* is a fishy odour perennial flowering herb used for flavouring traditional dishes and also serve as a traditional medicine for lowering blood pressure, blood purification and dysentery. It is an important medicinal plant in Chinese medicine.

GI tag for NER spices

Many of the spices in the North Eastern Region have been GI tagged.

I. **Naga chilli:** In 2007, Guinness World Records certified that the ghost pepper was the world's hottest chilli pepper, 401.5 times hotter than Tabasco sauce; the ghost chilli is rated at more than 1 million SHU (Scoville Heat Units). Classic Tabasco sauce ranges from 2,500 to 5000 SHUs.

II. **Mizo chilli:** Mizoram bird's eye up to SHU 2,50,500. This chilli comes from eastern most part of India, bordering Burma. The flavour and heat is wonderful and very enjoyable too. It has distinct flavour and blood red colour with capsaicin content of 1.1 per cent. This chilli will make the perfect Vindaloo.

III. **Karbi Anglong ginger:** Ginger fields in Karbi Anglong. The district produces best organic ginger in the world. The average annual production of ginger in the district is 30,000 tonnes and it is grown by about 10,000 farmers. The ginger grown in Karbi Anglong has a low fibre content, Eg. Aizol (4.1%). Varieties such as Nadia and Aizol, which yield high quantities of dry rhizome and oleoresin and oil, are in great demand among domestic buyers and exporters.

IV. **Lakadong Turmeric:** A very high curcumin variety (7-8%) native to the village Lakadong in Jaintia Hills of Meghalaya

V. **Sikkim large cardamom:** Cultivated as an understorey crop with other shade trees. Post-harvest management is largely traditional which follows Bhatti system. Large cardamom produce from the region is purely organic.

Scope of organic spices in NER

Most of the NE states are having virgin land without any commercial cultivation that is very much suitable for organic cultivation of spices and major spices like black pepper, ginger, turmeric and chillies have larger area in this tract. The region, by default use only less fertilizers and pesticides, far below the national average and this offers great potential for organic cultivation of spices. Area under organic spice cultivation can be instantly recognized and the process of certification expedited unlike other parts of the country.

Scope of value addition in Spices

In North Eastern Region, a huge quantity

of good quality spices *viz.*, ginger, turmeric, chillies and black pepper are produced, but most of the growers during peak season sell their produce at throwaway prices in the local market or to the commission agent. Different value added products from spices like oil and oleoresins, powdered form, paste from ginger and turmeric; pepper and ginger in brine; curcumin from turmeric; capsanthin and capsaicin from chillies; candy, cookies, flakes, beer, wine and juice from ginger, white, dehydrated, freeze dried canned, bottled and dehydrated salted green pepper etc. can be prepared from this NE region.

Major production constraints in north eastern region

In spite of the fact that many quality spices exist in North East region, no major breakthrough has been noticed in boosting the production and increasing export of spices. The major bottlenecks are as follows:

- Shifting cultivation: In this system agricultural crop is grown at one place for 3-5 years and after that farmers shift to another place. Earlier this cycle was for about 15 years; therefore in the meantime the soil gets sufficient time for regeneration of biomass/forests. Now due to reduction in jhum cycle up to 3-5 years, the soil fertility has reduced. This system has caused large scale deforestation, soil degradation and depletion of resource base.

- Land tenure system: For boosting the production of spices, settled cultivation is necessary like other crops. The productivity is also low due to land tenure system prevailing in the region because the farmers do not feel any sense of belonging to the land and therefore, they do not undertake adequate management practices. Settled cultivation and right of ownership of land to the farmers is necessary for judicious management of land. The owner right is not legalized in the name of entrepreneurs. Patta of the land is still in the name of forefathers or others.

- Small land holdings: Because of the terrain, the size of land holding is very small in the region and farmers are taking many crops as per their requirement from the same piece of land. Therefore, the commercialization of crop/ variety on large scale is very difficult in the region.

- Non-availability of quality planting materials and other inputs: Good quality, high yielding and disease resistant rhizomes are not available to the farmers. Though many high yielding varieties have been identified and recommended by the researchers for the region, quality seed production on a large scale is lacking due to non-existence of agencies responsible for quality seed production.

- High rainfall: High rainfall received in the region causes heavy infestation with weeds, pests and diseases and leaching of nutrients.

- Problems of processing and marketing: For a region like this, the success of spices growing is closely linked with the success of spice processing units, marketing and transport facilities. Till today, there are hardly any cold storage facilities available; few processing units exist, but are not functioning up to the desired capacity.

Developmental programmes on spices for NER

Spices Board

1. New planting: The programme is intended to encourage the growers to take up new plantation of old, senile and uneconomic gardens. A subsidy of Rs. 28,000/- per ha is offered to growers owning large cardamom up to 8 ha, the cost of replanting and maintenance during gestation period. The subsidy is limited to new plantation of 4 ha. The subsidy is paid in two equal annual instalments.

2. Production of planting materials through Certified Nurseries: For making available quality planting materials to the growers, Board gives assistance @ Rs.2 per sucker for raising of sucker nurseries in farmers' field.

3. Curing Houses (Modified Bhatti): The large cardamom growers traditionally cure their cardamom by direct heating in the locally constructed bhatties. Capsules dried under this method are black in colour with smoky smell. ICRI-Gangtok had developed a scientific curing technology for large cardamom by introducing Modified Bhatti in which cardamom capsules are dried using indirect heating system in which the dried capsules retain the pink [maroon] colour and natural flavour. In order to popularize this method, Board is providing subsidy @ Rs.9,000/- for 200 kg capacity and Rs.12500/- for 400 kg capacity Modified Bhatti towards 33.33% cost of construction of Modified Bhatti respectively.

4. Cultivation of Lakadong Turmeric: Lakadong / Megha Turmeric is having high curcumin content and hence suitable for extraction of colour. This variety is highly location specific and is very much preferred by the exporters for extraction of the colour. Availability of quality planting materials is a major limiting factor in its production. Hence a subsidy of Rs.18750/- per ha towards 50% of the cost of planting material is offered under the programme.

5. Cultivation of NE Ginger: Ginger varieties like Nadia and China are having higher oil content and hence are suitable for exports. In order to promote organic production of these varieties in NE states, Rs. 18750/- per ha is provided as subsidy towards 50% of the cost of the planting materials.

ICAR Research Complex for NEH Region

The centre has initiated research programmes on spice crops *viz.*, turmeric, ginger, king chilli etc. The emphasis is being given on evolving high yielding varieties of turmeric, collection, evaluation, maintenance and molecular characterization of turmeric, ginger and king chilli, off season production technology of king chilli and value addition in ginger. At the same time trainings are being imparted to the farmers on improved package of practices of these crops. Front line demonstrations on turmeric and king chilli are being conducted to popularize these crops. The institute is also giving consultancy to NGOs on organic turmeric cultivation. Information on these crops is being transferred to the stakeholders through leaflets and pamphlets etc.

Mission on Integrated Development of Horticulture (MIDH)

1. Production and distribution of planting material through development of model nurseries, and seed infrastructure
2. Rejuvenation/replanting programmes
3. Promoting INM/IPM strategies through development of forcasting techniques, plant health clinics, bio control labs etc.
4. Technology dissemination through FLDs
5. Popularizing post-harvest management technologies

Summary and conclusion

While there is little scope for enhancing the area under spices in the traditional belts of the country, we need to focus on newer niches where the potential for spices cultivation is immense like spreading to non-traditional area in the NER where opportunities and skill sets for the future exists. It is estimated that the region can create exportable surpluses at competitive prices so that the top slot occupied by the country in the international market would be maintained. NER has the potential to become major spice exporting centres if adequate processing facilities are set up in these areas. There is tremendous scope for cultivation of various spices in North Eastern states of India as the region is blessed with ideal soil and climatic conditions. The area has great potential for organic spice production, making available residue free commodity for domestic as well as export market.

Future thrust

The followings are the areas where more intensive research is needed so that overall scenario of the spices production can be changed by increasing production and productivity of spices in the NER.

- Survey, diagnosis and design: There is need for survey and diagnosis of lands suitable for spices and development of area specific farming system model in cluster approach.
- Introduction, evaluation and improvement: There is need for introduction of new crops, improve varieties, evaluate them and improve the local cultivars.
- System management research: It is required to have system management research based on specific agro ecological situation.
- Post- harvest management: Processing and preservation of value added products are required. There is need to develop quality control measures, adequate packing and storage techniques. The processing industry can help in sorting out the problem of proper disposal of perishable commodities. The value-added products can be extracted if processing units are set up in the region. Use of appropriate pre and post harvest practices for spice crops is vital for the success of the crops and to provide good return to the growers.
- Economics and technology transfer: The benefit-cost analysis of different farming systems is required. There is immense need to strengthen the extension system for transfer of technologies generated and providing training to the farmers.

All these should be done with emphasis on organic farming.

References

Agristat. 2018. Available at https:// www.indiaagrisat.com. [Accessed on May 2018]

Baruah, S. and Borthakur. 2012. Studies on morphology and ethnobotany of Six species of Garcinia L. (Clausiaceae) found in the Brahmaputra Valley, Assam, India. *J. Nat. Prod. Plant Resour.* 2(3): 389-396.

Borgohain, A. J. 2018. Growning black pepper in tea gardens of North East India- A sustainalility initiative by Amalgamated Plantations. In. *Spices for doubling farmer's income*. Symposium on Spices, Medicinal and Aromatic crops (SYMSAC-IX), 15-17, March, School of Agricultural Sciences & Rural Development, Nagaland University, Medziphema, Nagaland, pp. 2-9.

Das, K. 2016. *Production conditions of spices in North East India: Cases of ginger and chilli.* Centre for Development Studies, Thiruvananthapuram, pp. 35.

Deka, K. K., Bora, P., and Talukdar, J. 2016. Performance of different varieties and hybrids of black pepper (*Piper nigrum* L.) as mixed crop in arecanut garden of Assam, India. *Agric. Sci. Digest* 36 (4): 272-276.

Hnamte, V., Chatterjee, R., Chattopadhyay, P. K., and Pariari, A. 2012. Spices scenario in the North Eastern States of India with special reference to production and marketing. *J. of Crop and Weed.* 8(2):109-112

Horticulture Statistic Division, Dept of Agriculture, Co-operation and Farmers Welfare. 2017. *Horticultural Statistics at a Glance* 2017. Government of India, 481pp.

Jha, A. K. and Deka, B. C. 2009. *Present Status and Prospects of Ginger and Turmeric in NE States*. ICAR Research Complex for NEH Region, Umiam, Meghalaya, pp 1-6.

Kala, C. P., Farooquee, N. A., and Dhar, U. 2005. Traditional Uses and Conservation of Timur (*Zanthoxylum armatum* DC.) through Social Institution in Uttaranchal Himalaya, India. Conserv. Soc. 3(1):224-230.

Kumar, S., Kumar, R., Kumar, S., Singh, M., Rai, A.B., Rai, M. 2011. Incidences of leaf curl disease on Capsicum germplasm under field conditions. The *Indian J. of Agri. Sci.* 81: 187-189.

Mahesh, S. S., Saju, K. A., Vadiraj, B. A., Thaomas, J., and Deka, T. N. 2014. Efficacy of microbial inoculants and organic fertilizer for establishing large cardamom (*Ammomum subulatum* Roxb.) sucker nursery. *J. Spices Aromat.* Crops. 23(1): 138-142.

Nath, S. C., Hazarika, A. K., and Singh, R. S. 1994. Essential oil of leaves of *Cinnamomum tamala* Nees. & Eberm. from North East India. *J. Spices Aromat. Crops* 3 (1): 33-35.

Ngachan, S. V., Mohanty, A. K., and Pattanayak. A. 2011. Status Paper on Rice in North East India- *Rice Knowledge Management Portal*: pp 82.

Pandey, V., Pandey, H.K., Dayal, D., Joshi, U.C., Pant, T., Ahmed, Z., 2009. Studies on antioxidant constituents of some domesticated capsicums in the middle hill conditions of western Himalayas. *Hortscience* (Prague) 36, 26-30.

Parthasarathy, V. A. 2018. North East- Spice hub of India: In. *Spices for doubling farmer's income.* Symposium on Spices, Medicinal and Aromatic crops (SYMSAC-IX), 15-17, March, School of Agricultural Sciences & Rural Development, Nagaland University, Medziphema, Nagaland, pp. 2-9.

Patiri, B. and Borah, S. A. 2007. *Wild edible plants of Assam*. 161 pp.

Rahman, H., Karuppaiyan, R., Kishore, K., and Denzongpa. 2009. Traditional practices of ginger cultivation in Northeast India. *Indian J. Tradit. Knowl*. 8(1): 22-28.

Sanatombi, K., Sharma, G.J., 2008. Capsaicin content and pungency of different Capsicum spp. cultivars. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca* 36, 89-90.

Singh, B. K. and Ramakrishna, Y. 2014. Indian collections of turmeric (*Curcuma longa* L.): genetic variability, inheritance, character association and performance. *Indian J. Plant Genet.* Resour. 27(3): 263-270.

Spices Board India. 2020. Item wise export of Spices from India. Government of India. Available at: file:///C:/Users/Hp/Downloads/Major% 20Item %20wise% 20Export%202016-17.pdf [Accessed on Feb, 2020].

Spices Board India. 2020. Item wise import of Spices into India. Government of India. Available at: http://www.indianspices.com/sites/default/files/Major%20Item% 20wise% 20Import-2016.pdf [Accessed on Feb 2020].

Sudharshan, M. R. 2009. Genetic diversity in large cardamom and its suitability to North eastern states. In. *Spices for doubling farmer's income*. Symposium on Spices, Medicinal and Aromatic crops (SYMSAC-IX), 15-17, March, School of Agricultural Sciences & Rural Development, Nagaland University, Medziphema, Nagaland, pp. 2-9.

Sukrasno, N., and Yeoman, M. M. 1993.Phenylpropanoid metabolism during growth and development of *Capsicum frutescens* fruits. *Phytochemistry.*32: 839-844.

Tiwari, A., Kaushik, M. P., Pandey, K. S., and Dangi, R. S. 2005. Adaptability and production of hottest chilli variety under Gwalior agro-climatic conditions. *Curr. Sci.* 88: 1545-1546.

Yadav, R. K., Yadav, D. S., Rai, N and Patel, K. K. 2003. Prospects of horticulture in North Eastern Region. *ENVIS Bull.Himalayan Ecol*. 11: 10-25.

Yadav, R. K., Yadav, D. S., Rai, N., Sanwal, S. K., and Sarma, P. 2004. Commercial prospects of ginger cultivation in north-eastern region. *ENVIS Bull.: Himalayan Ecol.* 12(2), 2004.

Yatung, T., Dubey, R. K., Singh, V., Upadhyay, G., and Singh, S. 2014. Studies on seed protein profiling in chilli (*Capsicum annuum* L) genotypes of Northeast India. *Australian J. Crop Sci.* 8(3): 369-377.

Yonzone, R. and Rai, S. 2016. *Zanthoxylum acanthopodium* DC. (Rutaceae) -a favourable ethnomedicinal fruit for the local inhabitants of Darjeeling Himalaya of West Bengal, India. *J Complement Med. Alt. Healthcare*. 1(1).

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VALUE ADDED PRODUCTS FROM GINGER - ITS POTENTIAL FOR ENTREPRENEURSHIP DEVELOPMENT

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Ginger, the underground rhizome of *Zingiber officinale*, is an important commercial crop grown for its aromatic rhizomes which are used as vegetable, spice, medicinal purposes, etc. India is the largest ginger producing country in the world with an annual production of 18.44 lakh tonnes of fresh ginger from an area of 1.72 lakh ha during 2019-20 (DASD Kozhikode, 2020). India exported 18,150 tonnes of ginger valued Rs. 19602 lakhs during 2018-19 to countries like Bangladesh, Moroco, U.S.A, U.K, UAE etc. Ginger is cultivated in most of the states in India, however, states namely Karnataka, Madhya Pradesh, Assam, Kerala, Orissa, Maharashtra, West Bengal etc. together contribute around 70 per cent of the country's total production.

Ginger is mainly used as a condiment in various food preparations and also serves as a carminative and gastric stimulant in many medicinal preparations. As a condiment, it is used for flavouring mayonnaise and tomato ketchup, sauce, salads, meat sausages, chutney, pickles, biryani, fried rice etc. It is also used in pharmaceuticals for the production of herbal medicines in the treatment of cold, fever etc.

There is a huge market for both fresh and dried ginger. The peculiar hot and pungent taste of ginger is attributed to the presence of an acrid compound called gingerol. Powdered ginger has very good domestic as well as export market and is used for fragrance in soaps and cosmetic industries. Ginger oil obtained by the steam distillation of the dried ginger is mainly used in the flavouring of beverages, confectionery, perfumes etc. The demand of ginger oil is also ever increasing and it has good export and domestic demand. Consumer preference for ginger based products is increasing and there is a huge potential for ginger based value added commodities. Thus, entrepreneurship in this area has become quite prospective and new entrepreneurs can well be ventured in to this field.

Value added products from ginger

The value added products obtained from ginger are based on

i. Dry ginger based products

Whole dry ginger, ginger flakes, ginger powder

ii. Fresh ginger based products

Ginger paste, ginger candy, ginger conserve, syrup, ginger pickle, salted ginger etc.

iii. Ginger beverages

Ginger beer, ginger Ale, ginger wine

iv. Ginger oils and oleoresins

v. Freeze dried ginger cubes and slices

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I. Brief description of dry ginger based products

Processing of ginger for dry ginger production, the rhizomes are harvested at about 8 months of maturity. The outer skin is partially peeled which is generally done manually and this operation accelerates the process of drying. Excess peeling may cause loss of tissue and in turn causes the reduction in yield of essential oil.

Drying is the major unit operation and is mainly done under sun or in mechanical dryers when it is flaked or sliced. The initial moisture of 82-84% (at the time of harvest) is reduced to the safe storage moisture content of 10%. Sun drying of ginger rhizomes takes 7-10 days. Whereas, sliced ginger when dried in mechanical drier the drying time is much lower. The dried whole ginger is brown in colour and has a wrinkled appearance and the dry yield of dry ginger is about 20%. Dry ginger thus obtained is used for producing ginger powder and is also used for processing of essential oil and oleoresin. Fig. 1 and Fig. 2 show the flow chart for production of ginger flakes and whole dry ginger, respectively. Table 1 shows the machinery required and cost estimate for establishment of mini and medium plants for production of ginger flakes and ginger powder.

Table 1 : Dry ginger flaking unit - Machinery required and cost estimate for mini and medium plant

S.No.	Equipment	Purpose	Mini Plant 50 kg/h slicing and drying capacity 500 kg/batch (Rs.)	Medium plant 150 kg/h slicing and drying capacity 1 tonne/ batch (Rs.)
1.	Washer and peeler	To wash the mud and peal 80% skin of ginger simultaneously.	1,50,000/-	3,00,000/-
2.	Ginger slicer	Slice ginger into slices of 5-8 mm	1,25,000/-	2,75,000/-
3	Solar tunnel drier with multi layer trays (1 tonne/ batch)	Protected Solar drying of ginger flakes in trays	4,00,000/-	6,00,000/-
4	Sealing unit	Sealing of pouches	40,000/-	40,000/-
		Total cost	**7,15,000/-**	**12,15,000/-**

Table 2 : Ginger powder production unit - Machinery required and cost estimate for mini and medium plant

S.No.	Equipment	Purpose	Mini Plant, 50 kg/day (Rs.)	Medium plant, 100 kg/day (Rs.)
1	Pulverizing unit	For powdering of dry ginger	2,50,000/-	5,00,000/-
2	Sieving unit	To sieve the ginger powder	1,25,000/-	2,75,000/-
3	Sealing unit	Sealing of pouches	40,000/-	40,000/-
		Total cost	**5,15,000/-**	**8,15,000/-**

Fig. 1: Process flowchart for production of ginger flakes

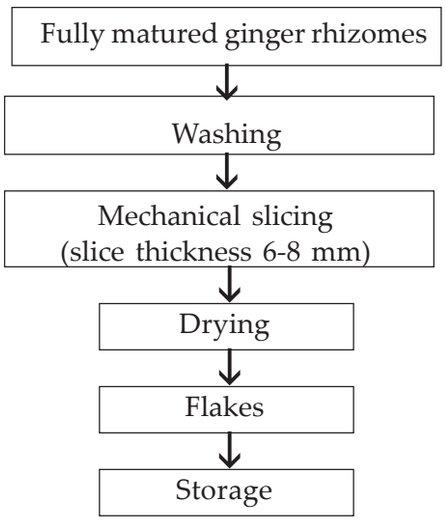
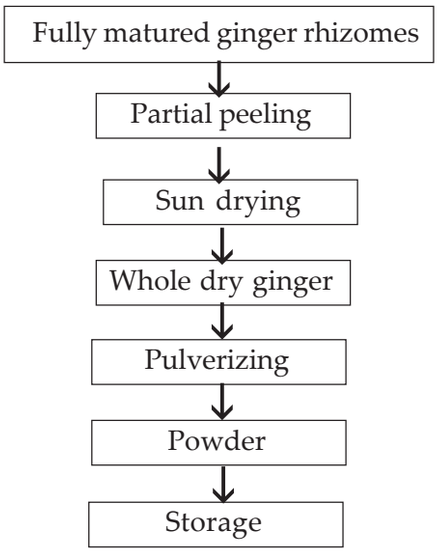


Fig. 2 : Process flowchart for production of whole dry ginger and ginger powder



II. Brief description of fresh ginger based products

Number of value added products are prepared from fresh ginger like salted ginger, ginger candy, ginger conserve, ginger pickle etc. The flow charts for the preparation of salted ginger, ginger paste, ginger pickle, ginger conserve and ginger candy are presented in Fig. 3, 4, 5, 6 and 7. Table 3, 4, 5 provides the equipments required and cost estimate for establishment of ginger paste, ginger candy and ginger pickle production units.

Fig 3 : Process flowchart for production of salted ginger

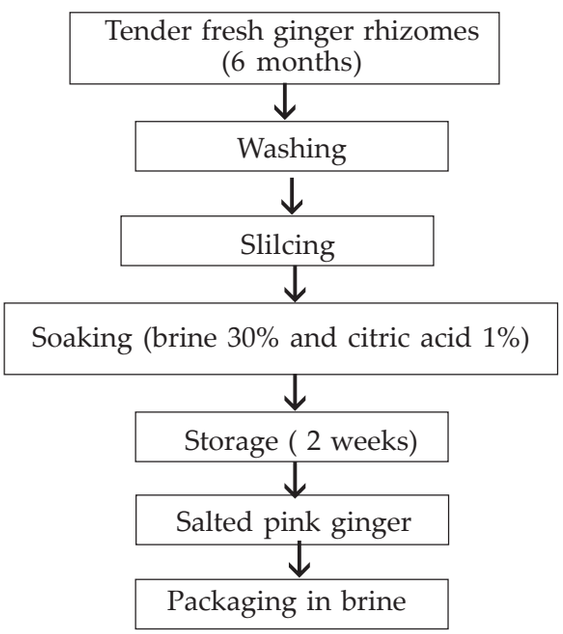


Fig. 4 : Process flowchart for production of ginger paste

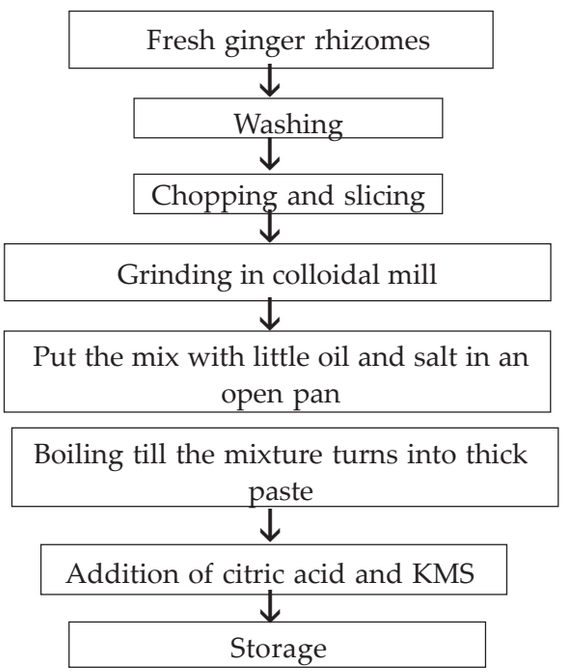


Fig. 5: Process flowchart for production of ginger pickle

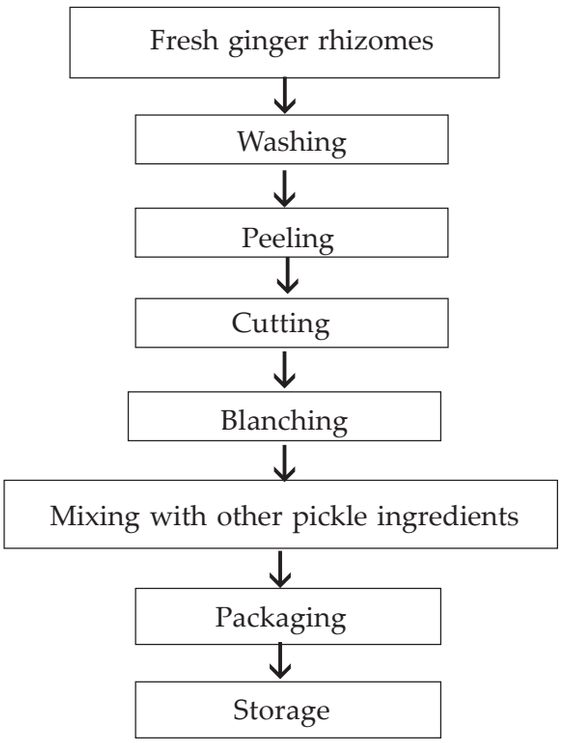


Fig. 6 : Process flowchart for production of ginger conserve

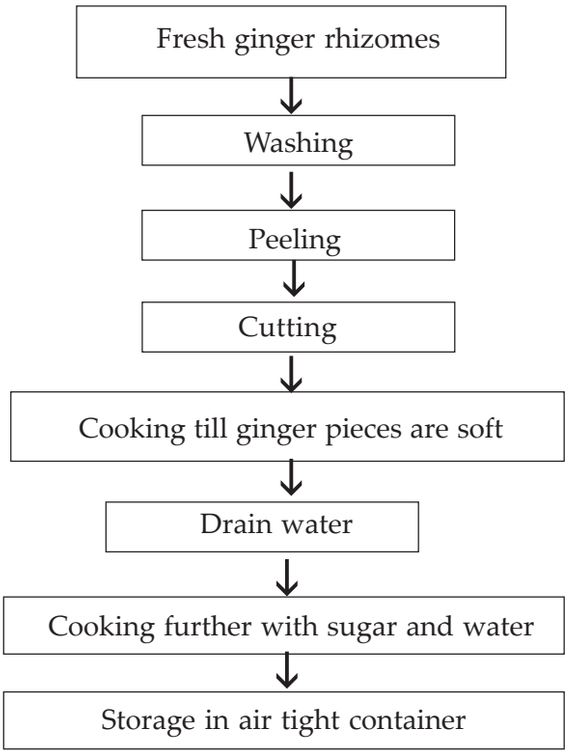


Fig. 7 : Process flowchart for production of ginger candy

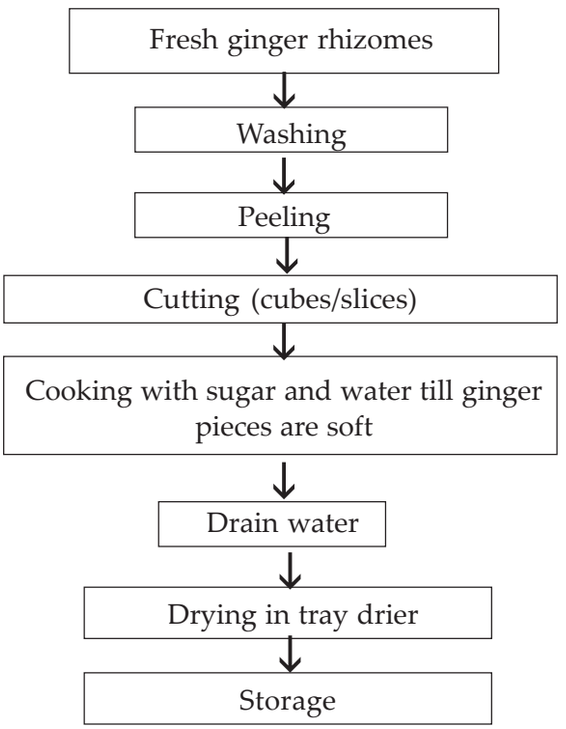


Table 3 : Ginger paste production unit - Machinery required and cost estimate for mini and medium plant

S. No.	Equipment	Purpose	Mini Plant, 50-75 kg/day (Rs.)	Medium plant, 300-400 kg/day (Rs.)
1	Washer and peeler	To wash the mud and peal 80% skin of ginger simultaneously.	1,50,000/-	3,00,000/-
2.	Fruit mill	For grinding Ginger to make ginger paste	1,40,000/-	2,25,000/-
3	Colloid mill	For fine grinding of ginger for ginger paste	1,40,000/-	2,25,000/-
4.	Semi solid dozer	For filling semi solids like paste, jam, sauce, pickles etc.to a pre set volume to the bottles or pouches	2,75,000/-	2,75,000/-
5.	Automatic sealing machine	Sealing of pouches	40,000/-	40,000/-
Total cost			**7,45,000/-**	**10,65,000/-**

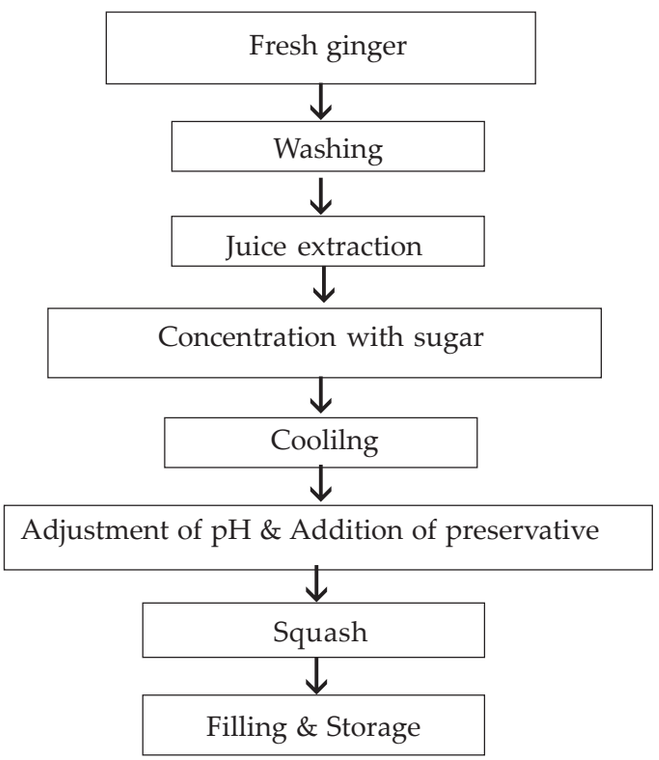
Table 4 : Ginger candy production unit - Machinery required and cost estimate for mini and medium plants

S. No.	Equipment	Purpose	Mini Plant, 50-75 kg/day (Rs.)	Medium plant, 300-400 kg/day (Rs.)
1	Washer and peeler	To wash the mud and peal 80% skin of ginger simultaneously.	1,50,000/-	3,00,000/-
2.	Ginger cutter	For cutting to cubes	95,000/-	2,50,000/-
3.	Cooking kettle	For boiling or blanching of ginger	95,000/-	2,40,000/-
4.	Coating pan	For coating sugar on ginger cubes	1,60,000/-	2,75/-000/-
5.	Electric oven	For drying ginger cubes	60,000/-	1,20,000/-
6.	Sealing unit	Sealing of pouches	40,000/-	40,000/-
Total cost			**6,00,000/-**	**12,25,000/-**

Table. 5 Ginger pickle making unit - Machinery required and cost estimate for mini and medium plants

S. No.	Equipment	Purpose	Mini Plant, 50-75 kg/day (Rs.)	Medium plant, 300-400 kg/day (Rs.)
1	Washer and peeler	To wash the mud and peal 80% skin of ginger simultaneously.	1,50,000/-	3,00,000/-
2.	Ginger cutter	For cutting to cubes / slices	95,000/-	2,50,000/-
3	Pickle blender	For even mixing powders or Pickles.	1,40,000	2,70,000/-
4.	Semi solid dozer	For filling semi solids like paste, jam, sauce, pickles etc. to a pre set volume to the bottles or pouches	2,75,000/-	2,75,000/-
5.	Sealing unit	Sealing of pouches	40,000/-	40,000/-
Total cost			**7,00,000/-**	**11,35,000/-**

Fig. 8 : Process flowchart for production of ginger juice/squash



III. Ginger based juice/ squash

The process flow chart for production of ginger juice/ squash is presented in Fig. 8 and the cost estimate is provided in Table 6.

Table 6 : Machinery required and cost estimate for mini and medium plants of ginger juice / squash plant

S. No.	Equipment	Purpose	Mini Plant, 50-75 kg/day (Rs.)	Medium plant, 300-400 kg/day (Rs.)
1	Washer and peeler	To wash the mud and peal 80% skin of ginger simultaneously.	1,50,000/-	3,00,000/-
2.	Juice expeller	For extracting Juice from Ginger	1,90,000/-	3,50,000/-
3.	Cooking kettle	For boiling or blanching of juice or vegetable	95,000/-	2,40,000/-
4	Liquid filling machine	For filling liquid to bottles	1,50,000/-	1,50,000/-
5	Cap sealing machine	For sealing bottles	4000/-	4000/-
Total cost			**5,89,000/-**	**10,44,000/-**

Table 7 : Steam Distillation Unit - Machinery required and cost estimate for mini and medium plants for ginger

S.No.	Equipment	Purpose	Mini Plant, 50 kg/batch (Rs.)	Medium plant, 300-400 kg/batch (Rs.)
1	Steam Distillation Unit	For extraction of volatile oil from dry ginger	6,50,000/-	10,00,000/-

Table 8 : Solvent Extraction Unit (Oleoresin extraction unit) - Machinery required and cost estimate for mini and medium plants for ginger

S.No.	Equipment	Purpose	Mini Plant, 50 kg/batch (Rs.)	Medium plant, 200 kg/batch (Rs.)
1	Solvent Extraction Unit	For extracting oleoresin from dry ginger	8,50,000/-	14,00,000/-

IV. Ginger based oil and oleoresin extraction plant

Ginger oil: Dry ginger on distillation (using water or steam) yields about 1.5 to 2.5% volatile oil (15 to 25 ml per kg dry ginger). It contributes to the aroma of ginger oil. The main constituent in the oil is zingiberene.

Ginger oleoresin: Dry ginger powder on treating with organic solvents like acetone, alcohol, ethyl acetate etc. yield a viscous mass that attribute the total taste and smell of the spice. The major non-volatile principle in oleoresin is gingerol. Oleoresin content varies from 4 to 10% .

Points for information and consideration

i. Mini plants are for cottage level production and medium plants are suitable for entrepreneurial activities.

ii. Essential oil and solvent extraction units would be economically viable only when large plants are established and is not recommended for startup entrepreneurs.

iii. In all the equipments, the contact parts are made of stainless steel 304.

iv. The rates are exclusive of taxes, transportation and erection charges.

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RED PALM WEEVIL - A POTENTIAL PEST ON ARECANUT

P. S. Prathibha and C.Thamban*

Introduction

Red Palm Weevil (RPW) *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Dryophthoridae) is an indigenous pest from South East Asia. It has recently become one of the most dangerous concealed borer pests of palms around the globe. Earlier, RPW was found to be infesting five palm species *viz.*, coconut (*Cocos nucifera*), date palm and Canary island palm (*Phoenix dactylifera P. canariensis*), true sago palm (*Metroxylon sagu*), and talipot palm (*Corypha umberaculifera*). Later, it has been noticed to attack 40 palm species including areca palm (*Areca catechu*). However, coconut, date palm and canary island palms remain as the most preferred hosts. RPW is distributed worldwide, including Middle East, North Africa and Southern Europe. In India, it is a fatal enemy and key pest of coconut palms of age group between 3- 20 years. Being a killer pest, 1 % incidence itself is considered as Economic Threshold Level (ETL), which demands curative insecticide treatment. Bud rot / leaf rot infections and infestation of rhinoceros beetle or any mechanical injury predispose RPW attack. Though it occurs round the year, becomes more prominent during monsoon season (Fig. 1).

Team of scientists from ICAR- CPCRI, Kasaragod has recently reported incidence of RPW in an arecanut garden at Chunda in Cherupuzha Grama Panchayat of Kannur District (Latitude 12° 2917085′′ Longitude 75° 398674′′). There was 6 % incidence of the pest in the arecanut garden and a total 60 palms were infested of which 10 palms were dead (Fig 1). The arecanut garden is planted with 'Swarnamangala' variety of arecanut. The palms are four years old under well management condition. The infestation occurred through the crown region. There was considerable

Fig. 1. Field visit- Red palm weevil infested garden at Chunda in Cherupuzha

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infestation of spindle bug in most of the palms which was evident as necrotic lesion on inner fronds. Injury due to spindle bug coupled with absence of coconut palms of preferred age group must be the possible reasons for the attack of RPW on arecanut. Though red palm weevil infestation was reported on arecanut in early occasions also crop loss was not that substantial. By regular monitoring and early detection of the pest incidence and timely adoption of curative insecticide treatment will help to manage the pest effectively.

Biology

The entire life cycle of RPW is concealed inside the palm trunk except the partially exposed adult stage. Adult weevils are highly sensitive to volatiles (Fig 2). Weevils locate the host plants by sensing the volatiles emanating from wounds. Female weevils lay eggs mostly

Fig. 2 : Red palm weevil adult

in wounds, cracks and crevices on the trunk, bole region or at leaf axil near the crown of young palm. Female beetles commence oviposition 1- 7 days after mating and its fecundity is about 276 eggs. Eggs are creamy white elongated, oval shaped that hatch in 3- 4 days (depending up on weather parameters and host). On hatching, apodous creamy larvae with well sclerotized head and mouth parts emerge. Number of larval instars unknown inside the palm trunk, in laboratory it varies from 7-16. Larval period ranges from 36 - 78 days (Fig 3). It pupates in fibrous cocoon of approximately 80 x 35mm size, made up of debris of chewed palm tissues. Pupal stage last for 22 to 25 days. Pupation occurs toward the outer periphery of the palm trunk which ensure easy emergence of adults. Adult weevils were found to live for 60 - 70 days and are ferrugineously brown with long curved and pointed snout having six black spots on the thorax. The duration of the life cycle (from egg to adult stage) was reported to vary from 45 days to 139 days based on the weather condition and type of the food.

Fig. 3 : Red palm weevil grubs

Nature of damage

Like most of the insect pests, larval stage is pestiferous. Infestation starts with the oviposition, emerging larvae bore the trunk and enter inside (Fig. 4). They feed on soft internal tissues by gnawing, makes tunnels and galleries extensively (If carefully perceived, gnawing sound will be audible from outside on palm trunk). As a result, internal tissues rots and emit typical fermenting odour. Conduction of water and nutrients affected which results in yellowing and wilting of fronds. It will take considerable

time to express the symptoms on leaves, by that time cabbage portion would have been eaten away. Later instar larvae are voracious feeder and move towards the periphery for pupation. Infestation on crown is more dangerous as it can easily affect the growing bud of the palm. Concealed nature of the pest upsurges the vulnerability.

Fig. 4: Boring by RPW grubs in trunk of arecanut palm

Diagnostic symptoms

- Presence of dried gums at the leaf axil / trunk which are the prospective entry points of the weevil (initial symptom)
- Oozing of reddish brown liquid from the bore hole on the trunk
- Presence of chewed fibers, larvae and cocoons, pupal case in leaf axil and inside the trunk if it split open.
- Hole at the bole region with gnawing sound
- Yellowing and wilting of the fronds followed by crown toppling (Later stage).

The following IPM measures suggested

- Regular monitoring for early detection of pest incidence (i.e., presence of gummy exudates on leaf axil / on the trunk which are potential egg laying sites)
- Prophylactic leaf axil filling of mixture of granular insecticide fipronil 0.3 G and sand (6 g + 250 g)
- Curative treatment with imidacloprid 200 SL @ 1 ml / litre by crown pouring / by trunk injection
- Cut and burn dead palms due to RPW or crown rot incidence which are the potential breeding sites for the weevil
- Management of spindle bug by leaf axil placement of thiamethoxam 25WG sachets of 2g @ 2 saches / palm on either side of spindle leaf during monsoon
- Control of crown rot / Mahali diseases by timely spraying of 1 % Bordeaux mixture

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PACKAGE AND PRACTICES FOR SCIENTIFIC CULTIVATION OF GINGER UNDER ORGANIC MANAGEMENT CONDITION IN MID HILLS OF SIKKIM

Gaurav Verma[1], Amit Kumar[2], B.A. Gudade[3], Raghavendra Singh[2], Subhash Babu[4] Mohammad Hasanain[4] , S. S. Bora[3] , Gaurendra Gupta[5] and Guddu Rai[2]

Abstract

Spices constitute the most important natural wealth for people. It is a cash crop which has significant economic importance for livelihood security of farmers in the era of climate change. It can be used as therapeutic agents as well as important raw materials for the manufacture of traditional and modern medicines. Being a multipurpose crop, there is urgent need for adoption of improved agronomic management practices to increase the productivity and profitability. The present paper is made for scientific cultivation of ginger under organic management condition, which is a prominent sub-Himalayan spice.

Introduction

Ginger (*Zingiber officinalis* Roscue) belongs to family-Zingiberaceae. It is locally known as "Adua" and the most important cash crop of Sikkim grown under organic management condition. It is one of the important spices all over the world and India is the largest producer with production of 10.4 lakh tonnes from 1,57,839 hectares area (FAOSTAT, 2017-18). Ginger is cultivated in most of the states *viz.*, Karnataka, Orissa, Assam, Meghalaya, Arunachal Pradesh and Gujarat, which together contribute 65 per cent to the country's total production. It is a slender monocotyledonous rhizomatous perennial herb, leaves are linear, sessile, glabrous, flowers are yellowish green, spikes are cylindrical and fruits are oblong capsules. Rhizomes are white to yellowish brown in colour, laterally flattened and irregularly branched. Its aromatic rhizomes are used both as spice and medicine. Ginger of commerce is the dried rhizome. It is marketed in different forms such as raw ginger, dry ginger, bleached dry ginger, ginger powder, ginger oil, ginger oleoresin, gingerale, ginger candy, ginger beer, brined ginger, ginger wine, ginger squash, ginger flakes etc. Few scales gave a covering to the growing tips. Rhizomes are smooth and if broken some fibrous elements of the vascular bundles comes out from the cut-ends. It contains up to 3% essential oil that causes the fragrance of the spice. The pungent taste of ginger is due to non-volatile phenyl propanoid and diarylheptanoids. It is also valued for its manifold medicinal properties in gastritis, dyspepsia, flatulence, cold and cough.

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Ginger Field

Ginger Rhizomes

Area of production

The main ginger producing areas in Sikkim are Rhenock, Rongli, Pakyong, Rorathang, Khamdong, Pandam, Sirwani and Rangpo in East District, Turuk, Sumbuk, Ratepani, Bikamat, Namthang, Melli dara, Maniram, Namchi, Temi-Tarku, and Bermiok in South District, Mangalbaria, Chakung, Malabansey, Tharpu and Geyalshing in West District and small pockets in North District.

Climate and soil requirement

In Sikkim, ginger is grown up to an elevation of 1500 m above MSL in all the four districts of Sikkim. Light textured soils with moderate soil fertility and warm humid climate favors for cultivation of ginger in Sikkim. But, it should be performing well at 6-7.5 pH.

Land preparation

In Sikkim condition, ginger is cultivated in terraces as well as on hill slopes. Fine bed used to prepare with convenient length and 75-100 cm in width. Raised beds (15-20 cm) with a gently outward slope avoids the water logging in ginger field. Soil solarization of beds for 40 days using transparent polythene sheet is followed in areas prone to rhizome rot disease and nematode infestations.

Major Varieties

Bhaise, Gorubathane, Jorethange, Tange and Majhauley are the local cultivar popular among farmers. However, state Govt. also popularised improved varieties like Rio-de-Janeiro and Nadia. In Sikkim condition Bhaise was found to be the highest yielder (9.41 t/ha) followed by Nadia (7.61 t/ha) and Gorubathaney (7.00 t/ha).

Sowing time/Season

Depending on altitude and rainfall, planting in Sikkim is done from February to April. Early planting results in high yield, provided hailstorm does not affect the crop severely. However, crop is mainly grown as rainfed which completely depends upon the receipt of pre-monsoon showers.

Seed and sowing

Seed rate of ginger is varying from season to season, method of sowing, size of rhizomes

and crop geometry. It is always propagated by seed rhizomes. Generally farmers are using full rhizome without breaking it, hence the seed rate is relatively higher (1.50-2.50 t/ha) as compared to other North Eastern States. Mother rhizome extraction is an age old practice (continued even today) in Sikkim. By the end of May or June i.e. when ginger crop attains 60 days growth, farmers used to remove mother rhizome ('*Mau*' in vernacular) leaving the sprouted piece of rhizome in the soil. Almost 10 q/ha of mother rhizome planted initially are taken back. It is planted in shallow pits in lines (30-45 cm) leaving 15-20 cm spacing between plants in a row. It is sown behind the plough in ridges and furrow system and in bed system; rhizomes are dibbled at 5-10 cm pits. Treat the planting materials with bioagent (*Trichoderma*) @ 4 g/kg planting material. Make 2.5 % copperoxychloride solution and dip the planting materials for 30 minutes before sowing.

Mulching

Ginger responds well to mulching, therefore, just after sowing, beds used to be covered with mulches consisting of forest litters, straw, grasses and other plant residues. Mulching with leaves and twigs of Chilaune (*Schima wallichii*), Banmara (*Eupatorium* sp) and Utis (*Alnus nepalensis*) @ 5 to 10 t /ha resulted in increased germination and reduced weed growth. Green manure crops like *Sesbania* can be planted among ginger crop (in bed interspaces and field borders) which can later be used as mulch. The roots of green manures are good source of organic matter.

Water management

In Sikkim, ginger is mostly cultivated as rainfed however, irrigation and proper water management increased its production. It requires about 1300-1500 mm of water for completion of 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.

Nutrient management

Ginger is a nutrient exhaustive crop in cropping systems. To achieve the higher nutrient use efficacy, integrated application of FYM @ 40-50 t/ha along with 2 t/ha neem cake and bio-fertilizer (Azospirillum+PSB) @ 5-6 Kg/ha applied in rows at the time of planting. Two months after planting, application of vermicompost + Nalpak @ 5 t/ha to boost up the growth and sustainable production of crop.

Weed management and earthing up

High rainfall from June to September favors heavy weed growth. Weeds remove nutrients and predispose ginger to pest and diseases. Enhancing the crop competitiveness through preventive methods, cultural practices, mechanical methods, biological control and crop diversification are new examples of weed management. In case of excess weed, four to five hand weeding is required. After every weeding, earthing up is recommended to cover the exposed rhizome. At least two earthing up should be done first after 50 days at the time of mulching and second after 75 days of planting.

Maturity indices

The stage of maturity of rhizomes has a significant influence on its quality and suitability for consumption and processing for preserved, seed ginger and dried ginger. The appropriate stage and maturity indication will depend upon the purpose for which it is to be harvested.

❖ **Preserved ginger**: In this case the main indications are when there is minimum of crude fibre, maximum of volatile oil, oleoresin and starch. The rhizomes are harvested for the direct sale or manufacture of preserved ginger at immature stage *i.e.* green immature and green mature.

- Green immature: The rhizomes are tender, succulent, fibreless and the rhizomes break easily (after 5-6 months of planting). It should not be watery but attained solidity and mild in pungency.

- Green mature: The rhizomes have fully developed mature, hard skin, on breaking fibre formation is there and the leaves start turning yellow and stem lodges. The rhizomes are more fibrous and pungent.

Plant protection measures

Pests	symptoms	Control measures
Shoot borer	Larvae bore into the pseudostem and feed on growing shoots, yellowing and drying of the infested shoots	Spraying of spinosad @ 0.3 ml/l, during July-October at monthly intervals
Leaf roller	Rolls the leaves and feeds on them	Spray of azadirachtin 1500 ppm @ 5 ml/l of water at every three days interval during July to October
Rhizome scale	Infests rhizome, feeds on plant sap cause withering	Dip the seed rhizomes with 5% NSKE or azadirachtin 1500 ppm @ 5 ml/l of water twice prior to storage/sowing.
Diseases		
Soft rot or rhizome rot	Collar region exhibits rotting and it spreads to rhizome and root. Leaves exhibit yellowing symptoms.	1. Provide good drainage and select healthy, disease free seed rhizomes. 2. Treat seed rhizomes with *Trichoderma* @ 4-6 g/kg before planting. 3. Apply dolomite to raise the soil pH. 4. Add neem cake 2 t/ha as basal dressing
Bacterial wilt	Affected pseudostems or rhizome shows milky ooze on gentle pressing.	1. Use disease free planting material. 2. Soil drenching by application of *Trichoderma* or *Bacillus* @ 10 g/l. 3. Treat seed rhizomes with *Trichoderma* @ 4-6 g/kg before planting.

❖ **Dry ginger**: The crop maturity is indicated by yellowing of leaves and withering of stem. The rhizomes are fully mature after 7-8 months and become more fibrous, skin hard and are more pungent.

❖ **Seed ginger**: The rhizomes are allowed to remain in the field for 3-4 weeks more and the skin of rhizome ripe, thickened and leave and pseudo stem completely dries and falls down.

Harvesting

The crop is ready for harvest about 7-8 months after planting when the leaves turn yellow and start drying up gradually. Early harvesting can also be done keeping in view the prevailing price and demand in the market. However, early harvesting is also done when the produce is to be used for processing because of less fibre and pungency while for drying purpose, harvesting is delayed. The clumps are lifted carefully with a spade or digging fork or on large scale field is ploughed and the rhizomes are collected.

Yield

The average yield of fresh ginger is varies from 12-15 t/ha but recovery of dry ginger is only 20-25%.

Post-harvest technology

Curing

Ginger is marketed both in peeled and unpeeled forms. In scraped ginger, the epidermal layer of the fresh rhizomes is scraped off with a sharpened bamboo splinter and then rhizomes are washed in water and dried in the sun for 7-10 days. This produce is uniformly turned during drying. As the essential oil is in the epidermal cells, excessive or careless scraping results in the loss of oil and depreciated quality of the spice.

Bleaching

In the Middle East countries, which buy a very large part of Indian produce, higher demand is for white, polished rhizomes free from specks or spots, for this purpose, the raw rhizomes are soaked in water for a day and later in thick milk of lime. This material is dried in sun and then rubbed with gunny bags pieces to remove the last remnants of the skin. This treatment imparts a smooth finish to the product.

Grading

The rhizomes prior to storage are graded according to their shape, size, number of fingers, colour, scales etc.

Harvesting of Ginger

Storage of seed ginger

In order to get good germination, the seed rhizomes are to be stored properly in pits under shade. For seed materials, big and healthy rhizomes from disease free plants are selected immediately after harvest. For this purpose, healthy and disease free clumps are marked in the field when the crop is 6-8 months old and still green. The seed rhizomes are treated with a solution containing 0.3% Spinosad and 0.4% Phytoneem for 30 minutes. The same solution is used for treating the pit also. Drain the solution and dry the rhizomes under shade. The rhizomes are stored in the pits of convenient size in sheds. One quintal of rhizomes can be stored in one cubic meter pits.

Conclusion

Ginger is a most important cash crop which has significant economic importance for livelihood security of farmers in the era of climate change. It has various industrial, medicinal, nutritional, culinary and ornamental uses. Being a multipurpose crop, there is urgent need to adoption of improved agronomic management practices for its cultivation to increase the sustainable productivity and profitability.

Reference

Arya, P. S. 2008. *Spice Crops of India*. pp. 247-59.

Bhattacharjee, S. K. 2001. *Handbook of Medicinal Plants.* pp. 381-82.

Pruthi, J. S. 1993. *Major Spices of India*. pp. 244-283.

Muralia, S. and Pathak, A. K. 2007. *Medicinal and Aromatic Plants*. pp. 241-43.

Thomas, R. P. 2013. *Spices: Cultivation and Uses.* pp. 58-63.

Fageria, M.S. 2003. *Vegetables Crops*. pp. 232-255.

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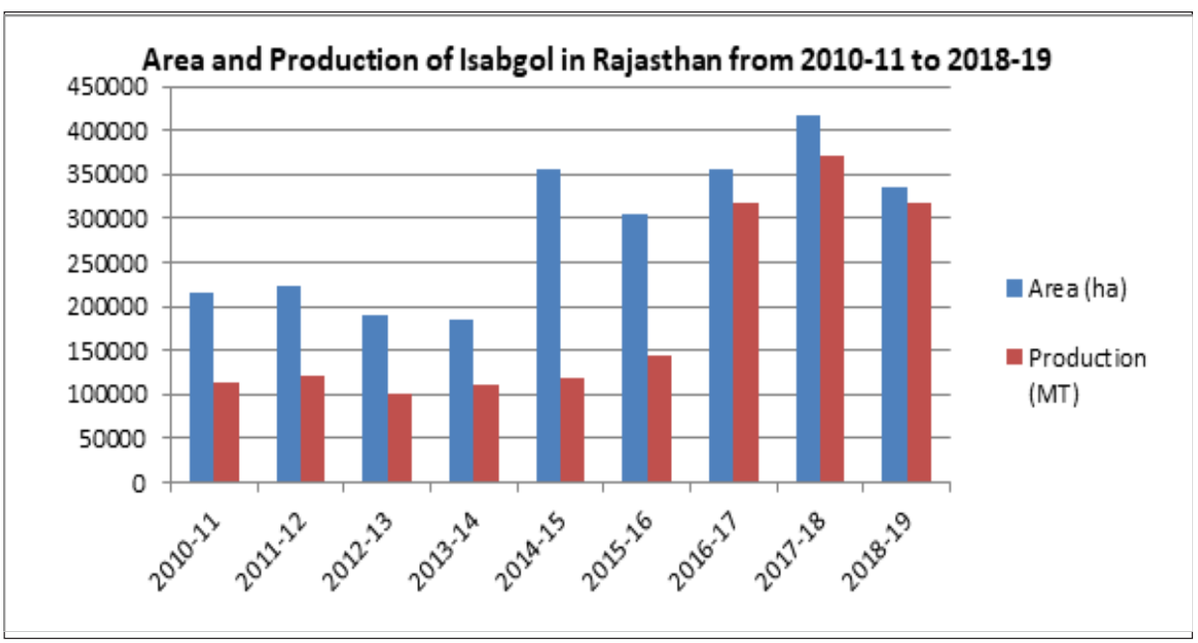
ISABGOL: A GOOD CROP FOR DOUBLING INCOME OF FARMERS

M.L. Mehriya, Sarita and Hitesh Borana

Isabgol is an important irrigated rabi season crop known for its medicinal properties. It is stem less herbaceous grown for its husk. Isabgol seed mucilage is frequently referred to as husk or Psyllium husk. Psyllium seeds contain over 30% of hydro-colloidal polysaccharide (mucilage) in the outer seed coat, sugars and protein. This mucilage is colloidal in nature and its composition varies with the conditions of preparation (Bandopadhyay, 1961). It is mainly composed of xylose, galacturonic acid and arabinose with galactose and rhamnose. The dehusked seed of isabgol is around 69% by weight of the total seed crop which is used as a feed of bird (Anon, 1989). The milled seed mucilage has a white fibrous material which is hydrophilic (water-loving). It contains a significant amount of proteins and husk yields colloidal mucilage which are valued for medicinal application and used in ayurvedic, unani and allopathic systems of medicines (Singh and Lal, 2009). India ranks first in Isabgol production (98%) and the sole supplier of seeds and husk in the international market. Among medicinal plant, this plant is the first ranking foreign exchange earner for the country. India is the largest producer as well as exporter of Isabgol seeds and husk (Seed coat is known as "husk"). Medicinal and pharmaceutical application of Isabgol, has a high value of increasing market demand, cultivation of isabgol is important for uplifting the economy of a country and to enhance the income of Farmers. USA is the main importer of Isabgol



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seeds and husk. India provides about 85% of the Isabgol available in the world market. It is an annual herb and cultivated in Rajasthan, Gujarat, Madhya Pradesh & Haryana ((Lal *et al.*, 1999). The crop is mainly cultivated in the states of Rajasthan, Gujarat, Haryana and Madhya Pradesh. Rajasthan contributes in area around 3,36,327 ha and 3,17,018 MT of production in 2018-19.

- The psyllium husk contains 6.83%, 0.94% protein, 4.07% ash and 84.98% of total carbohydrates (Guo *et al.*, 2008; Yu *et al.*, 2009).

Table 1: Nutritional Quality of Isabgol Seeds

Protein	17.40%
Fat	6.70%
Energy	4.75 kcal/g
Total dietary Fibre	24.60%
Insoluble Fibre	19.60%
Soluble Fibre	5%

Table 2 : Fractional Carbohydrates Composition of Isabgol Husk

Rhamnose	1.5 %
Arabinose	21.96%
Galactose	3.76%
Glucose	0.64%
Xylose	56.72%
Mannose	0.40%
Arabinoxylan	>60%

Reasons for suitability of isabgol in Rajasthan:

- Isabgol thrive well in warm temperate region and requires cool and dry weather during its crop season hence generally it is sown during winter months.
- It can be grown well in saline soils with poor quality water in western Rajasthan as Rabi crop.
- The water requirement is low as compared to traditional crop makes it suitable for such areas.
- However, Isabgol cultivation under arid condition with sandy loam soil is a profitable venture, which is gaining popularity among the farmers of western Rajasthan.

Table 3 : Major Isabgol producing districts in Rajasthan (2018-19)

District	Area (ha)	Production (MT)
Barmer	123311	126677
Jalore	53299	42639
Nagaur	42353	50613
Chittorgarh	9231	8086
Jaisalmer	37440	22419

Source: www.horticulture.Rajasthan.gov.in

Uses of Isabgol

- The mucilage has medicinal properties and used against constipation, irritation of digestive track etc.
- The left over material of seed after husk removal is used as animal feed.
- Isabgol products available in the market are used as laxative that is particularly beneficial in constipation, chronic ailments and dysentery (Singh, 2007).

- ❖ It is the main constituent of a number of laxative preparations containing sodium bicarbonate and various flavours used in modern medicine.
- ❖ It is employed as a basic stabilizer in ice-creams and as an ingredient of chocolates and other food products.
- ❖ On treatment with hot caustic soda solution and subsequent, the seed husk produces jelly which provides a substitute for agar-agar.
- ❖ Isabgol seed gum has been used to prepare dry dentifrice powder and germicidal lubricating gels.

Table 4 : Isabgol sustainable production technology in Rajasthan (Research report from ARS, Mandor)

Practices	Technology developed
Crop Improvement	RI 1 is performing well over location (Mandor, Jalore, Nachana). It produced 1623 kg ha^{-1}, which was higher over GI 2 (1045 kg ha^{-1}), HI 2 and RI 89(kg ha^{-1}), respectively
Time of sowing	31st October and 15th November date of sowing at par in seed yield and recorded significantly higher over 15th october and 30th November sown crop
Sowing methods	Seed yield recorded with line sown crop was at par with the seed yield of the crop sown through broadcast method
Row spacing	30 cm line sowing found at par with 20 and 40 cm row spacing
Seed rate and Crop geometry	4 kg ha^{-1} is sufficient to achieve required plant population of 5-6 lakh ha^{-1}
Nutrient requirement	Potential yield level can be achieved by applying 30 kg N and 20 kg P_2O_5/ha
Irrigation schedule	One light irrigation is applied 5-6 DAS to soften hard crust for uniform emergence of seedlings. Further irrigation are given at 30,50,70 and 90 DAS and recorded highest seed yield over 4 and 3 post sowing irrigations
Sprinkler irrigation schedule	Six irrigation applied through sprinkler with operating period of 3 hours produced 27.9% higher seed yield over surface method of four irrigation.
Weed management	Pre emergence application of isoproturon at 500 g/ha super imposed with weeding 20 DAS is needed to keep the crop weed free
Effect of PGRs on isabgol	Foliar spray of cycocel (50 ppm), NAA (50 ppm) and Brassiniosteroid (0.5 ppm applied 45 & 60 DAS significantly increase the seed yield of isabgol by 15.2, 16.8 & 23.4 % over water spray)
Effect of N application on husk recovery and swelling factor	N dose (30-45 kg ha-1) significantly reduced the husk recovery and swelling factor by 8.5 and 9.7%, respectively.

Table 5 : High yielding varieties and their Sources of Availability

S. No.	Varieties	Seed Yield (kg per hectare)	Source
1	**Gujarat Isabgol 1 ((GI 1)**	800-900	MAP unit, Anand Agricultural University, Anand, Gujarat
2	**Gujarat Isabgol 2 (GI 2)**	900-1000	MAP unit, Anand Agricultural University, Anand, Gujarat.
3	**Gujarat Isabgol 3 (GI 3)**	1300	Spices Research Station, Jagudan, S.D. Agriculture University, Sardarkhrushi Nagar, Gujarat.
4	**Jawahar Isabgol 4 (MIB 4)**	1300-1500	MAP unit, College of Horticulture, RVSKVV, Mandsaur, Madhya Pradesh
5	**Haryana Isabgol 5**	1000-1200	MAP unit, CCS Haryana University of Agriculture, Hisar, Haryana
6	**Niharika**	1000-1200	CIMAP, Lucknow, Uttar Pradesh
7	**RI-1**	1200-1600	ARS, Mandor, Jodhpur

Climate and Soil

- Highly environmental sensitive crop.
- It requires a cool climate with dry sunny weather during maturity.
- Even a mild dew, cloudy weather or light showers cause seed shedding.
- Sowing should be done to eliminate the monsoon period from coinciding with maturity of the seed.
- 20-25^0 C temperature is required for seed germination, whereas at the time of maturity it requires 30-35^0 C temperature.
- Sandy loam to loamy soils which are well drained and with pH between 7-8 are ideal to raise this crop.

Sowing and seed rate

- Last week of October to second fortnight of November is considered as ideal time for sowing of isabgol.
- Direct sowing by broadcasting is a common practice followed by the farmers since long time. However, line sowing of 30 cm row to row spacing give better yield over broadcasting
- The seeds are very small hence mixed with soil or sieved farm yard manure for easy sowing. After sowing the seeds are covered by light one-way sweeping with a broom/ tree twigs having foliage. For uniform germination, care should be taken that the seeds do not get buried deep in the soil.
- A seed rate of 4 kg per hectare is found optimum for good plant stand. Higher seed rate increases susceptibility to downy mildew disease.

Nutrients Management

- Isabgol crop will respond well to inorganic fertilizers like N, P_2O_5, and K_2O.
- Applying 30 kg N and 20 kg P_2O_5/ha
- When applying Nitrogen, half dose should

be applied at the time of sowing and remaining after 4 weeks of sowing.

Water Management

- A light irrigation should be given immediately after sowing.
- In case of poor germination even after 6-7 days, a second irrigation should be applied.
- In sandy loam soils, 4 irrigations are recommended generally, first at the time of sowing followed by 2nd, 3rd and 4th irrigation at 30, 70 and 90 DAS.
- Slightly saline water (EC upto 4 ds/m) can also be used for irrigation because plant can withstand low level of salinity.

Weed Management

- 2 to 3 hand weedings should be carried out to keep the crop weed free during early vegetative growth of Isabgol crop.
- The first weeding is very critical for crop-weed-competition point of view and must be done at 20-25 days after sowing. Pre-emergence application of Isoproturone at the rate of 500-600 g active ingredient per hectare is recommended to control the weeds effectively and increase the profits.
- First weeding should be carried out after 3 weeks of sowing seeds in the field.

Crop rotations

- The following crop rotations are being adopted in various parts of India.
  - Soybean-Isabgol
  - Maize-Isabgol
  - Sorghum-Isabgol
  - Groundnut-Isabgol
  - Maize-Isabgol-Green gram

Pest & Disease Management

- Aphid is the major insect of isabgol crop. It generally appears 50-60 days after sowing. Application of neem based formulations is preferred as a control measure. However, two spray of 0.025% Oxydemeton methyl (Metasystox 25 EC) and subsequent spray at an interval of 15 days are recommended to effectively control this insect.
- White grub and termites are some of the other pest which may damage the crop by cutting off the roots.

Downy mildew, powdery mildew and Rhizoctonia wilt are the major diseases of Isabgol. Adoption of more than the recommended dose of nitrogen, seed rate and irrigation makes the crop more susceptible to these diseases.

The diseases can effectively be controlled by-

a. **Downy Mildew-** Seed treatment with metalaxyl (Apron SD@ 5g/kg seed) and spraying Metalaxyl 0.2% (Ridomil MZ) on first occurrence of disease, followed by two sprayings at 12-14 days interval.

b. **Powdery Mildew-** The crop is sprayed with 0.2 % of wettable sulphur 2 or 3 times at 2 weeks interval and 0.1% of Bavistin to control mildew immediately after the appearance of the disease and repeating the same 2 weeks later.

c. **Rhizoctonia wilt-** Seed treatment should be done with carbandazim@ 2 g/kg of seed along with amending the soil with FYM @ 5 t/ha+*Trichoderma* culture 2.5 kg/ha is more effective.

Harvesting

- Blooming begins two months after sowing and the crop becomes ready for harvest in March- April (110-130 days after sowing).
- When mature, the crop turn yellowish and the spikes turn brownish. The seeds are shed when the spikes are pressed even slightly.
- At the time of harvest, the atmosphere must be dry and there should be no moisture on the plant, harvesting will lead to considerable seed shattering. Hence, the crop should be harvested after 10 am.
- Isabgol seeds should be processed through a series of grinding mills to separate the husk. About 30 to 35% husk by weight is thus recovered.

Yield and economics

- On an average 800-1000 kg per hectare seed yield of isabgol is obtained. However, higher seed yield of about 1500 kg per hectare can be obtained from medium textured soils with better crop management practices.
- Isabgol straw yield is twice of the seed yield and about 1200-1600 kg per hectare is generally obtained. Following all the good cultivation practices, isabgol cultivation costs about Rs.23,000/- and gives net return of Rs.50,000- 60,000/- from the one hectare crop.

Post harvest processing

- Post harvest processing is usually the most critical stage in determining the end quality of the product.
- The harvested produce should be prevented from any contamination, degradation and/ or damage at any stage of processing.
- Transport the harvested plant material to the processing site and protect from heat and rain during transportation.
- The processing site should be clean and protected from direct sunlight and rain. Use a clean surface, a cemented floor or tarpaulin sheet which is in good condition, for laying out the harvested material. Remove weeds and other extraneous matters.
- After couple of days, the seeds are separated by trampling using tractor or bullocks. The seeds are also threshed by motor/ tractor operated threshing machine.
- Processing of husk from seeds is done in mills. About 28-30% husk is obtained on weight basis of the seeds.
- Isabgol husk is removed by grinding and then purified by sieving the mixture to separate the husk from the remainder of the seed parts or by blowing the husk away from the impurities. Pack the produce into clean and dry sacks, ensuring it is clearly labelled. Store the produce in a clean and dry room.
- Raise the sacks off the ground, away from the wall and not with fertilizers or pesticides. Use of rat poison and fumigation should be avoided in the storage rooms. As per the traders view the isabgol seeds has the longer shelf life.
- The dry seeds can be stored for 8-10 years (Jat *et al.,* 2015).

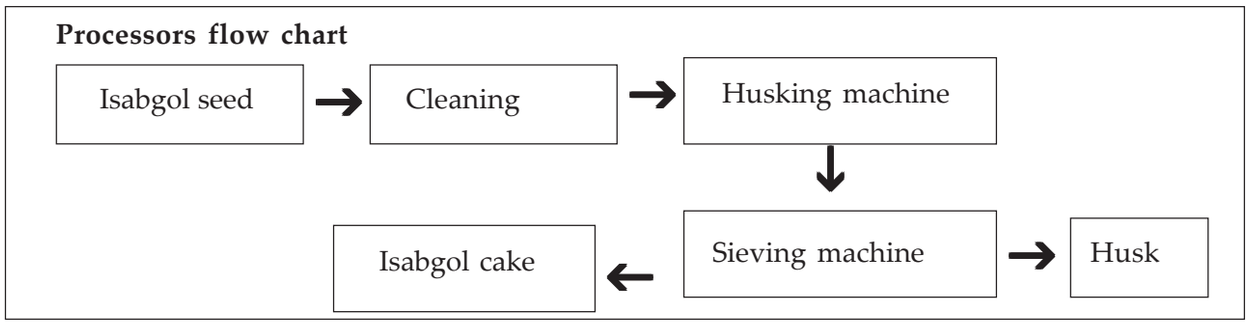

Table 6: Grade Specification of Isabgol

Properties	Grade			
	85% Pure	**95% Pure**	**98% Pure**	**99% Pure**
Colour	Light Brown to Pale Buff			
Taste	Bland			
Odour	Faint Distinct			
Moisture	12% Max			
Mucilloid content	86% min	95% min	98% min	99% min
Light Extraneous Matter	15% max	5 % max	2% max	1% max
Heavy Extraneous Matter	1.1% max	1.1% max	1.1% max	1.1% max
Swell Volume/ gm	35 ml/min	40 ml/min	40 ml/min	50 ml/min

References

https://www.slideshare.net/subhamdwivedi1/postharvest-management-of-medicinal-and-aromatic-plants

Anon., 1989. *The Wealth of India* - Raw Materials Vol. VIII, Council of Scientific and Industrial Research, New Delhi, India, 146-154.

Bandopadhyay, P.C. 1961. Viscometric investigations in high polymeric acids, acid polysaccharides from *Plantago ovata*. *J. Scientific & Industrial Res.* 20: 101-104.)

Guo, Q., Cui, S.W., Wang, Q. and Young, J.C. 2008. Fractionation and physicochemical characterization of psyllium gum. *Carbohyd. Polym.* 73:35-43.

Jat, R.S., Reddy, R.N., Bansal, R. and Manivel, P. 2015. *Good Agricultural Practices for Isabgol*. ICAR, Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand

Lal, R.K., Sharma, J.R., Sharma, S., 1999. Genetic diversity in germplasm of isabgol *(Plantago ovata). J. Herbs Spices Med. Plants.* 6, 73-80.

Singh, B. 2007. Psyllium as therapeutic and drug delivery agent. *Int. J. Pharmaceutics.* 334: 1-14.

Singh, N. and Lal, R.K. 2009. Genetics of quantitative and qualitative traits of isabgol (*Plantago ovata*). *Genet. Mol. Res.* 8, 939-950.

Yu, L., Lutterodt, H. and Cheng, Z. 2009. Beneficial health properties of psyllium and approaches to improve its functionality. In: *Advances in Food and Nutrition Research*. Taylor, S. (ed.). 55:193-217.

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INTEGRATED DISEASE MANAGEMENT OF GARLIC

R. C. Gupta, M. K. Pandey, M. K. Pathak, H.P.Sharma and P. K. Gupta*

Garlic (*Allium sativum* L.) is an important spice and condiment cultivated all over the country during rabi season except in Ooty hills of Tamil Nadu where it is grown during rainy season. Garlic is also used for the medicinal purposes in different ways. The total production of garlic is about 18.62 lakh metric tons from an area of approximately 3.54 lakh hectares in India. Madhya Pradesh, Gujarat, Rajasthan, Haryana and Tamil Nadu are the major garlic growing states and contribute more than 80 % of garlic production in the country. Garlic suffers from various fungal, bacterial as well as viral diseases causing yield loss in different areas of the country. Root-knot nematode (*Meloidogyne* spp.) is an emerging threat to garlic production in Karnataka and Haryana states in the country. *Meloidogyne* is one of the most damaging genera among the plant-parasitic nematodes on vegetables and other horticultural crops. The economically important diseases of garlic and their integrated management practices for quality production of garlic bulbs are described in the present article.

Purple Blotch:

Purple blotch is the major foliar disease of garlic caused by Alternaria porri. The disease occurs in all the growing areas of garlic during rabi season.Initially small white sunken spots develop on leaves and in advance stage these

Young garlic plant affected by Purple blotch disease

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spots enlarge and appear as eye shaped and ultimately turn to purple colour in the center surrounded by chlorotic margin.

Management:

- Burning of plant debris reduced the inoculum of purple blotch pathogen.
- Deep ploughing of field during hot summer months period *i.e.* May and June.
- Dip treatment of garlic cloves in carbendazim@ 1g/L+potassium nitrate @ 10g/L of water solution.
- Soil application of bio-products *viz., Trichoderma viride* @ 5kg/ha and *Pseudomonas fluorescens* @ 5kg/ha mixed with vermicompost @ 220 kg before planting.
- The disease can be managed by sprays of mancozeb @ 0.25 % or propineb@ 0.25 %, or chlorothalonil @ 0.2 %,or ridomil MZ @ 0.2% or propiconazole @ 0.1% four times at an interval of 10 days to be started when initial symptoms are noticed.

Stemphylium Blight:

It is an important foliar disease of garlic caused by *Stemphylium vesicarium*. Initially small yellow to orange streaks develop in middle of the leaf which soon develop as spindle shaped to ovate elongate diffusate spots on leaf margin. The spots turn grey at the centre, later on turn dark brown with the development of conidia/conidiophores. The blighted leaves droop down and completely dry.

Management:

- The disease can be managed by sprays of mancozeb @ 0.25 % or propineb @ 0.25 %, or chlorothalonil @ 0.2 % four times at an interval of 10 days starting when initial symptoms noticed on the crop.

Young garlic plant affected by Stemphylium blight disease

White rot :

White rot is a typical soil borne disease of garlic caused by *Sclerotium rolfsii* and or *Sclerotium cepivorum*. The disease is more common in the cultivated areas where regularly garlic crop is taken. The fungus survives or overwinters through formation of hard mycelium structure called 'sclerotia' for longer period in the absence of the host.Yellowing and drying of the leaf from tip to downward is also a characteristic symptom. The white mycelial growth may be seen on collar region of infected plant at the soil level. The bulbs are covered with white fluffy mycelium and semi-watery decay of the cloves. Later brown to black sclerotia are developed on rotted bulb surface and also inside the cloves of bulbs.

White rot disease in garlic

Management:

- Summer deep ploughing during the month of May-June after light irrigation in the field.
- Soil application of Trichoderma viride @ 5 kg /ha with well rotten FYM or compost.
- Selection of healthy cloves from healthy garlic bulbs for planting.
- Crop rotation with non-host crops like sorghum or pearl millet for 4-5 years.
- The disease can be minimized by sprays of carbendazim@ 0.1 % followed by copper oxychloride @ 0.3%, 3-4 times at the interval of 10 days starting, when symptoms on garlic crop noticed in the field.

Iris Yellow Spot Virus:

This viral disease is caused by Tomato Spotted Wilt Virus belonging to Tospo virus group categorized under the Family Bunyaviridae.This is a newly introduced viral disease and the prevalence of this viral disease is increasing day by day in garlic growing areas in the country. Straw colored, diamond shaped or eye spots appears on leaves. The crop damaged more where heavy thrips infestation

in garlic crop is noted. The virus is transmitted through insect vector thrips (*Thrips tabaci*) which is also a major pest of garlic.

Management:

- Rogueing of virus infected plants from the field.
- Removal of volunteer plants in and around the field.
- Selection of healthy cloves from garlic bulbs for planting.
- Control of the insect vector by spraying of insecticides such as fipronil @ 0.15 % or cypermethrin @ 0.1%, or carbosulfan @ 0.2% or spinosad @ 0.3 % in onion bulb crop also on weed around the field to check the transmission of virus.
- The spray of myco-insecticide *Beauveria bassiana* @ 4.0 g/L.
- The spray of neem seed kernel extract @ 5% for thrips management.

Iris Yellow Spot Virus (IYSV) in garlic

Root-knot nematode:

Root-knot nematode (*Meloidogyne* spp.) is one of the most damaging genera among the plant-parasitic nematodes in vegetables. The root-knot nematode (Meloidogyne graminicola) in garlic was reported first time in 2015 from Karnataka in India. Further, the root-knot nematode incidence in garlic was observed from Karnal, Haryana during 2016. Root-knot nematode is an emerging constrains in quality production of garlic. These usually cause swellings on the roots of affected plants that are generally called galls or root-knots. The second stage juveniles (J2) of nematode infect plant roots causing the development of galls. Galls can crack or split open especially on the roots of garlic plants allowing the entry of soil-borne pathogenic microorganisms namely fungi (*Fusarium oxysporum*, *Phoma terestris*) and bacteria (*Pseudomonas aeruginmosa*). Above ground symptoms of a root-knot nematode infestation include wilting during the hottest part of the day even with adequate soil moisture, loss of vigor, yellowing of leaves, tip drying and other symptoms similar to lack of water or nutrients.

Management Practices:

The quality production of garlic can be

achieved by approaching integrated disease management of root-knot nematode through integration of cultural practices, intercropping, soil amendment of neem cake, bio-control and use of chemical nematicide. The management practices of root-knot nematode are given below:

- Summer deep ploughing during the month of May-June after light irrigation to the field.
- Crop rotation with non-host crops like sorghum or pearl millet for 4-5 years.
- Intercropping with Marigold.
- The use of chemical nematicide i.e. *Carbosultan* 25 EC @ 25kg/ha at the times of clove planting.

Root-knot nematode in garlic

Galls formation in the root tip of garlic

Black Mold:

Black mold is a very serious storage disease of garlic caused by saprophytic fungus known as *Aspergillus niger*. Other species of *Aspergillus viz., A. fumigatus* and *A. allaceus* are also causing similar types of symptoms on garlic during storage. Sometimes, the losses occur up to 40 % of stored bulbs due to severe attack of black mold disease under congenial weather conditions especially under high humidity and high temperature coupled with frequent rainfall. The white mycelium appears at the infection site and later produce black sooty mass of conidia. In severe stages the entire surface of the bulbs are covered with black conidia and also the areas in between the cloves are infected as a result the quality of bulbs gets reduced.

Management:

- Pre-harvest spray of carbendazim @ 0.1% or companion (carbendazim+ mancozeb) a mixed fungicide @ 0.2%.
- Disinfection of storage by using chloropyriphos @ 5 ml/L and carbendazim 2 g/L.
- Proper drying and curing of garlic bulbs after harvest.
- Post-harvest sortingand grading of rotten or damaged bulbs.
- Maintaining proper ventilation in garlic storage.

Black mold of garlic

Healthy crop of garlic

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SINGLE BUD TRANSPLANTS IN GINGER

Archana Unnikrishnan*

Introduction

Ginger (*Zingiber officinale*), a herbaceous perennial, belonging to Zingiberaceae family is believed to be a native of South-eastern Asia. It is an important commercial crop grown for its aromatic rhizomes which is used both as a spice and a medicine. India is the leading producer of ginger in the world and during 2017-18, the country produced 1.12 million tons of the spice from an area of 1,60,135 hectares. Ginger is cultivated in most of the states in India. However, Karnataka, Orissa, Assam, Meghalaya, Arunachal Pradesh and Gujarat together contribute 65 per cent to the country's total production. Ginger of commerce is the dried rhizome. In Kerala, on an average 0.08 million tons of ginger is produced from an area of 4370 hectares. It is marketed in different forms such as raw ginger, dry ginger, bleached dry ginger, ginger powder, ginger oil, ginger oleoresin, ginger candy, ginger beer, brined ginger, ginger wine, ginger squash, ginger flakes etc.

Ginger is cultivated both as cash crop and intercrop in plantation crops. It is propagated through rhizomes. In conventional planting, seed rhizomes, broken into small pieces of 2.5 - 5 cm length, weighing 20-25 g with one or two viable buds, are used for planting. In this method, the seed rate varies from 1500 to 2500 kg per hectare depending on seed size and spacing and accounts for about 40-50 percent of total cost of production. The low availability of quality planting material and dormancy period of seed rhizomes are the other constrains in conventional planting. To overcome these problems, an improved method is standardized for rapid multiplication of ginger with reduced cost. The technique involves raising transplants from single sprout seed rhizomes in the pro-tray and planting in the field after 30-45 days.

Production of single bud sprouts

The practice of ginger transplants production is somewhat similar to that of other seedlings which are raised in protrays/nurseries. Select healthy ginger rhizomes and treat them with mancozeb (0.3%) and quinalphos (0.075%) for 30 minutes, store in well ventilated place. From this stored lot, take seed rhizomes and cut into small piece with single bud, weighing 3-5 g. Treat the single bud sprouts with mancozeb (0.3%) for 30 minutes before planting. Seed priming is also beneficial for improving the sprouting. Seed rhizome primed with Ethephon 200 ppm ensures better germination rate and quality crop in the field. After the pre-treatment, fill the pro-trays (98 celled) with nursery medium either containing partially decomposed coir pith and vermicompost (75:25), enriched with PGPR or *Trichoderma* 10g/kg of mixture or cocopeat, vermicompost, vermiculite and perlite (3:1:1:1) mixture. Root establishment will be more in the

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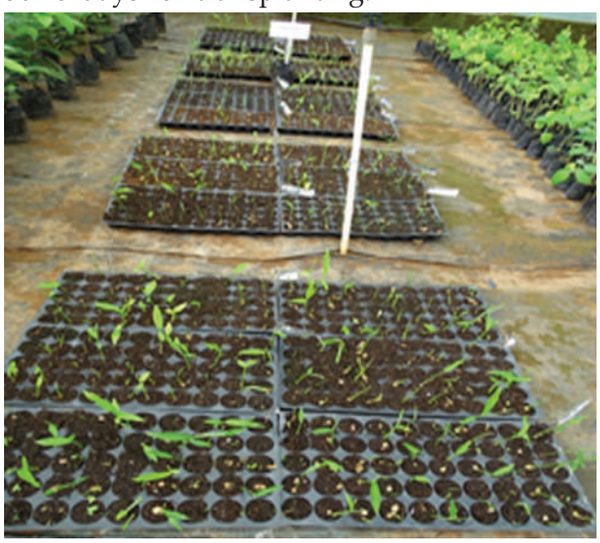
latter than in the former. Sow the ginger rhizome in pro-trays. Maintain the pro-trays under shade net house/rain shelter up to 45 days after sowing. Apply water soluble fertilizer (19:19:19) at 2g/L as foliar spray. *Pseudomonas* (20g/L) can also apply once in a week. Adopt need based irrigation with rose can or by using suitable sprinklers. Sprouting will start from 1-3 weeks after sowing. The primed seed rhizomes show early sprouting than the untreated ones. Seedlings will be ready within 30-45 days for transplanting.



Pro-trays of sprouted single bud seed rhizome maintained in the net house

Transplanting

The ginger seedlings of 30-45 days old are ready for transplanting in to the main field. It is planted in beds (10" x 3" x 0.5"), 20 cm apart. Apply cowdung, neemcake and *Trichoderma* (9:1:1) mixture in the beds before planting. The plants should be mulched with green/dry leaves. The ginger seedlings can also be planted in grow bags containing potting mixture of soil, sand and farm yard manure (3:1:1).

Aftercare

In this method, the ginger transplants need more care than conventional method. For the initial 1-2 months, apply NPK mixture (19:19:19) at 10 days interval. After that, follow the same management practices as followed in conventional method. Seven to eight months after transplanting, ginger plants will be ready for harvesting. The yield of rhizomes varies with the season, pre-treatment and management practices. Generally, the yield and quality of rhizomes are on par with the conventional method. The plants in grow bags gives an yield of 0.5 to 1.5 kg per bag.

Ginger seedlings ready for transplanting

Ginger transplants in the filed

Ginger transplants planted in grow bags

Conclusion

This technology is becoming popular with several advantages such as less planting material requirement (500-750 kg/ha), saving in seed cost, better field establishment (98-100 %) and high benefit: cost ratio. Availability of ginger transplants for year round planting is the main advantage of this technology compared to conventional planting. It also ensures continuous supply of planting material based on the demand of the farmers.

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REPORT FROM INDIAN INSTITUTE OF SPICES RESEARCH ON CONSERVATION OF A HIGH YIELDING PRECOCIOUS MONOECIOUS NUTMEG TREE

J.Rema, R. Ramakrishnan Nair and K.V. Saji

Nutmeg (*Myristica fragrans* Houtt.) is an evergreen, dioecious perennial tree spice that produces two distinctly different spices viz. nut and mace from the fruit. The tree is usually dioecious in nature bearing either male or female flowers. Very large variability is seen in the seedling population of this widely cross pollinated crop. Rarely monoecious trees which bear both male and female flowers on the same tree do exists in this population.

During a germplasm survey in Karnataka, 30 seedlings of nutmeg were purchased from the nutmeg plantation maintained by Mr. Poornand Venkatesh Bhat, Shriram Siddhi Estate, Ankola, Karwar, Uttarakand, Karnataka during 2012. The seedlings were germinated in bag during 2012. Twelve seedling of one year old were planted in the field in the nutmeg conservatory at ICAR-IISR, Kozhikode in 2013.

It was observed that one of the seedlings, Acc. 562 was precocious in nature and flowered in the second year of planting in 2015. Usually the seedling trees of nutmeg flower after 6 to 7 years of planting making Acc. 562 different from other nutmeg trees conserved in the germplasm conservatory at IISR. Acc. 562 is monoecious in nature and both male female and rarely hermaphrodite flowers were seen in the tree and

Fig. I. Mature fruits of Acc 562

ICAR- Indian Institute of Spices Research, Kozhikode, Kerala.

Fig. 2 Fruits borne in clusters

the flowers were borne in clusters. Generally while planting nutmeg male trees also has to be planted in the ratio 1:15 for pollination. As Acc.562 is monoecious in nature, male and female flowers are seen on the same plant, there is no need for planting male trees and hence more number of trees can be accommodated per unit area.

The tree is about 6 feet tall during the sixth year and has drooping plagiotropic branches. The tree flowered in the second year of planting and 11 fruits were obtained. The number of fruits increased every year with the growth of the tree. Fruits are borne singly as well as in clusters up to 7 (Fig.1&2) About 400 fruits were obtained in the 6 th year of planting. The fresh fruits weigh about 65 to 75 g, nut 8 -10 g and mace 1.5 to 2 g. The seed is brownish black and medium sized and mace entire.

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इमली के नाशीकीटों का प्रबंधन : एक समीक्षा

अभिषेक शुक्ला

सारांश : इमली का हमारे दैनिक आहार में अति विशिष्ट स्थान है। इमली मूलतः पूर्वी अफ्रीका का देशज है जो कि प्राकृतिक रूप से एशिया, मध्य तथा दक्षिणी अमेरिका में उगाई जाती है। इमली एक बहूउद्देशीय वृक्ष है अर्थात इसकी पत्तियां, जड़े तथा अपरिपक्व फलियों/फलों को सब्जी और अन्य रूपों में प्रयोग किया जाता है जबकि इसकी परिपक्व फलियों/ फलों को मसालों के तौर पर भोजन को स्वादिष्ट बनाने हेतु बड़े व्यापक तौर पर प्रयोग में लाया जाता है। इमली के पेड़ का प्रत्येक भाग अर्थात जड़, छाल, पत्तियां, फूल, फलों का गूदा (पल्प) और बीज़ में उच्च पोषण गुण होते है तथा ये औषधीय गुणों से भी परिपूर्ण होते है। इमली के उत्पादन को अनेकों कारक प्रभावित करते है जिनमें अनेक प्रकार के नाशीकीट और अकीट नाशीजीवों प्रमुख है। प्रस्तुत लेख में इमली के इन्हीं नाशीकीटों की सविस्तार समीक्षा की गई है। प्रस्तुत समीक्षा में इन्हीं नाशीकीटों की वार्गिकी, इनके द्वारा होने वाले नुकसान तथा उनके कुछ प्रमुख प्रबंधन उपायों के विषय में भी सविस्तार चर्चा की गई है।

इमली (*टेमेरिड़स इंडिका*) एक सदाबहार, उष्णकटिवंधीय वृक्ष है जो कि लेग्युमिनेसी कुल से संबद्व है। इसकी उत्पत्ति के बारे में अनेक धारणाएं है परंतु अधिकतर वैज्ञानिक इसे उष्णकटिबंधीय पूर्वी अफ्रीका का देशज माना जाता है जिसमें मेड़ागास्कर प्रमुख माना जाता है। यहीं से ये अरब व्यापारियों द्वारा इसका एशिया और दक्षिण–पूर्वी एशिया में फैलाव हुआ। मार्कोपोलो ने इमली का उल्लेख सन 1298 में किया था, जबकि बुद्ध धर्म ग्रंथों में इमली का उल्लेख 650 ईसा पूर्व किया गया था तथा हमारे भारतीय ब्रह्मसंहिता, जो कि 1200 से 200 ईसा पूर्व लिखा गया था, में भी इमली के विषय में सविस्तार चर्चा की गयी है। इमली को संपूर्ण विश्व में हमेशा उपेक्षित तथा कमतर उपयोगी प्रजाति माना गया, परंतु आज इमली की खेती विश्व के सभी उष्णकटिबंधीय क्षेत्रों में व्यापक पैमाने पर की जा रही है। इमली को सामाजिक तथा कृषि वानिकी हेतु एक श्रेष्ठ वृक्ष भी माना जाता है। इसका गहरे तथा व्यापक मूल–तंत्र के कारण ये बड़ी ही आसानी से सूखे की स्थिति का प्रतिरोध कर लेती है। इन्हीं सब कारणों से आज इमली का महत्व तेजी से बढ़ गया है और हमारे किसान भाई इसकी खेती अपनी उपेक्षित तथा समस्याग्रस्त ज़मीन पर करके आर्थिक लाभ प्राप्त कर रहें हैं।

इमली एक बहूउद्देशीय सदाबहार वृक्ष है तथा इसका प्रत्येक भाग पौष्टिक व औषधीय गुणों से परिपूर्ण होता है। इनका औद्योगिक व आर्थिक दृष्टि से बड़ा महत्व होता है। इमली के उत्पादों और बृक्षों का भोजन, दवाओं, चारे,

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ईंधन, रंग बनाने वाले पदार्थ, पेंटिग, वार्निश, छाया, जीवित बाड़, मधुमक्खी पालन आदि में व्यापक तौर पर प्रयोग किया जाता है। सभी उष्णकटिबंधीय फलों के समान, इमली पर भी अनेक प्रकार के नाशीकीटों तथा अकीटों का प्रकोप होता है। इनमें नाशीकीटों का स्थान सर्वप्रमुख है जो कि इमली की पत्तियों, पुष्पों तथा फलों (फलियों) पर न केवल खेतों में इनके लगने के समय पर बल्कि इनके भंडारण के दौरान भी आक्रमण करते है। प्रस्तुत लेख में इमली के इन्हीं सब नाशीकीटों तथा अन्य नुकसान पहुंचाने वाले अकीट जीवों के विषय में सविस्तार समीक्षा की गई है जो कि हमारे किसान भाईयों तथा अन्य पाठकों के लिए उपयोगी सिद्ध होगा।

इमली के नाशीकीट

इमली के प्रमुख नाशीकीटों में पत्तियों को खाने वाले, फलों में छिद्र बनाने वाले, बीजों को खाने वाले तथा इनके भंडारण (संग्रहण) के दौरान क्षति पहूंचाने वाले नाशीकीटों का समावेश है। इन सभी प्रमुख नाशीकीटों की उनकी वर्गीकी के अनुरूप यहां पर सविस्तार चर्चा की गयी है।

1. गण–हेमिप्टेरा : इस गण में रस चूसने वाले विभिन्न नाशीकीट पाये जाते है जिनका उनके कुलों के अनुसार वर्णन निम्नानुसार किया गया है।

कुल–मार्गारीड़ी : इस कुल में इमली को ग्रसित करने वाली मिलीबग शामिल है। इनमें *पेरीसोप्नुमोन टेमेरेंडीस* जिसे इमली की मिलीबग भी कहते है, शामिल है। इस कीट के शिशु (निंफ) तथा वयस्क दोनों ही विकासशील प्ररोहों, कोमल टहनियों, पत्तियों तथा छोटे–छोटे फलों से लगातार रस चूसते रहते हैं। इसके प्रकोप के फलस्वरूप फलों का उत्पादन प्रभावित होता है। इस कीट से ग्रस्त इमली के फल असमय ही गिरने/झड़ने लग जाते है। इस कीट से ग्रसित इमली के फल आकार में भी छोटे रह जाते है तथा उनका आकार विकृत व टेढ़–मेढ़ा हो जाता है। लगातार रस चूसने के साथ–साथ इस कीट के शिशु (निंफ) तथा वयस्क दोनों ही अपने शरीर से लगातार मधुरस (हनीड्यू) नामक पदार्थ का उत्सर्जन भी करते है। ये मधुरस धीमे–धीमे पत्तियों पर फैलने लगता है, कुछ समय पश्चात इन पत्तियों पर काले रंग की फफूंदी उग आती है जिसे ब्लेक मोल्ड के नाम से जाना जाता है। इस काल फफूंदी के कारण इमली का फलन व पुष्पन प्रभावित होता है। इस कीट के प्रकोप के कारण इमली की 70 प्रतिशत तक उपज में कमी आ जाती है। इस कीट की वयस्क मादाएं पेड़ों से उतरकर जमीन में अपने अंडे देती है। ये अंडे एक थेलीनुमा संरचना में देती है जिन्हे अंड थेली (एगसेक) के नाम से जाना जाता है। इन अंडों से निकले शिशु (निंफ), जिन्हें क्रोलर्स भी कहते है, पेड़ों पर चढ़ने लगते है तथा ये इमली के पेड़ के कोमल भागों पर कुछ समय बाद स्थिर हो जाते है और यहीं से सतत रस चूसते रहते है। इस कीट का शरीर सफ़ेद रंग के रोयेंदार मोमीय पाउड़री पदार्थ से ढंका होता है इसी कारण से इन कीटों को मिलीबग के नाम से भी जाना जाता है।

कुल–डायस्पीड़ीड़ी : इस कुल के अंतर्गत शल्क कीट (स्केल) का समावेश होता है। इमली को ग्रसित करने वाले शल्क कीट निम्नानुसार हैः

ओरिएंटल यलो स्केल या ओरिएंटल रेड़ स्केल : इस शल्क कीट का वैज्ञानिक नाम *एओनिडीला ओरिएंटिलिस* है। इस कीट के अत्यधिक प्रकोप की दशा में पत्तियां पीली पड़ जाती है जिससे वो असमय ही झड़ जाती है तथा छोटी–छोटी टहनियां भी मरने लगती है। इन सब के कारण इमली के पेड़ों से असमय ही फल गिरने लगते है। ये एक सर्वभक्षी नाशीकीट है । इस कीट की मादाएं इमली के पेड़ों पर सुरक्षित आवरणों जैसे तने की छाल आदि के नीचे अपने अंडे देती है। इन अंडों से निकालने के बाद शिशु (क्रोलर्स) इमली के पेड़ों पर चढ़ कर कोमल प्ररोहों की तलाश शुरू कर देते है तथा वो सही स्थान मिलने पर वहीं स्थायी हो जाते है तथा इनका रस चूसने लगते है।

वेस्ट इंडियन स्केल या रूफुसा स्केल : इस शल्क कीट का वैज्ञानिक नाम *सेलीनास्पाईड्स आर्टीकुलेट्स* है। ये शल्क कीट इमली के तनों, पत्तियों और फलों को ग्रसित करके उनसे रस चूसता है। इनकी उपस्थिति से काली फफूंदी नहीं उगती है।

कुल–स्यूडोकोक्सीड़ी : इस कुल के अंतर्गत भी मिलीबग ही शामिल है तथा यहां इमली को नुकसान पहुंचाने वाली निम्न मिलीबग शामिल है।

स्फेरिकल मिलीबग : इस मिलीबग का वैज्ञानिक नाम *निपेपीकोकस विरीड़ीस* है। ये कीट इमली के फलों, उनके वृन्तों तथा कोमल प्ररोहों को ग्रसित करते है।

कोको मिलीबग : इस मिलीबग का वैज्ञानिक नाम *प्लेनोकोकस लिलेसिनस* है। इस कीट के शिशु (निंफ)व वयस्क मादाएं पत्तियों की ऊपरी सतह, पत्तियों के डंठलों, शीर्ष प्ररोहों, यहां तक कि पूर्ण विकसित प्ररोहों और जड़ों पर आक्रमण करती है। इसके आक्रमण के कारण पत्तियों पर पीले रंग के धब्बे बन जाते है जिससे ये पत्तियां सूख कर झड़ जाती है। इस कीट के आक्रमण के कारण इमली के फल असमय ही झड़ जाते है जिससे उत्पादकों को काफी नुकसान उठाना पड़ता है।

2. गण–कोलियोप्टेरा : इस गण में भृग तथा घुनों का समावेश होता है। इनके प्रकोप से इमली के उत्पादन पर प्रतिकूल असर पड़ता है। इस गण के अंतर्गत निम्नलिखित कुलों के भृंग तथा घुन इमली को नुकसान पहुंचाते है।

कुल–ब्रूचिड़ी : इस कुल में मूंगफली की बीज़ भृंग जिसका वैज्ञानिक नाम *केरियोडोन सिरेट्स* है, का समावेश होता है। ये एक सर्वव्यापी नाशीकीट है तथा ये कीट मूंगफली का मुख्य नाशीकीट है। मूंगफली के अतिरिक्त ये इमली का भी मुख्य नाशीकीट है। कीट की मादाएं 53 से 95 अंडे देती है। ये अंडे इमली के बीजों की सतह पर चिपका दिये जाते है। इन अंडों से 8 से 9 दिनों में ग्रब (सूंड़ीयां) निकल आती है। अंडों से निकले ग्रब तुरंत ही बीज़ में छिद्र बना कर उनके अन्दर प्रविष्ट कर जाते है। इसके पक्ष्चात ये इन बीजों के अन्दर के भाग को खाना शुरू कर देते है, एक ग्रब अपने संपूर्ण जीवन काल में एक बीज़ को खाता है। जब ये ग्रब पूर्ण विकसित हो जाते है तथा प्यूपा (ककून) में बदल जाते है। ये ककून आकार में एक केप्सूल के समान दिखाई देता है और इनका रंग गंदला–सफेद

होता है। इनसे 10 से 11 दिनों में वयस्क भृंग बाहर निकल आते है। वयस्क मादा भृंग 31 से 32 दिनों तक जीवित रहती है जबकि नर कीट 28 से 29 दिनों तक जीवित रहते है। इनका प्रकोप सभी भंडार गृहों में देखा जाता है।

इस कुल की एक अन्य भृंग जिसका वैज्ञानिक नाम *केरियोडोन गोनिग्रा* है। कई बार इस कीट की उपस्थिति भी इमली के बीजों पर देखी जाती है।

कुल–कुरकुलोनिड़ी : इस कुल में घुनों (वीविल) का समावेश होता है। इसमें इमली की घुन प्रमुख नाशीकीट है जिसका वैज्ञानिक नाम *साईटोफिलस लिलीएरिस* है। इस कीट की वयस्क घुना का रंग लाल–भूरे से गहरे–भूरे रंग का होता है। इन कीटों का शरीर चमकदार भी होता है और इनकी लम्बाई 4.0 से 4.5 मि.मी. तक होती है। इस कीट द्वारा इमली के अन्दर घुस कर उनके बीजों को खाकर उनको पाउड़र में बदल दिया जाता है। इस कीट की उपस्थिति तथा उपद्रव सभी इमली के पेड़ों पर लगने वाले फलों में देखा जाता है। इन कीटों की पूर्ण विकसित ग्रब इमली की फलियों में ही प्यूपा में बदल जाते है तथा इनमें से वयस्क कीट एक छोटा सा छिद्र बनाकर बाहर निकलता है। वयस्क कीट कुछसमय बाद समागमन करता है तथा इसके एक सप्ताह बाद मादाएं अंड़े देना शुरू करती है। एक मादा अपने जीवन काल में 165 तक अंड़े देती है। मादा कीट बीजों में छोटे–छोटे छिद्र बना कर उनमें अंड़े देती है। वयस्क कीटों का जीवन काल 91 से 126 दिनों तक होता है। अंडों का रंग सफ़ेद होता है और ये आकार में अंड़ाकार होते है जो कि बीजों पर चिपका दिये जाते है। अंड़े 0.61 मि. मी. लंबे तथा 0.30 मि.मी चौड़े होते है। ये ग्रब चार अवस्थाओं से गुजरते है। पूर्ण विकसित ग्रब प्यूपा अवस्था में बदल जाते है। इनके प्यूपा सफ़ेद रंग के होते हैं। ग्रबकाल 16 दिनों का होता है जबकि इस कीट का जीवन काल 25 से 33 दिनों का होता है।

3. गण–लेपीड़ोप्टेरा : इमली को अनेक प्रकार के पतंगे खेतों तथा संग्रहण के दौरान नुकसान पहुंचाते है। इस गण के अंतर्गत निम्नांकित कुल के कीट पतंगे नुकसान पहुंचाते हुए देखे गए है।

कुल–साईकिड़ीड़ी : इस कुल के अंतर्गत आने वाले कीटों को बेगवार्म के नाम से जाना जाता है। इस कुल के अंतर्गत दो प्रजाति के बेगवार्म शामिल हैः

बेगवार्म : इस कीट का वैज्ञानिक नाम *टेरोमा प्लेमीयोफ्लिप्स* है। ये भारत तथा श्रीलंका के इमली उत्पादक क्षेत्रों में गौण नाशीकीट के रूप में जाना जाता है परंतु आज के समय में ये कीट इमली को भारी मात्रा में पत्तियों को खाकर नुकसान पहुंचाता है। इस कीट की सूंड़ीयां पेड़ की पत्तियों व छोटी–मोटी लकड़ी के टुकड़ों को रेशमी धागों से जोड़ एक थैलेनुमा संरचना की निर्माण करते है। इस थैलेनुमा संरचना में सूंड़ी घुसकर छिपकर रहती है तथा जब ये पत्तियां खाती है तो इसके सिर को बाहर निकालती है। इन कीटों के वयस्क नर पतंगे पंखयुक्त होते है जबकि मादाएं पंखविहीन होती है। मादा कीट हमेशा ही थैलेनुमा संरचना में ही रहती है तथा इसी के अन्दर रह कर नर कीट से समागमन करती है एवं यहीं पर अपने अंड़े देती है। ये अंड़े

इन थैलेनुमा संरचना में ही फूटते है तथा वहीं पर सूंड़ीयां बाहर निकलती है। एक मादा कीट अपने जीवन काल में 100 से 200 तक अंड़े देती है तथा इन्हीं थैले से सूंड़ीयां निकलती है तथा रेशमी धागों की मदद से एक स्थान से दूसरे स्थान पर फैलती है। इनके बाद ये इमली के पेडों पर स्थाई हो जाते है और वहीं पर थैलेनुमा संरचना का निर्माण करके उसमें रहना शुरू कर देती है। जैसे–जैसे ये आकार में बढ़ते है इस थैले का आकार भी बढ़ता जाता है। जब ये सूंड़ीयां पूर्ण विकसित होती है तब इन्हीं थैलेनुमा संरचना में प्यूपावस्था में बदल जाती है तथा प्यूपा टहनियों पर लटकती रहती है। इस कीट का पूरा जीवन चक्र 10 से 11 दिनों में पूर्ण होता है और इसकी पांच पीढ़ियां एक वर्ष में पूर्ण होती है। इस कीट का उपद्रव 2 से 3 साल में एक बार, कुछ छोटे–छोटे टुकड़ों में देखा जाता है। अभी हाल ही के कुछ दशकों में इस कीट की पौषी पौधों की संख्या भी बढ़ती जा रही है एवं ये कुछ वानिकी वृक्षों को भी ग्रसित करते हुए देखा गया है।

बेगवार्म : इस कीट का वैज्ञानिक नाम *यूमेटा क्रेमेरी* है। ये कीट प्रजाति दुनिया के सभी उष्ण व उपोष्ण कटिबंधीय क्षेत्रों में पाया जाता है।नर पतंगों के शरीर हल्के–गहरे भूरे रंग के बालों से ढंके हुए होते है। इन कीटों के आगे के पंख लाल–भूरे रंग के होते है जिन पर काले रंग की उभरी हुई नसें देखी जा सकती है। इनके बीच की जगह में काली रेखाएं भी होती है। इन कीटों के पिछले पंख काले घूसर रंग के होते है। अंडों से निकालने के तुरत बाद सूंडीयां इमली के पेड़ की शीर्ष की तरफ चढने लगती है और ऊपर की शीर्ष प्ररोह व पत्तियों को खाने लगती है। ये सूंड़ीयां अपने शरीर के चारों तरफ पत्तियों तथा छोटी–छोटी लकड़ियों के टुकड़ों को रेशमी धागों से बांध कर थैलेनुमा रचना बनाती है। ये सूंडीयां तीन बार निर्मोचन करती है और सूंड़ीकाल 2 से 3 माह तक होती है। जैसे–जैसे सूंड़ीयों की आयु बढ़ती है वो इमली की पुरानी पत्तियों तथा छाल को भी खाना शुरू कर देती है। जब ये सूंड़ीयां पूर्ण विकसित होती है तब ये 3 से.मी. आकार की हो जाती है तथा बाद में प्यूपा अवस्था में चली जाती है। वयस्क मादा कीट अपने 15 से 17 दिनों के जीवन काल में 500 अंड़े देती है।

कुल–ग्रेसीलीएरिड़ी : इस कुल के अंतर्गत इमली का फल बेधक कीट प्रमुख है। इस कीट का वैज्ञानिक नाम *ओईके डेरचीस* है। इस कीट की सूंड़ीयां जनवरी–फरवरी माह के दौरान इमली के फलों में घुस कर उनमें रेशमी घागों वाली ढीलीढाली सुरंघे बनाती है जिनमें इस कीट का मल–मूत्र भरा रहता है। इस कीट की सूंड़ीयां लंबी गोलाकर हरे सफेद रंग की होती है। इनका सिर भूरे रंग का होता है। पूर्ण विकसित सूंड़ीयां संफ़ेद रेशमी घागों से बने आवरण में प्यूपा अवस्था में बदल जाते हैं। ये प्यूपा अवस्था, कीट से ग्रस्त इमली के फलों में बनी सुरंघों में ही पूर्ण होती है तथा प्यूपाकाल 9 से 10 दिनों का होता है। वयस्क पतंगे 8 मि.मी. तक आकार के होते है तथा इनके अग्र पंख पीले–भूरे रंग के होते है, इन पंखों पर हल्के भूरे रंग के धब्बे पाये जाते है जबकि पिछले पंख हल्के पीले रंग के होते है। इनके किनारे कटे हुए होते है। ये कीट इमली के एक महत्वपूर्ण नाशीकीट है।

कुल–टोर्टिसीड़ी : इस कुल के अंतर्गत आने वाले कीट को भी फल बेधक कीट कहते है

जिनका वैज्ञानिक नाम *क्रिप्टोफेलिबीबीया ईलीपीड़ा* है। ये एक बहुभोजीय कीट है जो कि इमली की फलियों/फलों में सुरंघें बना कर उनको अन्दर से खाती है। इस कीट के प्रकोप से इमली की उपज पर काफी प्रतिकूल असर पड़ता है। इमली के अतिरिक्त इस कीट का उपद्रव बिलपत्र के पौधों पर भी देखा जाता है।

कुल–लाईकेनिड़ी : इस कुल के अंतर्गत अनार का फल बेधक कीट शामिल है। इस कीट का वैज्ञानिक नाम *विरेकोला आईसोक्रेट्स* है। इस कीट की सूंड़ीयां इमली के अपरिपक्व फलों, उनके गूदे (पल्प) और बीजों को खाकर नुकसान पहूंचाते है। इस कीट से ग्रस्त फलों में जीवाणु का भी प्रकोप हो जाता है जिससे उनमें सड़न उत्पन्न होने लगती है। इस कीट से ग्रस्त फलों में सड़न उत्पन्न होने के कारण फल असमय ही गिरने लगते है और उनमें सड़ी गंध आने लगती है। इमली में इस कीट के उपद्रव के कारण उपज में 40 से 90 प्रतिशत तक कमी आ जाती है और किसानों को आर्थिक नुकसान उठाना पड़ता है।

कुल–पायरीलीड़ी : इस कुल के अंतर्गत ऐसे कीट है जिन्हें फल बेधक के नाम से जाना जाता है। ये कीट इमली को संग्रहण के दौरान नुकसान करते है। इस कुल के अंतर्गत निम्न नाशीकीट शामिल है।

इमली का बेधक : इस कीट का वैज्ञानिक नाम *पेरालिप्सा गेलेरिस* है। इस कीट के वयस्क पतंगों के अग्रपंख गहरे–भूरे रंग के होते है जिन पर नीले–काले चिन्ह होते है जबकि पिछले पंखों का रंग सफ़ेद–भूरा होता है जिस पर कुछ बालदार लकीरें होती है। वयस्क नरों की लम्बाई पंखों के विस्तार साथ 17 से 21 मि.मी. तथा मादाओं का पंखों के विस्तार के साथ आकार 21 से 24 मि.मी. तक होता है। मादाएं फलों पर बनी दरारों पर क्रीमी संफ़ेद रंग के अंड़े देती है। मादा कीट एक फल पर 2 से 7 तक अंड़े देती है। इन अंडों से 5 दिनों में सूंड़ीयां बाहर निकलती है। अंडों से निकली प्रथम अवस्था सूंड़ीयां 1 मि.मी. लंबी होती है जबकि अंतिम अवस्था की सूंड़ीयां लगभग 18 मि.मी. तक लंबी होती है। ये सूंड़ीयां बेलनाकार, मज़बूत और आगे पीछे से नुकीले होते है। इनका सिर लाल–भूरे रंग का और घुमावदार होता है। इनके पैर पीले–भूरे रंग के होते है। इनका पिछला भाग भूरा–कत्थाई होता है जिस पर कांटेदार संरचना पायी जाती है। जब से सूंड़ियां इमली के फलों का बीज़ तथा गूदा (पल्प) खाती है तब ये इन्हीं फलों में रेशमी धागों की मदद से सुरंघे बनाती है। इस कीट का सूंड़ी काल 7 से 11 सप्ताह का होता है जब ये सूंड़ीयां पूर्ण विकसित हो जाती है तो ये इन्हीं में जाकर रेशमी धागों के प्यूपा में बदल जाते है। इस कीट का प्यूपाकाल 14 से 18 दिनों तक का होता है परंतु मई से अक्टूबर माह के दौरान ये 160 दिनों तक लंबा भी होता है। प्यूपा का आकार 9.5 मि.मी. लंबा होता है तथा मादा प्यूपा का आकार नर प्यूपा की अपेक्षा कुछ बड़ा होता है। इस कीट को इमली के संग्रहण के दौरान आर्थिक महत्व वाला नाशीकीट माना जाता है।

फल बेधक : इस कीट का वैज्ञानिक नाम *ऐसेरा कोस्टालिस* है। इस कीट की सूंड़ीयां 15 मि.मी. लंबी होती है तथा इनके शरीर का रंग हरा होता है। इनका सिर लाल–पीले रंग का

होता है जबकि धड़ पीलापन लिए हुए होता है। इस कीट की सूंड़ीयां फलों के मांसल गूदे (पल्प) को खाती है तथा इसी के अन्दर ढीलीढाली रेशमी धगों से सुरंघे बनाती है। इस कीट का मल–मूत्र फलों की बाहरी सतह पर देखा जा सकता है। ये कीट इमली के बीजों में भी छिद्र बनाकर उनमें घुस जाते हैं। इस कीट का प्यूपा 9.0 मि.मी. तक लंबा होता है इन प्यूपा के उदर भागों पर 10 छोटी–छोटी हुक के समान संरचनाएं पायी जाती है। ये कीट द्वारा छोटी हल्की पारदर्शी रेशमी धागों से बने ककून में प्यूपावस्था में बदलता है। ये प्यूपा इमली के फलों में ही बनते है। इनका प्यूपाकाल 10 से 12 दिनों का होता है।

फल बेधक : इस कीट का वैज्ञानिक नाम *फाईसीटा आथोंसिलेना* है। इस कीट की मादाएं लगभग 190 सफेद रंग के, अंडाकार आकार के अंडे इमली के फलों के मांसल भागों पर देती है। इन अंडों से 4 से 5 दिनों में सूंड़ीयां बाहर निकलती है जिनका रंग गुलाबी होता है। ये सूंड़ीयां 27 से 40 दिनों में पूर्ण विकसित हो जाती है। इनका आकार 14 मि.मी. तक होता है। ये सूंड़ीयां इमली के गूदे (पल्प) को खाती है तथा वहीं पर रेशमी धागों से जाले बनाती है। इस कीट की 5 सूंड़ी अवस्थाएं पायी जाती है। पूर्ण विकसित सूंड़ीयां इन्हीं रेशमी काकून में प्यूपा अवस्था में बदल जाती है तथा इनमें से 6 से 8 दिनों में वयस्क पतंगे बाहर निकल आते हैं। इमली पर इस कीट का प्रकोप अक्टूबर और नवम्बर माह में सर्वाधिक देखा जाता है।

इमली के अन्य नाशीजीव : इनमें नाशीकीटों के अतिरिक्त इमली को ग्रसित करने वाले सूत्रकृमि (निमेटोड़) और वरूथी (माईट) शामिल होते है। इन नाशीजीवों की संक्षिप्त जानकारी निम्न तालिका में दी गयी है।

सूत्रकृमि (निमेटोड़) : इनको राउंड वार्म के नाम से भी जाना जाता है। ये जीव फायलम निमेटोड़ा से संबंध रखते है। इमली को ग्रसित करने वाले सभी सुत्रकृमि जड़ों के परजीवी है।

वरूथी (माईट) : इन्हें एकीरी या एकेरिना के नाम से भी जाना जाता है जो कि एरीकनिड़ा गण से संबद्ध है। वरूथी (माईट) संग्रहण के दौरान संग्रहित इमली को ग्रसित करके नुकसान पहुंचाती है, जो निम्नानुसार है।

इमली के कीटों का प्रबंधन

(अ) नर्सरी और खेतों में :

(1) कर्षण विधि : इस विधि में निम्नानुसार

सामान्य नाम	वैज्ञानिक नाम	नुकसान
निड़ील निमेटोड़	लोंगीडोरस इलोगेटीस	इमली की जड़ों को नुकसान पहुँचाती है
बरोईगं निमेटोड़	रोड़ोफिलस सिमीलस	इमली की जड़ों को नुकसान पहुँचाती है
जड़ गांठ निमेटोड़	मेलिडोगायनी ईंकोग्नेटा	इमली की जड़ों को नुकसान पहुँचाती है
शियोइड़ निमेटोड़	हेमीक्रिकोनिमोड़ीस मेंजीफेरी	इमली की जड़ों को नुकसान पहुँचाती है
ड़ेगर निमेटोड़	जिफ़ेनीमा सिट्रई	इमली की जड़ों को नुकसान पहुँचाती है

समान्य नाम	वैज्ञानिक नाम	नुकसान
सूखी इमली की माईट	कार्पोगलाईफल लेक्टिस	ये सभी वरूथीयां इमली के भंडारण के दौरान उनको ग्रसित करके उनकी गुणवत्ता पर प्रतिकूल असर डालती है साथ ही साथ ये वरूथीयां अनेक प्रकार की रोगकारक फफूंदीयों के वाहक का भी काम करके उनके फैलाव में मदद करती है।
खुजली माईट	पेमीटस वेंट्रिकोस	
संग्रहित उत्पादों की माईट	केलोग्लाइफस हयूगेसी	
टुकरेला माईट	टुकरेला एरनाटा	

कार्य करने चाहिए :

- इमली के पैडों के चारों तरफ गर्मी के मौसम में निराई–गुड़ाई करने से जमीन में रहने वाले नाशीकीटों तथा सूत्रकृमियों के अंड़े और उनकी अपरिपक्क्व अवस्थाएं जमीन के ऊपर आ जाती है। ये तेज़ धूप और परभक्षी जीवों द्वारा नष्ट कर दी जाती है।

- कीटों से ग्रस्त (यथा मिलीबग, स्केल, आदि) इमली की शाखाओं तथा टहनियों को काट कर जल देने से छोटे स्तर पर इन कीटों की संख्या में कुछ कमी लाई जा सकती है।

- मिलीबग तथा शल्क (स्केल) कीटों के शिशुओं (निंफ) को उनकी शुरूआती अवस्था में ही नष्ट कर देना चाहिए।

- इमली के पेड़ के आसपास पायी जाने वाली चींटियों को बांबियों का नाश करना चाहिए। इससे यथा मिलीबग के प्रकोप में कमी करने में मदद मिलेगी क्योंकि चींटियां इन यथा मिलीबग का एक स्थान से दूसरे स्थान तक परिवहन करके उनके फैलाव में सहायता करती है।

- मिलीबग के शिशुओं, जिन्हें क्रोलर्स भी कहते है, अंडों से निकालने के बाद तेज़ी से इमली के तनों पर चढ़ते है। इन शिशुओं (क्रोलर्स) को तनों पर चढ़ने से रोकने के लिए इन पेडों के तनों के चारों तरफ 30 से.मी. चौड़ी प्लास्टिक की चिपचिपी पट्टी लगानी चाहिए। इससे अंडों से निकले शिशु (क्रोलर्स) पेड़ पर नहीं चढ़ पायेंगे तथा इन चिपचिपी पट्टियों पर चिपककर नष्ट हो जाएंगे।

(2) जैविक नियंत्रण : इस विधि में इमली के नाशीकीटों के प्राकृतिक शत्रुओं जैसे परजीवी, परभक्षी और रोगकारकों की सही पहचान करके उनका प्रयोग इन नाशीकीटों के प्रबंधन हेतु किया जाता है। यहां पर इन प्राकृतिक शत्रुओं के संरक्षण और संवर्धन के उपायों पर भी ध्यान दिया जाता है।

- शल्क कीट तथा फुदकों के प्राकृतिक शत्रु जैसे मकड़ियों (ओक़िजपस प्रजाति, प्लेकजीपस प्रजाति और ओलिस प्रजाति) साथ ही साथ अन्य परभक्षी कीट यथा हरा लेसविंग,

कोक्सीनेलिड़ भृंग और मेंटिड आदि की पहचान करके उनका संरक्षण और संवर्धन करना चाहिए।

- सूंड़ीयों की संख्या को परजीवी कीट यथा लार्वा परजीवी, कोटेशिया प्रजाति, चिराप्स प्रजाति, ब्रेकीमेरिया प्रजाति और ज़ेन्थेपिम्पेला प्रजाति काबू में रखते है अतः इमली उत्पादकों को इन मित्र कीटों की पहचान करके उनका संरक्षण और संवर्धन करना चाहिए।

(3) वनस्पतिक कीटनाशी दवाओं द्वारा नियंत्रण : इमली में विभिन्न नाशीकीटों की रोकथाम हेतु वनस्पतिक कीटनाशी दवाओं का छिड़काव करना चाहिए। इस हेतु इमली के बड़े पेड़ों पर फोगर स्प्रेयर की मदद से छिड़काव करना चाहिए। इन वनस्पतिक कीटनाशी दवाओं में मेंथा, लीम, अरंडी, करंज आदि के तेल का अथवा उनकी पत्तियों के सत का छिड़काव करना लाभप्रद सिद्ध होता है। इन कीटों के नियंत्रण हेतु रासायनिक दवाओं का प्रयोग लगभग नहीं के बराबर होता है।

(ब) भंडारण के दौरान नाशीकीटों का प्रबंधन : यहां निम्नांकित बिंदुओं को ध्यान में रखना चाहिए :

(1) कर्षण विधि : इसके अंतर्गत निम्न बिंदुओं को करना चाहिए :

- भंडारगृहों में इमली के संग्रहण से पूर्व उनकी भली भांति साफ–साफई करनी चाहिए।
- भंडारगृहों को वायुरोधी रखना चाहिए।

- भंडारगृहों का तापमान 20 डिग्री सेंटीग्रेड से नीचे रहे इसके प्रयास करते रहना चाहिए।

(2) वनस्पतिक कीटनाशी दवाओं का प्रयोगः नीम बीज़ के सत का प्रयोग करके इमली के भृंग द्वारा दिये जाने वाले अंडों को नष्ट अथवा रोका जा सकता है। इसी प्रकार से संग्रहण पात्रों का नीम तेल से उपचार करना चाहिए।

(3) जैविक नियंत्रण : भंडारगृहों में पतंगों तथा अन्य कीटों की रोकथाम हेतु कीटरोगकारक फफूंदी मेटाराईजीयम ऐनिसोप्ली का प्रयोग करना चाहिए।

(4) धूमन : भंडारगृहों में नाशीकीटों तथा वरूथी के प्रकोप में बहुत अधिक वृद्धि होती है, तब उन भंडारगृहों का धूमन करना चाहिए।

आशा है कि प्रस्तुत लेख द्वारा हम इमली के नाशीकीटों व अन्य नाशीजीवों के विषय में जान गये है, जरूरत इस बात की है कि इन नाशीकीटों की समय पर पहचान करके उनके लिए उचित प्रबंधन उपायों को अपनाना चाहिए जिसे इमली उत्पादकों को उनकी उपज का लाभ प्राप्त होगा।

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सुपारी और मसाले के लिए जुलाई–सितंबर, 2020 का कृषि कार्य

समान्यत : दक्षिण–पश्चिम मानसून इस तिमाही के मध्यतक सक्रिय रहता है। इस अवधि के दौरान बागों में जल निकास की पर्याप्त व्यवस्था सुनश्चित करना चाहिए। सुपारी तथा अन्य बहुत सी बहुवर्षेय मसाले फसलों में सक्रिय वर्धन और फल लगने का समय है, इसलिए पौधों को पर्याप्त पोषक तत्व प्रदान करना बहुत आवश्यक है।

वर्षा के मौसम में नमीयुक्त वायुमंडल बहुत–सी बीमारियों और कीटों के आक्रमण के लिए अनुकूल होता है। इसलिए फसल को नुकसान से बचाने के लिए उचित समय पर पर्याप्त पौध संरक्षण उपाय करना चाहिए।

सुपारी

पौधशाला

* बीच–बीच में निराई करना आवश्यक है।
* सूँडियों और टिड्डों जैसे कीटों को यांत्रिक उपायों से मारना चाहिए।
* रोग संक्रमित पौधों को जला दें। वर्षा के मौसम में छॉव जालों को हटाकर रखें।
* रोग संक्रमण पर निगरानी रखें।
* रोग की उग्रता के अनुसार पौदों का उपचार करें।
* पौधशाला में पर्याप्त जल निकास का बंदोबस्त करें।
* खरपतवार निकालने के साथ–साथ रोग संक्रमण पर निगरानी रखे ।
* वर्षा की लभ्यता के अनुसार सिंचाई दें।

नया बाग

* दुर्बल और मृत पौधों को हटाकर उनकी जगह अच्छे पौधों की रोपाई करें।
* मृत पौधों को हटाने के बाद गड्डों में उचित फफूँदनाशाी का प्रयोग करें।
* वर्षा के मौसम में पौधों के आधार में मिट्टी चढ़ाकर तरूण पौधों को बांध लें।
* नए बागों में 3 महीने में एक बार क्रम में निराई करें।
* निराई करते समय पौधों के कॉलर भाग, तना और जड़ों को नुकसान मत करें।
* जल निकास की नालियों के लिए निगरानी करके मिट्टी, पत्थर और पौध अवशिष्ट को हटाकर साफ करके रखें।
* मटियारी मिट्टी में अगस्त–सितंबर के दौरान रोपाई की जानी चाहिए। उच्च वर्षावाली इलाकों में मानसून खतम होने के बाद ही रोपाई करें।
* प्रारंभिक अवस्था में आंशिक छाया करके कतारों के बीच में 4–5 वर्ष तक केल की रोपाई करें।
* मिट्टी चढ़ाकर तरूण पौधों को आधार से बांधकर पल्वार करके छॉव दें।
* छॉव देने वाली समहेंप पौधों को फूल आने से पहले काटकर मिट्टी में समायाजित करें।

पुराना बाग

* जल निकास की सुविधाएँ की जानी चाहिए।
* 1% बोर्डाक्स मिश्रण का छिड़काव पहले छिड़काव के 40–50 दिन बाद में करें।

* बागों में 6 महीने में एक बार के क्रम में निराई करें।
* पर्ण दाग और फल फट जाने का नियंत्रण करें।
* कलियों, मुकुट, फल और जड़ सड़न का नियंत्रण करें।
* सडे हुए पत्तों और पुष्प गुच्छों को हटाकर बागों में सफाई करें।
* यदि मानसून वर्षा लंबे समय तक चालू है तो फल सड़न रोग के नियंत्रण के लिए 1% बोर्डाक्स मिश्रण का तीसरे दौर का छिड़काव करें।
* कलिका गलन रोग – संक्रमित पौधों के क्षतिग्रस्त भागों को खुरचकर बाकी स्वस्थ भागों में 1% बोर्डाक्स मिश्रण से अच्छी तरह धोना चाहिए और घायल भागों पर बोर्डाक्स पेइस्ट का लेपन करें और बारिश से बचाकर रखें।
* अगस्त में तरूण संसाधित बेरियों क लिए तुड़ाई शुरू करें।
* मिट्टी हल्के खोदकर उर्वरकों का (दूसरी खुराक) प्रयोग करें।
* तरूण पौधों को उर्वरकों की क्रमिक खुराक यानी, एक तिहाई और दो तिहाई मात्रा क्रमशः पहले और दूसरे वर्ष में करें। समान्यतः दक्षिण–पश्चिम मानसून सितंबर–अक्तूबर में खतम हो जाता है, तब उर्वरकों की दूसरी खुराक 65 ग्राम नत्रजन, 90 ग्राम फॉसफोरस और 90 ग्राम पोटाश प्रति वयस्क पोड़ की दर पर पौधों के आधार से 75–100 सेंटी मीटर की दूरी पर 15–20 सेंटी मीटर की गहराई वाले गोलाकार गड्ढों में डालकर गड्ढे ढॅक लें।
* इसी मौसम में हरे पत्ते और कंपोस्ट/गोबर की खाद 12 किलो ग्राम प्रति पेड़ की दर पर देना चाहिए जिससे मिट्टी के सूक्ष्माणु सक्रिय हो जाते हैं और खनिज पदार्थों के पुनरावृत्ति भी हो जाता है।
* अम्लीय मिट्टी में उर्वरकों देने के 15 दिन पहले चूने का प्रयोग एक किलो ग्राम पेति पेड़ की दर पर करें। यह दो वर्ष में एक बार के क्रम में करें।
* बागों में उेड़ों के बीच में अंतराखेती करें।
* मुकुट सड़न रोग है तो, संक्रमित गुच्छों को हटाकर रोग के प्रारंभिक अवस्था पर मिट्टी का उपचार करें और उग्र स्थिति में भुरकाव करना पड़ेगा।
* भारी वर्षा के बाद होने वाले सूखे व गर्म मौसम स्पिंडल बग के संक्रमण के लिए अनुकूल है। मुकुटों पर कार्बरिल 50 wp छिडका दें और यह सबसे आंतरिक पत्तों तक छिड़कना चाहिए। यदि कीट संक्रमण फिरभी रहे तों, 30-35 दिन बाद दुबारा छिड़काव करें।
* जड़ सूँडी के नियत्रण के लिए पौधों के चारों ओर 10–15 सेंटी मीटर की गहराई में मिट्टी खोदकर 0.04% क्लोरपाइरिफॉस से दो बार उपचार करें, पहला मई में, दक्षिणी–पश्चिमी मानसून शुरू होने से पहले और दूसरा सितंबर–अक्तूबर में मानसून समाप्त होने पर।
* कीटों का पूर्ण उन्मूलन के लिए दो या तीन वर्ष तक लगातार इसका प्रयोग जारी रखें।

मसाले

काली मिर्च

* जुलाई में, बढ़ने वाले बेलों को आधार से बांध लें और आधारी पेड़ों की आनावश्यक शाखाएँ काटकर प्रूनिंग करें।
* पेल्लू भृंग और प्ररोहाग्र वेधकों के नियंत्रण के लिए बेलों में 0.05% क्विलालफोस या 0.05% डिमेथोएट छिड़का दें।
* खरपतवार के काट–छांट करके निराई करें।
* अगस्त में बढ़ने वाले बेलों को आधार से बांधना जारी रखे।
* अगस्त में उर्वरकों की मात्रा के बाकी आधा भाग का प्रयोग करें। जैवीक नियंत्रण एजेंट (*ट्राइकोडेर्मा, स्युडोमोनस फ्लूरोसेंस और पोचोनिय क्लामिडोस्पोरिय*) का दूसरी खुराक जैवीक उर्वरकों के साथ प्रयोग करें। *असेस्पिनिल्लम* (50 ग्राम प्रति बेल) और *पी सोल्युबिलाइस* (50 ग्राम प्रति बेल) ग्रबर के साथ प्रयोग करें।
* आन्थ्रेकनोस रोग के तीव्र संक्रमण में 1% बोर्डाक्स मिश्रण छिड़का दें।
* बागों में छॉव नियंत्रण के लिए आधारी पोड़ों का काट–छांट समय पर करना चाहिए।
* सितंबर में तरूण पौधों के बढ़ने वाले बेलों को आधारी पोड़ों से बांधना जारी रखें।
* बेलों के आधारों में 0.2% कोप्पर ओक्सीक्लोराइड 5-10 लीटर प्रति बेल की दर पर उपचारित करे।
* पत्तों में भी 1% बोर्डाक्स मिश्रण छिड़का दें।
* इसके अलावा बेलों के आधारों में 0.3% पोटासियम फॉस्फोनेट 5-10 लीटर प्रति बेल की दर पर और पत्तों में भी 0.3% पोटासियम फॉस्फोनेट छिड़का दें।

अदरक और हल्दी

अंतिम खुराक के रूप में अदरक को 38 कि.ग्रा.नत्रजन, 25 कि.ग्रा.पोटाश या *बी. तुरिंजियेन्सिस* 2 ग्राम प्रति लीटर की दर पर और हल्दी के लिए 10 कि.ग्रा.नत्रजन 30 कि.ग्रा. पोटाश प्रति हेक्टेयर की दर पर उर्वरकों का प्रयोग करें। जब कभी आवश्यक हो, निराई करके मिट्टी चढ़ा दें। पर्याप्त जल निकास का बंदोबस्त करके पानी के जमाव से बचना चाहिए। जहॉ देर से रोपाई की थी वहॉ जैवी खाद की दूसरी खुराक देकर हरे पत्तों से पल्वार करें।

अदरक की फसल मृदु–गलन और पर्ण दाग रोग से प्रभविता हो सकता है। *ट्राइकोडेर्मा हर्जियानम* के साथ नीम खली 1 किलो ग्राम प्रति क्यारी की दर पर प्रयोग करने से इन रोगों का संक्रमण कम हो जाता है। पर्याप्त जल निकास सुनिश्चित करें और मृदु–गलन संक्रमित पौधों को निकालकर नष्ट कर देना चाहिए तथा रोग के फैलाव को रोकने के लिए रोगग्रस्त एवं उसके आसपास के पौधों में 0.3% डाइथेन एम.45 का छिड़काव करें। पर्ण दाग रोग की राकथाम के लिए 1% बोर्डाक्स मिश्रण या 0.2% डाइथेन एम–45 का छिड़काव करें। तना वेधकों के नियंत्रण के लिए 0.05%डिमेथेएट 1.67 मि.लीटर प्रति लिटर पानी की दर पर छिड़काना चाहिए।

मिर्च

तुड़ाई पूरा हो जाने पर फील्ड को या तो परती रखा जाए या अगले मौसम में खेती के लिए प्रस्तावित खेतों में हरी खाद देने के लिए काउपी, समहेंप आदि पौधों की रोपाई करें। जहां पर्याप्त बारिश होती है, वहां नर्सरी में बीज की बुवाई की जा सकती है। मई–जून में रोपित वर्षा मौसम फसल को प्रति हेक्टेयर 35 कि.ग्रा. नत्रजन युक्त उर्वरक देने के बाद खरपतवार निकाल कर निराई करके मिट्टी चढ़ाना चाहिए।

थ्रिप्स, फल गलन के हेतुक कवक और डाइबैक रोग का संक्रमण सक्रिय हो जाएगा। थ्रिप्स के नियंण के लिए 0.25% मेटास्स्टिोक और फल गलन तथा डाठबैक के मामलों पर डाइथेन एम–45 का छिड़काव 2.5 ग्राम प्रति लिटर की दर पर 15 दिनों के अंतराल में करें।

वर्षा और मिट्टी के प्रकार के आधार पर 7–10 दिनों में एक बाद मिर्च के खेतों की सिंचाई करें। पूरे खेत में पाधे बढ़ जाने तक खेत को पूरी तरह खरपतवार मुक्त नखना जरूरी है। कार्बनिक खाद/जैविक खाद का प्रयोग करें। पौधों की प्रतिरोपाई करने के 20 वीं दिन में ट्राइकोन्टानोल 1.25 पीपीएम (2.5 मि.ली विपुल 10 लिटर पानी में विलीन करके) छिड़कने से इनमें प्रकाश संश्लेषण का प्रक्रिया बढ़ जाएगा।

वृक्ष मसाले (लौंग, जायफल और दालचीनी)

चे फसलें बहुत अधिक उर्वरका लेनेवाले हैं इसलिए अच्छी बढ़वार एवं पैदावार के लिए अधिक पौष्टिकों एवं उर्वरकों की ज़रूरत है। लौंग और जायफल को कम्पोस्ट या गोबर की खाद 25–50 कि.ग्रा. और दालचीनी को 10 कि. ग्रा. प्रति पेड़ की दर पर प्रयोग करें। सितंबर के मध्य में कार्बनिक खादों के साथ उर्वरकों की दूसरी खुराक लौंग को नत्रजन 150 ग्राम, फॉसफोरस 125 ग्राम तथा पोटाश 370 ग्राम प्रति पेड़, जायफल को नत्रजन 250 ग्राम, फॉसफोरस 125 तथा पोटाश 500 ग्राम तथा दालचीनी को नत्रजन 100 ग्राम, फॉसफोरस 90 ग्राम तथा पोटाश 100 ग्राम प्रति पेड़ की दर पर प्रयोग करें। 15 साल से कम उम्र के पेड़ों को उर्वरकों की वर्गीकृत खुराक दें।

पत्ते गलन, फल गलन, नव पर्ण झुलसा और फूल कलिका गिरने की रोकथाम के लिए 1% बोर्डाक्स मिश्रण का एक या ढेड महीने के अंतराल में छिड़कना चाहिए।

बीजीय मसाले

धनिया, जीरा, सौफ और मेंथी मुख्य बीजीय मसाले है। लहसुन एक और महत्वपूर्ण मसाले फसल हैं। अब खरीफ मौसम होने के कारण रबी मौसम में खेती करने तक खेत को परती रखा जाए। फिरभी खरीफ सौंफ की रोपाई के लिए पौधशाला तैयार करें। सौंफ की खेती के लिए 100 वर्ग मीटर स्थल में उगाई करें। 1.5 किलो ग्राम बीज एक हेक्टायर मे रोपाई के लिए काफी है। बीजों को 24 घंटों तक पानी में डुबाकर रखने के बाद 2–3 घंटों तक सुखाकर 31 मीटर आकार के क्यारियों में बुआई करें। नर्सरियों में पल्वार करना और सिंचाई करना आवश्यक है।

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FARM OPERATIONS FOR ARECANUT & SPICES JULY-SEPTEMBER, 2020

In the first half of the quarter, generally the South West Monsoon remains active. Adequate drainage in the gardens should be ensured during the period to avoid any water logged situations. This period also generally coincides with the active vegetative and fruit-setting phase in respect of Arecanut and majority of the perennial spice crops. Therefore it is essential that enough nutrients are made available to these plants well in advance.

The humid atmosphere prevails in the monsoon season generally congenial for the multiplication of many pest and disease causing organism. In order to check infection adequate plant protection measures are to be adopted well in time to avoid any crop loss.

Arecanut

Nursery

* Intermittent removal of weeds is necessary.
* Mechanical killing of insects like grass hoppers and caterpillars may be done.
* Burning of diseased plants is advisable.
* Removal of shade nets during rainy season.
* Improve the drainage facilities and ensure proper drainage in the nursery
* Drenching the seedlings depending on severity of disease incidence.
* Weeding and supervision for any disease incidence
* Watering depending on continuity of rain

New garden

* Replace the weak and dead seedlings by gap filling.
* After removal of diseased plants drench the pit and surrounding pits with suitable fungicide.
* Soil bunding at the base and anchoring the young seedlings during rainy season.
* In young plantations, weeding should be done once in 3 months.
* Care should be taken not to damage collar region of seedlings, stem and roots of young plants, while weeding
* Supervise for the condition of drainage channels. Channels blocked with muddy soil, stones and plant wastes should be cleaned
* The planting is to be done during August-September in clay soils. Planting at the end of monsoon in high rainfall areas, particularly plots with high water table and clayey soils
* Banana may be planted between rows to provide shade to arecanut in the initial stages up to 4-5 years
* Soil bunding and anchoring the young seedlings, mulching and shading during September.
* Sunhemp plants may be cut and incorporated in the basins before they attain flowering stage.

Old garden

* Ensure drainage facilities
* Second round of spraying with 1% Bordeaux mixture may be taken up 40-45 days after the first spraying.

* In grown up gardens, weeding can be done once in 6 months.
* Control leaf spot and nut splitting
* Control bud, crown, fruit and root rots
* Improve the sanitation in the garden by removing fallen rotten leaves, inflorescence bunches.
* If the monsoon prolongs, third round of spray with 1% Bordeaux mixture against the incidence of fruit rot disease may be given.
* In the case of bud rot affected palms, the damaged tissues may be scooped out. Remaining healthy tissues should be treated with Bordeaux paste or the crown drenched with 1% Bordeaux mixture and protected suitably from rain.
* During August harvesting for tender nut processing may be started
* Forking and fertilizer application (second dose)
* Young palms need to be given only graded doses i.e., one third and two thirds of fertilizers in the first and second year, respectively. As the south west monsoon generally recedes in September-October, the second round of fertilizers application may be taken up to supply 65g N, 25g of P2O5 and 90g K2O per adult palm in circular basins of 15 to 20 cm deep taken at a radius of 75 cm to 1 m away from the base of the palm.
* Organics may be added during this season which will enhance soil microbial activity and recycling of minerals. Application of 12 kg organic manure as green leaf compost/farm yard manure is recommended per palm.
* In acid soils, 15 days prior to application of fertilizers apply lime @ 1 kg per palm and incorporate in the soil by forking. Lime can be applied once in two years.
* Intercultivation by forking interspaces may be practiced.
* Watch the palms carefully for incidence of bud rot and if noticed scoop out the rotten tissues, wash the surface, apply Bordeaux paste and protect from rain.
* In case of crown rot, remove the infected bunches properly and control the disease during initial stages of infection by drenching the soil and advanced stage by spraying.
* The hot and dry spells in between the heavy rains during this period, may induce the incidence of spindle bug attack. Spray crowns with carbaryl 50 WP. The spray should reach the leaf axils. Repeat spraying after 30-35 days if pest incidence continues.
* For Management of root grubs, loosen soil around the base of palms to a depth of 10-15cm and drench with chlorpyrifos 0.04 per cent suspension twice, one in May just before the onset of southwest monsoon and again in September- October towards the end of the monsoon. Repeat application for 2 or 3 years consecutively to secure a complete eradication of the pest.

Pepper

* During July, tie growing shoots of young vines to the standard and second pruning of the standards may be done.
* In case of the incidence of "pollu" beetle or top shoot borer a spray of quinalphos

(0.05%) or dimethoate (0.05%) is recommended

* Slash weeding may be done.
* Tie growing shoots of young plants to the standards may continue during the month of August.
* The balance half dose of the recommended fertilizers may be applied during the August. Apply second dose of biocontrol agents (Trichoderma, Pseudomonas fluorescens and Pochonia chlamydosporia) along with organics. Apply Azospirillum(50g/vine) and P. solubilizer (50g/vine) along with FYM.
* In case of the severe incidence of Anthracnose, spray with Bordeaux mixture 1%.
* Branches of support trees to be lopped off to regulate shade.
* During the month of September Tie growing shoots of young plants to the standards continued.
* Drench the basin of the vines with 0.2% COC @ 5-10 litres per vines.
* Foliar spray with 1% Bordeaux mixture is also given.
* Alternatively, drench the base of the vines with 0.3% Potassium Phosphonate at the rate of 5-10 litres /vine and a foliar spray with 0.3% potassium phosphonate is also to be given.

Ginger and Turmeric

The final dose of fertilizers to supply 38 kg N and 25 kg K2O per h or B. thuringiensis 2 g/litre a for Ginger, 10 kg N and 30 gm K2O per ha for Turmeric may be applied. Weeding and earthing up in the beds may be done as and when required. Water stagnation should be avoided by providing sufficient drainage. Application of second round of organic manures can be done in plots where planting was delayed. After manuring, mulch with green leaves for the second time.

The Ginger crop may be prone to the incidence of soft rot and leaf spot diseases. Application of Trichoderma harzianum along with neem cake @ 1 kg/bed helps in reducing the incidence of the disease. Ensure adequate drainage, pull out and destroy the soft rot affected clumps and drench the affected as well as surrounding beds with 0.3 % Dithane M 45 to check the disease spread. Spray 1 % Bordeaux mixture or 0.2 % Dithane M 45 against leaf spot disease. For controlling shoot borers 0.05 % Dimethoate (1.67 ml/litter water) may be sprayed.

Chilli

On completion of harvesting, the main field is either kept fallow or green manuring can be practiced by sowing pulse crops (cowpea or sunnhemp) proposed for next season cultivation. Wherever sufficient rains are received, sowing of seeds may be taken up in the nursery.

The rainy season crop planted in May-June requires weeding, hoeing and earthing up followed by application of fertilizers to supply 35 kg N per ha.

Thrips and fungus causing fruit rot and die-back may be active. Spray Metasystox 0.025 % at 15 days interval against thrips and Dithane M 45 @ 2.5 gm per litre of water against fruit rot and die back.

Irrigate Chilli fields once in 7-10 days based on rainfall and soil type. The field should be kept weed free till the crop almost covers the land area. Organic manures/bio fertilizers can be applied. Tricontanol can be sprayed @ 1.25 ppm (2.5 ml of Vipul dissolved in 10 litre of water) on 20th day of transplanting to increase photosynthetic activity of plants.

Tree Spices (Clove, Nutmeg and Cinnamon)

These are heavy feeders and require proper manuring for regular growth and yield. Cattle manure or compost 25 to 50 kg per tree for Clove and Nutmeg and 10 kg for Cinnamon may have to be applied. Along with organic manures in the 2nd half of September and second split dose of fertilizers to supply NPK 150 gm, 125 gm and 370 gm per tree for Clove, 250 gm, 125 gm and 500 gm per tree for Nutmeg and 100 gm, 90 gm and 100 gm per tree for Cinnamon may be applied. Young trees below 15 years age are given only graded doses.

Against leaf rot/fruit rot/twig blight/ flower bud shedding etc., spray 1 % Bordeaux mixture and the spray repeated at 1- 1 ½ months intervals to the extend required.

Seed Spices

The main seed spices are Coriander, Cumin, Fennel and Fenugreek. Garlic is yet another important spice crop. Being kharif season now, the land is kept fallow to take up cultivation operation during rabi season. Yet, for kharif Fennel (transplanted), this is the time for starting nursery. 1.5 kg Fennel seed in 100 sq.m. area is sufficient for transplantation in one hectare land. Fennel seeds soaked in water for 24 hours and dried two-three hours are sown in prepared bed of size 3 x 1 meter. Mulching and periodical irrigation are necessary in the nursery.

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बाज़ार समीक्षा (जनवरी–मार्च, 2020)

सुपारी

समीक्षाधीन तिमाही के दौरान लगभग सभी बाज़ारों में सूखी सुपारी के मूल्य में मिश्रित प्रवृत्ति देखी गई। कोची में इस अवधि के दौरान सुपारी के मूल्य स्थिर एवं मजबूत होकर 19,300 रूपए प्रति क्विंटल पर स्थिर रहा। कोषिक्कोड में जनवरी, 2020 के प्रथम सप्ताहांत के दौरान सूखी सुपारी के मूल्य 24,000 रूपए प्रति क्विंटल था, उसमें उतार–चढ़ाव होकर तिमाही के अंत में 24,000 रूपए प्रति क्विंटल की थेडी बढ़ोत्तरी हुई। इसी अवधि के दौरान मैंगलोर में चोल सुपारी और नई सुपारी की कीमत में स्थिरता एवं मजबूती की प्रवृत्ति दर्ज किया गया और इनकी औसत कीमत क्रमशः 27,000 रूपए तथा 22,000 रूपए प्रति क्विंटल पर था। तिमाही के पहले दो महीनों के दौरान गोवा में चाली (पुरानी) के मूल्य में 1,200 रूपए प्रति क्विंटल की गिरावट हुई।

काली मिर्च

बाज़ारों में काली मिर्च के मूल्य में उतार की प्रवृत्ति दिखाई पड़ी। कोची बाज़ार में अनगारबल्ड काली मिर्च का भाव, जो जनवरी, 2020 के प्रथम सप्ताहांत के दौरान 33,000 रूपए प्रति क्विंटल था, वह मार्च, 2020 के अंतिम सप्ताहांत के दौरान घटकर 29,800 रूपए प्रति क्विंटल हो गया। कोषिक्कोड बाज़ार में नाडन और वयनाडन काली मिर्च के भाव में उतार की प्रवृत्ति दिखाई पड़ी।

अदरक

प्रायः सभी बाज़ारों में अदरक की कीमत में मिश्रित प्रवृत्ति दिखाई पड़ी। कोषिक्कोड में सूखे अदरक

MARKET REVIEW (January to March, 2020)

ARECANUT

Arecanut (dry) price has expressed a mixed trend in almost all the markets during the quarter under review. In Kochi, the price of arecanut showed a steady to firm trend and ruled at Rs.19,300/quintal during the period under review. In Kozhikode, the price of dry arecanut which was Rs. 24,000/quintal during the first weekend of January, 2020 showed fluctuations and marginally increased to Rs. 24,500/quintal by the end of the quarter. In Mangalore, the prices of choll supari and new supari registered a steady to firm trend and ruled at Rs. 27,000 and Rs. 22,000 a quintal respectively. In Goa, the price of Chali (old) decreased by Rs.1,200/quintal during the first two months of the quarter.

BLACK PEPPER

Pepper market witnessed a decreasing trend in prices. The price of ungarbled black pepper in Cochin market, which was Rs. 33,000/quintal during the first weekend of January, 2020, had decreased to Rs. 29,800/ quintal during the last weekend of March, 2020. In Kozhikode market, the prices of both Nadan and Wayanadan pepper showed a decreasing trend.

GINGER

Ginger prices displayed a mixed trend in almost all the markets. The price of dry ginger

के दाम में 5,000 रूपए प्रति क्विंटल की वृद्धि हुई और कोची में थोडी उतार–चढ़ाव के साथ इसका दाम 27,000 रूपए प्रति किवंटल पर रहा। चेन्नई में सूखे अदरक के दाम में 1,000 रूपए प्रति क्विंटल की गिरावट हुई। समीक्षाधीन तिमाही के दौरान बेंगलुरू बाज़ार में ताजे अदरक के दाम में मिश्रित प्रवृत्ति दिखाई पड़ी।

in Kozhikode market increased by Rs. 5,000/ quintal and in Kochi, the price ruled at Rs. 27,000/quintal with minor fluctuations. In Chennai, dry ginger prices decreased by Rs.1,000/quintal. Fresh ginger prices in Bangalore market showed a mixed trend during the period under review.

मिर्च

समीक्षाधीन अवधि के दौरान टूटिकोरिन और चेन्नाई बाज़ार में मिर्च के मूल्य में तेज़ गिरावट की प्रवृत्ति देखी गई। टूटिकोरिन में मिर्च के मूल्य में 5,000 रूपए प्रति क्विंटल की गिरावट हुई और चेन्नै बाज़ार में जनवरी–मार्च, 2020 के दौरान सम्बा किस्म मिर्च के मूल्य में 6,600 रूपए प्रति क्विंटल की गिरावट हुई।

CHILLI

Chilli prices showed a sharp decline in Tuticorin and Chennai markets. In Tuticorin, chilli price decreased by Rs.5,000/ quintal and in Chennai the Samba chillies registered a decline of Rs. 6,600/quintal during the period from January to March, 2020. But in Bangalore market, the price showed an increase trend.

हल्दी

कोची बाज़ार में हल्दी की कीमत में 500 रूपए प्रति किवंटल की गिरावट हुई। समीक्षाधीन अवधि के दौरान चेन्नै बाज़ार में ईरोड हल्दी के भाव में स्थिरता एवं मजबूती की रूख देखी गई और इसकी कीमत 9,500 रूपए प्रति क्विंटल रहा और सेलम हल्दी के भाव में 500 रूपए प्रति क्विंटल की वृद्धि हुई।

TURMERIC

Turmeric prices in Cochin dropped by Rs. 500 a quintal. In Chennai market, the price of Erode turmeric has shown a steady trend and ruled at Rs.9,500/quintal and that of Salem Turmeric has moved up by Rs. 500/quintal by the end of the quarter under review.

लहसुन

तिमाही के पहले दो महीनों के दौरान बेंगलुरू बाज़ार में मिश्रित प्रवृत्ति दिखाई पड़ी और तदुपरांत इसके मूल्य में 8,500 रूपए प्रति क्विंटल की गिरावट हुई।

GARLIC

Garlic prices in Bangalore showed a mixed trend during the first two months and thereafter the price declined to Rs. 8,500/ quintal.

बीजीय मसाले

जनवरी–मार्च, 2020 के दौरान जीरा के दाम में मिश्रित प्रवृत्ति देखी गई। इसी अवधि के दौरान धनिया

SEED SPICES

The market witnessed a mixed trend in Cumin prices in Chennai market during

की कीमत में वृद्धि हुई। धनिया की कीमत 9,500 से 10,500 रूपए प्रति क्विंटल तक बढ़ गाई।

जायफल/जावित्री और लौंग

समीक्षाधीन अवधि के दौरान (छिल्का सहित और छिल्का रहित) जायफल के दाम में मिश्रित प्रवृत्ति देखी गई। लेकिन इसी अवधि के दौरान जावित्री की कीमत 10,000 रूपए प्रति क्विंटल में घट गई।

भारत तथा विदेश के प्रमुख बाज़ार केन्द्रों में सुपारी और मसाले के साप्ताहिक थोक भाव नीचे तालिका में दिया गया है।

January to March, 2020. Coriander price displayed an increasing trend. The price of coriander increased from Rs. 9,500/quintal to Rs. 10,500/quintal during the period.

NUTMEG, MACE & CLOVES

The prices of Nutmeg (with shell and without shell) showed mixed trend during the period under review. But the prices of Mace decreased by Rs.10,000/quintal during the same period.

Week-end wholesale prices of arecanut and spices recorded in the major market centers of India are appended in the following tables.

WEEKLY WHOLESALE PRICES OF ARECANUT

KERALA **(Rs./quintal)**

Month	Week	Kochi Dry	Thalassery New	Kozhikode Dry (Old)
Jan-20	1st	19300	22000	24000
	2nd	19300	22000	25000
	3rd	19300	22500	26000
	4th	19300	22200	25500
	5th	19300	22200	25500
Feb-20	1st	19300	22200	25000
	2nd	19300	22500	24500
	3rd	19300	22700	25000
	4th	19300	23800	26000
Mar-20	1st	19300	24000	25500
	2nd	19300	24200	25000
	3rd	19300	24100	24500
	4th	19300	NT	NT

Source : District Economics and Statistics Office, Ernakulam; Regional Statistical Office, Kozhikode.

KARNATAKA, TAMIL NADU & GOA

(Rs./quintal)

Month	Week	Mangalore		Chennai Rashi	Goa Chali (Old)
		Choll Supari	New Supari		
Jan-20	1st	27000	22000	22500	27000
	2nd	27000	22000	22500	26600
	3rd	27000	22000	22500	26600
	4th	27000	22000	22500	26600
	5th	27000	22000	22500	26000
Feb-20	1st	27000	22000	22500	26000
	2nd	27000	22000	22500	25800
	3rd	27000	22000	22500	25600
	4th	27000	22000	22500	25800
Mar-20	1st	27000	22000	22500	NA
	2nd	27000	22000	22500	NA
	3rd	27000	22000	22500	NA
	4th	27000	22000	22500	NA

Source: Agricultural Produce & Marketing Committees (APMC),Mangalore, Economics & Statistics, Chennai, Directorate of Marketing, Goa.

WEEKLY WHOLESALE PRICES OF BLACK PEPPER (Rs./Quintal)

Month	Week	Kochi	Kozhikode		Kottayam
		Ungarbled	Nadan	Wayanadan	
Jan-20	1st	33000	39000	32000	35500
	2nd	32900	29000	32000	35000
	3rd	32300	29000	32000	35000
	4th	31800	29000	32000	33500
	5th	31400	29000	32000	33000
Feb-20	1st	30900	28500	32000	33000
	2nd	31400	28500	32000	32500
	3rd	31900	30000	32000	33000
	4th	31200	29000	32000	33000
Mar-20	1st	30400	27500	30000	32000
	2nd	29900	27000	30000	32000
	3rd	30100	28000	32000	32000
	4th	29800	NT	NT	32000

Source: District Economics & Statistics, Ernakulam & Kottayam, Regional Statistical Office, Kozhikode .

WEEKLY WHOLESALE PRICES OF GINGER (DRY) (Rs./Quintal)

Month	Week	Kozhikode		Kochi	Chennai	Bangalore
		Dry	Fresh	Dry	Dry (white)	Fresh
Jan-20	1st	22000	6000	27000	32000	3350
	2nd	22000	5500	27500	32000	4650
	3rd	22000	5500	27500	32000	4650
	4th	22000	5500	27500	32000	4650
	5th	22000	5500	27500	33500	4650
Feb-20	1st	22000	5500	27500	33000	4650
	2nd	22000	5000	27500	33000	4650
	3rd	22000	5000	27500	33500	4650
	4th	22000	5000	27500	32500	4650
Mar-20	1st	27000	5000	27000	30000	4650
	2nd	27000	5000	27000	30000	3450
	3rd	27000	5700	27000	30000	4650
	4th	NT	NT	27000	31000	4650

Source: Regional Statistical Office, Kozhikode; Economics & Statistics, Ernakulam; Department of Economics and Statistics, Chennai, APMC, Bangalore.

WEEKLY WHOLESALE PRICES OF CHILLI (Rs./Quintal)

Month	Week	Tuticorin Samba - I	Bangalore	Chennai	
				Ramnad	Samba-II
Jan-20	1st	18000	15200	14500	18600
	2nd	18000	15200	14500	20000
	3rd	18000	15200	14500	19000
	4th	18000	15200	14500	18500
	5th	9000	13500	15500	19000
Feb-20	1st	9000	13500	14000	17000
	2nd	9000	13500	14000	17000
	3rd	14000	13500	14000	16500
	4th	12500	15250	14000	12500
Mar-20	1st	12500	20500	14500	12000
	2nd	13000	20500	14500	12000
	3rd	13000	20500	14500	12000
	4th	13000	20500	14500	12000

Source: Directorate of Marketing, Tuticorin; APMC, Bangalore; Dept. of Economics and Statistics, Chennai.

WEEKLY WHOLESALE PRICES OF TURMERIC **(Rs./Quintal)**

Month	Week	Chennai		Kochi	Bangalore
		Erode	Salem	Dry	
Jan-20	1st	9500	10500	11500	10500
	2nd	9500	10500	11500	10150
	3rd	9500	11000	11500	10150
	4th	9500	11000	11500	9400
	5th	9500	11000	11500	9250
Feb-20	1st	9500	11000	11500	9250
	2nd	9500	11000	11500	9250
	3rd	9500	11000	11500	9250
	4th	9500	11000	11500	9250
Mar-20	1st	9500	11000	11000	10000
	2nd	9500	11000	11000	9000
	3rd	9500	11000	11000	8500
	4th	9500	11000	11000	8500

Source: Dept. of Economics and Statistics, Chennai; Economics and Statistics, Kochi; APMC, Bangalore.

WEEKLY WHOLESALE PRICES OF MAJOR SEED SPICES & GARLIC (Rs./Quintal)

Month	Week	Coriander Rajasthan Green Bangalore	Cumin No.1 Chennai	Garlic Medium Bangalore
Jan-20	1st	9500	19000	11000
	2nd	8750	19000	11000
	3rd	8750	19000	11000
	4th	9000	18000	11500
	5th	9250	20500	14500
Feb-20	1st	9750	19000	13500
	2nd	9750	19000	13500
	3rd	9750	18000	13500
	4th	9750	17000	13500
Mar-20	1st	9900	NT	12500
	2nd	9900	NT	11250
	3rd	10500	NT	8000
	4th	10500	NT	8000

Source: APMC, Bangalore & Dept. of Economics & Statistics, Chennai.

WEEKLY WHOLESALE PRICES OF NUTMEG & CLOVE (Rs./Quintal)

Month	Week	Thrissur			
		Nutmeg		Mace	Clove
		with shell	without Shell	Yellow	
Jan-20	1st	28000	48000	180000	66000
	2nd	30500	51000	170000	63000
	3rd	30500	51000	170000	62000
	4th	29000	50000	170000	61000
Feb-20	1st	28000	48000	175000	62000
	2nd	28000	48000	175000	64000
	3rd	28000	49000	180000	65000
	4th	28000	48000	180000	64000
Mar-20	1st	28000	48000	170000	61000
	2nd	28000	48000	175000	63000
	3rd	28000	48000	170000	62000
	4th	28000	48000	170000	63000

Source: Economics and Statistics, Thrissur.

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