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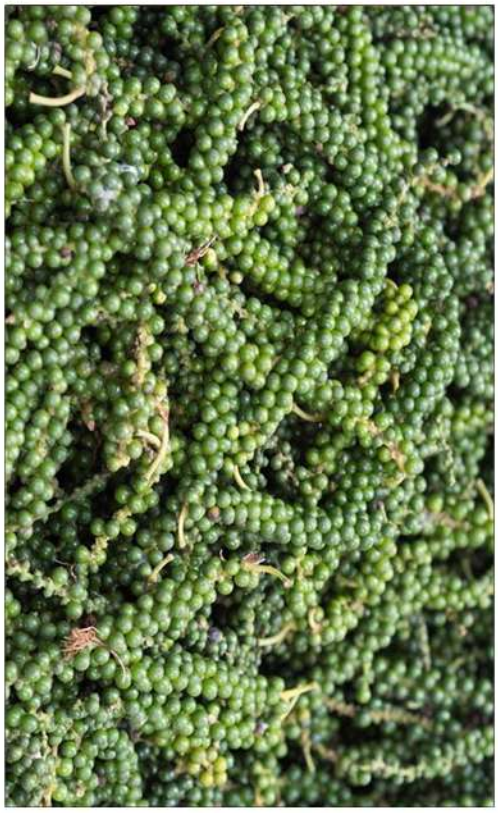


Directorate of Arecanut and Spices Development
Department of Agriculture, Co-operation & Farmers Welfare
Ministry of Agriculture & Farmers Welfare, Government of India
Calicut - 673005, Kerala, India

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
DIRECTORATE OF CASHEWNUT AND COCOA DEVELOPMENT
कृषि एवं किसान कल्याण मंत्रालय
Ministry of Agriculture and Farmers Welfare
कृषि, सहकारिता एवं किसान कल्याण विभाग
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ARTICLES INVITED FOR INDIAN JOURNAL OF ARECANUT, SPICES AND MEDICINAL PLANTS

Indian Journal of Arecanut, Spices and Medicinal Plants is a quarterly publications in English released by the Directorate of Arecanut & Spices Development, Calicut, Ministry of Agriculture and Farmers Welfare, Government of India, dealing with the development of Arecanut, Spices, Medicinal & Aromatic Plants in the Country. It has wide circulation among farmers, Extension Workers, Scientists, Exporters, Industrialists etc.

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.
3. Preference will be given to articles in bilingual i.e., Hindi and English.
4. A Certificate may also be furnished to the effect that the article submitted has not been published in any other journal in any form.

   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

Indian Journal of Arecanut, Spices & Medicinal Plants Vol. 22(4) : 3-8 (2020)

SUSTAINABLE SPICES PRODUCTION USING BENEFICIAL MICROORGANISMS

R. Praveena, Santhosh J Eapen, R. Dinesh, R. Suseela Bhai and C. Sarathambal*

Harnessing natural resources including beneficiary microorganisms is one of the most effective approaches to improve farm productivity and food quality in a sustainable way. Current agricultural practices depend heavily on chemical inputs resulting in food contamination, weed and disease resistance, soil and water pollution and other negative environmental concerns. A reliable alternative to chemical inputs is microbial inoculants that can act as biofertilizers, bioherbicide, biopesticides, and biocontrol agents. The role played by these beneficial microorganisms is very critical especially in organic farming systems and they play a vital role in maintaining soil quality and productivity, besides enhancing environmental quality

Promising microorganisms for biocontrol

Due to its ubiquitous distribution and dominance *Trichoderma* has evolved as a fore runner in the field of biocontrol, growth promotion and disease suppression. Their nutritional requirement is minimal and has the mechanism to utilize the cell wall components such as cellulose and chitin as carbon source. The strains of *Trichoderma* used as biocontrol agents show different mechanisms of action in their antagonistic interactions with fungal pathogens. These include antibiosis, through the production of a variety of compounds with antibiotic activity, by competing for nutrients and space with other organisms, and the ability to produce cell wall dissolving enzyme activity by which the disease causing fungal cell walls are dissolved. *Trichoderma* also induces systemic resistance to pathogens in plants.

Recently the increased application of nematicides to manage nematodes has resulted in the phasing out of chemical molecules and also increased the significance of evolving novel biological control measures for nematode management. *Pochonia chlamydosporia* is one of the most potential biological control agent used against nematodes. The fungus can colonize the rhizosphere of plants without affecting plant growth and can remain saprophytic in soil in the absence of both plant and nematode hosts.

Bacterial wilt of ginger caused by *Ralstonia pseudosolanacearum* (race 4 biovar 3 strain) is one of major diseases affecting ginger. *Bacillus licheniformis* was found effective in managing the bacterial wilt disease in ginger. The mechanism involved disruption of the cell structure and shape by making punctures on the cell wall, inhibition of biofilm formation and suppression of swarming motility of wilt pathogen *R. pseudosolanacearum* by *B. licheniformis*.

Plant Growth Promoting Rhizobacteria (PGPR)

Plant growth promoting rhizobacteria

* ICAR-Indian Institute of Spices Research, Kozhikode

[PGPR] are a wide range of root colonizing bacteria with the capacity to enhance plant growth by increasing seed emergence, plant growth and crop yield. PGPR are highly diverse and recently focus on rhizobacteria as biocontrol agent is gaining importance. Their effects can occur via local antagonism to soil borne pathogens or by induction of systemic resistance against pathogens throughout the entire plant. Direct mechanisms of plant growth promotion include mineral solubilisation, stimulation of root growth, rhizoremediation and plant stress control, while mechanisms of biological control include antibiosis, reducing the level of diseases, induction of systemic resistance, competition for nutrients and niches.

Microbial formulations

Spices being an export oriented crop, stringent guidelines exist on pesticide residue levels and aflatoxin contamination in the exported products. Large scale and indiscriminate use of pesticides flout all the guidelines for safe production of spices. The only way out of these problems of pesticide residues is by the adoption of biocontrol technologies.

ICAR- Indian Institute of Spices Research, Kozhikode has short-listed several microbial strains with proven abilities to inhibit an array of plant pathogens of spices. The institute has commercialized most of them for management of foot rot , slow decline diseases of black pepper and rhizome rot of ginger etc.

A. TALC BASED FORMULATION

1. *Trichoderma harzianum*

Talc based formulation of *T. harzianum* (MTCC 5179) @ 1-2 kg per 100 kg can be mixed with 100 kg dry powdered cow dung and dry neem cake (90:10 kg) moistened by sprinkling water. After thoroughly mixing, cover the mixture with a perforated polythene sheet or ordinary newspaper and keep it in shade for 10-14 days for multiplication. After 1 week mix well and keep for further multiplication. Cowdung alone can also be used as the food base; but, a mixture of the two is better than using cowdung alone. *Trichoderma* incorporated cowdung-neemcake mixture can be used in the potting mixture, nursery beds and in the field. At the onset of monsoon (May-June), apply the mixture around the base of black pepper vine 1-2 kg/vine and a second application of *T. harzianum* can be given during August-September. Talc based formulation as such @ 1 g/ kg of soil may be added at the time of filling of nursery mixture in polythene bags. Talc based formulation of *T. harzianum* can also be applied directly @ 50 g/ vine twice a year (during April-May and September-October).

2. *Pochonia chlamydosporia*

Talc based formulation of *P. chlamydosporia* (MTCC 5412)@ 1-2 kg per 100 kg can be mixed with 100 kg dry powdered moistened cowdung and the mixture can be used in the potting mixture, nursery beds and in the field. At the onset of monsoon (May-June), apply the mixture around the base of black pepper vine (1-2 kg/ vine) and a second application can be given during August-September. Talc based formulation of *P. chlamydosporia* can also be applied @ 50 g/ vine twice a year (during April-May and September-October).

3. *Bacillus licheniformis*

Integrated management technology for wilt

disease in ginger integrating physical (soil solarisation for 45-55 days), chemical (soil amelioration with calcium chloride) and biological (ginger apoplastic bacterium- *Bacillus licheniformis*) methods was developed at ICAR-IISR. Integrated management strategy using soil solarization followed by rhizome priming using the bacteria, *B. licheniformis* (MTCC12725) was found effective in managing the disease. The talc formulation of *B. licheniformis* was launched as *'Bacillich'* and was also encapsulated for field delivery. Ginger seed rhizomes can be treated with *Bacillich* 2% (2 kg/100 L water) and the field can be drenched with the bacterial suspension (1%) at the time of planting and at 30, 45, 60 and 90 days after planting depending on disease incidence.

Bacillus licheniformis

'Bacillich'

4. Microbial consortium for Black pepper

A talc based formulation (IISR Biomix) consisting of a consortium of Plant Growth Promoting Rhizobacteria [*Micrococcus luteus* (BRB 3)] + [*Enterobacter aerogenes* (BRB 13)] + [*Micrococcus* sp. (BRB 23)] is available for enhanced growth and yield. For application, 20 g of talc formulation need to be mixed in one litre of water and applied at the rate of 250 mL per black pepper vine in the field and at the rate of 100 mL per bag in the nursery. Alternatively, 1 kg of talc formulation can be mixed with 100 kg of farmyard manure (or well decomposed cow dung) and applied at the rate of 1 kg per vine in the basin *i.e.* around the root zone. It can be applied twice a year (during May-June and September-October).

IISR Biomix

5. PGPR talc formulations

Talc formulation of plant growth promoting bacteria *Bacillus amyloliquefaciens* (IISR Biopower G), can be used for ginger seed

treatment @ 10g/L and soil drenching (@ 2Kg/ ha) at 30 & 60 days after planting. The major advantages are enhanced nutrient mobilization, nutrient use efficiency, increased growth and yield. Plant growth promoting strains of bacteria *Pseudomonas putida* and *Micobacterium paraoxidans* are available in talc formulation for seed spices (IISR Biopower SS). The formulation can be applied to soil @ 1kg /ha, 30 days after planting for increased growth and yield.

6. Seed coating formulations

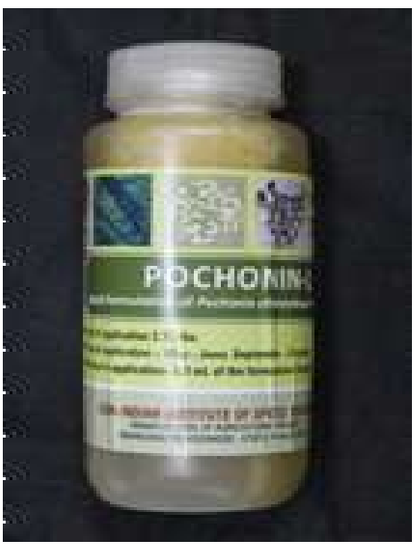
Seed coating formulations of plant growth promoting strains of bacteria *Pseudomonas putida* and *Micobacterium paraoxidans* can be used for coating all kinds of seeds including seed spices and horticultural crops (@ 10g /L). Seed coating is done at a particular temperature using PGPR and other ingredients and the coated seeds can be stored at room temperature. Coated seeds are free from storage pest incidence, improves germination, enhance the

PGPR coated seeds

yield from 15-30% and can be used in organic production systems.

B. LIQUID BASED FORMULATION

The novel liquid formulation of *P. chlamydosporia* (POCHONIN L) was developed, which contain the resting spores of the fungus with the advantage of increased shelf life and efficiency of the culture. Farmers/ growers can depend on the developed *P. chlamydosporia* formulation with good shelf life, low application rates and with targeted delivery of the fungus



Liquid Formulation of *P. chlamydosporia*

to crops for nematode management. The liquid formulation can be diluted @1ml/L and used.

C. BIOCAPSULES

Biocapsules, a novel formulation for microorganisms with plant growth promoting, mineral solubilizing and biocontrol potential traits was developed at ICAR-IISR, Kozhikode. The encapsulation technique involves specific formulation of the beneficial microorganism of interest in an immobilized/inactive condition mixed with other substances which to protect and maintain the encapsulated microorganism. Gelatin based bio-capsule covers are used and each capsule filled with the encapsulated formulation weighs about one gram. Under ideal conditions, a single capsule will have up

to 1012 colony forming units (CFU) of the microorganism. This means that a single capsule mixed in 100 litres of water will still have about one million colony forming units of microorganisms per millilitre. The process of making the formulation is simple and does not require any sophisticated equipment and conditions except basic facilities. The entire encapsulation process can be done at normal room temperature (20-30^{0}C).

* Several strains of beneficial microorganisms are available in biocapsule form. The choice of the correct strain suited to the crop is important for getting desired results.
* Since there is a difference in the method of application between biocapsules containing beneficial bacteria and beneficial fungi, it is important to know the type of beneficial microorganism in the bio-capsule.
* If the biocapsule contains beneficial fungi (eg., *Trichoderma* sp), the prepared solution need to be drenched on the same day.
* Capsules with bacteria need to be kept for 8 hours for incubation in sterile water.
* Soil should have sufficient moisture and organic matter content when bio-capsule solution is applied.

***Trichoderma* capsules**

The biocapsule containing *Trichoderma* can be mixed with boiled and cooled water (1 capsule /litre water) and this solution can be made up to 100/200 litres of normal water and applied as soil drench at the base of the plants after two hours. The quantity of solution to be used varies with crops. For example, if we want to deliver *Trichoderma* to a fully grown black pepper vine, a quantity of 3-5 litres of prepared solution will be required to be applied at the base of the plant as soil drench.

Biocapsules with beneficial bacteria

Biocapsules with beneficial bacteria (*Bacillus* sp., *Azotobacter, Azospirillium, B. megaterium* or any beneficial bacterial strain) need to prepared one day before application. One biocapsule need to be kept in one litre of sterile water (water which has been boiled and then cooled to room temperature can be used) and this solution is kept for 8 hours for incubation with 2-3 stirring. After 8 hours the bacterial solution is then mixed with about 200 litres of normal water and mixed well. This solution can be applied as soil drench in required quantities.

Biocapsules

Points to remember

* Ensure sufficient moisture in soil during application of biocontrol agents.
* Enrich the soil with organic manures to sustain the population of applied microbes.
* Avoid mixing of pesticides with biocontrol formulations.
* Ensure 7-10 days gap between application of chemical pesticides and biocontrol products.

* Store the formulations in cool and dry place, avoid direct sunlight.
* Avoid keeping of biocontrol agents mass multiplied on organic substrates for longer duration.

Being export-oriented crops, spice products need to conform to the food safety parameters prescribed by the importing countries. Recently there is high concern towards the environmental issues arising out of excessive use of synthetic pesticides. Biological control potential and plant growth promoting traits of a microbe provides an alternative to synthetic chemicals and such beneficial microbes are ideal candidates for sustainable crop production.

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VIGILANCE AWARENESS WEEK

In accordance with the instructions received from the Ministry, Vigilance Awareness Week 2020 was observed in the Directorate during the period from 27th October to 2nd November, 2020. Posters and banners were prepared and displayed in prominent places of the Directorate. On 27th October, 2020 all the officers and staff assembled in the Office. Dr. Homey Cheriyan, Director, DASD addressed the staff explaining the importance of eradicating corruption and to raise public awareness regarding the threat caused by corruption. Afterwards, the Director administered the integrity pledge to all the staff at 11:00 AM on 27th October, 2020.

Officers and staff taking the integrity pledge

Banner about Vigilance Awareness Week displayed in the office premises

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STATUS OF PRODUCTION AND EXPORT OF INDIAN BLACK PEPPER

Sachu Sara Sabu[1], Anil Kuruvila[1] and K. Manojkumar[2]

Introduction

Black pepper, the "King of spices", is one of the widely acclaimed and used spice in the world. Indigenous to India, especially Kerala, this 'black gold' holds supreme position in the world market. Though India is the largest consumer among the black pepper producing countries in the world, the country has lost its position as the major producer and exporter of black pepper to Vietnam, since 1999. India stands in third position among the leading producers of black pepper in the world. Kerala and Karnataka are the major black pepper growing states in India, which account for more than 80 per cent of the production in the country.

Black pepper is one of the major export earning spice in India and is considered as a premium product in the export market. Nevertheless, the share of black pepper in total spices export from India declined from 18 percent during early 1990s to about seven percent in 2017, both in quantity and value terms (WITS, 2019). During 1960s, with 25 per cent share in world production and 20 per cent share in world export, India was the major producer and exporter of black pepper in the world (Nagoor, 2010). Recently, India has been loosing its comparative advantage in world pepper market, especially after the trade liberalisation (Thomas and Sanil, 2019). Considering all these facts, this article deals with the status of black pepper in the world and India, and also analyse the growth and instability in area, production, productivity and export of black pepper in India.

Materials and methods

The present study is based on the time series data on area, production, productivity and export of black pepper published by International Pepper Community, Spices board, Ministry of Commerce and Industry, and Directorate of Economics and Statistics, Government of India. Country-wise data on production and exports of black pepper was collected from Pepper Statistical Year Book published by the International Pepper Community for the period from 1989 to 2017. Time series data on area, production, productivity and export of black pepper in India from 1980-81 to 2016-17 published by various sources were used for analyses. The growth and instability in area, production, productivity and export of black pepper was studied for the pre-liberalisation (1980-81 to 1994-95), post-liberalisation (1995-96 to 2016-17) periods, and overall periods.

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2. Directorate of Arecanut and Spices Development, Ministry of Agriculture& Farmers Welfare, Government of India, Calicut, Kerala- 673 005.

Exponential growth model

Growth rates are used to measure the past performance of economic variables. The growth in area, production, productivity and export of black pepper in India during 1980-81 to 2016-17 (Gujarati and Sangeetha, 2007) were analysed using the exponential growth function of the form,

$Y = ab^t e^t$

where,

Y= Dependent variable for which growth rate is to be estimated

a= Intercept

b= Regression co-efficient

t= Time variable

e = Error term

The compound growth rate was obtained for the logarithmic form of the exponential equation as below.

ln Y = ln a +t ln b

Then, the compound growth rate (r) was computed by using the relationship

r =Anti ln of (b - 1) x 100

The compound growth rates were tested for their significance by the statistics given by

t = r /SE (r)

where,

SE(r) = [100 b X SE (lnb)] / ln e

Instability Index

Coppock's instability index (Coppock, 1966) was used to estimate the variability in area, production, productivity and export of black pepper, which is algebraically expressed in the following form,

$$V \log = \frac{1}{N-1} \sum \{\log(\frac{X_{t+1}}{X_t}) - M\}^2$$

Instability index = (antilog V log - 1) x 100

where,

X_t = area/production/productivity/exports (quantity, value and unit value) in year t

N = Number of years

m = Arithmetic mean of the difference between the logs of X_t and X_t+1 etc.

V log = Logarithmic variance of the series

A higher numerical value for the index represents greater instability.

Results and discussion

Global Scenario of black pepper

The global production of black pepper has exhibited an increasing pattern from about 1.96 lakh tonnes in TE 1992 to 3.6 lakh tonnes in Triennium Ending (TE) 2017 (Table 1). The production of black pepper in India has increased from 60,000 tonnes in TE 1992 to 72,333 tonnes in TE 2002 showing an increase of about 12,333 tonnes during the period. Subsequently the production has declined and reached 52,833 tonnes in TE 2017. The share of India in global production declined to 28 per cent in TE 2002. With the exception of Vietnam and Sri Lanka, all the major black pepper producing countries have experienced a decline in production between TE 1992 and TE 2017.

The increase in global production during this period was almost accounted by Vietnam. From 2003 onwards, Vietnam became the major producer of black pepper, pushing India to the second position and subsequently India drifted to third position behind Indonesia in 2010.

about 4 per cent in 1990 to about 43 per cent in 2017. From 2003 onwards, Vietnam became the major producer of black pepper. The shares of Brazil, Indonesia and Malaysia in global production have also declined during the period (Figure 1).

Table 1 : Country-wise production of black pepper (tonnes)

Year	Brazil	India	Indonesia	Malaysia	Sri Lanka	Vietnam	Total
TE 1992	36005	60000	58667	28667	2698	8451	196478
TE 2002	36795	72333	46167	23300	10765	58200	258278
TE 2012	33667	53707	58667	24276	15594	101667	330643
TE 2017	48000	52833	41333	17233	25169	143333	359902

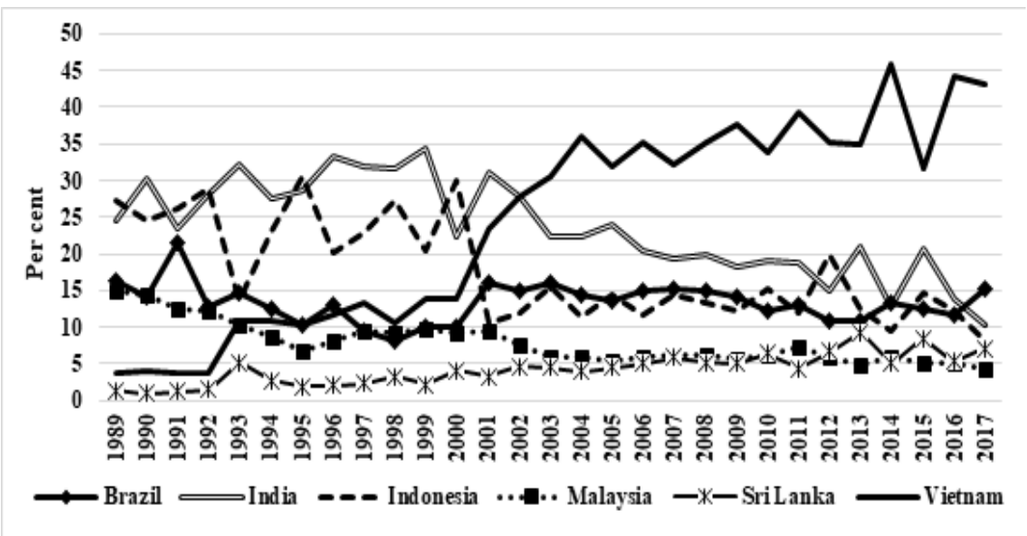
Source: Estimated from various issues of Pepper Statistical Yearbook, International Pepper Community

Note : Triennium Ending (TE) means average value of production in three years i.e., TE 2003 means average of production in 2001, 2002 and 2003

India accounted for the highest share of 30 per cent of world production in 1990 and then the share in world production declined to 10 per cent in 2017. The share of Vietnam in global production has increased tremendously from

The world exports of black pepper increased from 1.61 lakh tonnes in TE 1992 to 2.86 lakh tonnes in TE 2017. As a reflection of the pattern in production, with the exception of Vietnam and Sri Lanka, the share of all other major

Figure 1 : Country-wise share in world production of black pepper



Source: Data from various issues of Pepper Statistical Yearbook, International Pepper Community

producing countries in world black pepper exports declined during the period from TE 1992 to TE 2017. The exports from India as a share of world exports almost halved from 15.1 per cent in TE 1992 to 7.8 per cent in TE 2017. (Table 2). India being a large consumer of black pepper and because of the increasing domestic demand over the years, only a limited amount of black pepper was exported from the country in comparison to its competitors.

Indian Scenario of black pepper

The major black pepper producing states in India are Kerala, Karnataka and Tamil Nadu. The respective shares of these states in area, production and productivity of black pepper are given in Table 3. The area under black pepper in India increased from 1.82 lakh hectares in TE 1991-92 to 2.18 lakh hectares in TE 2001-02 and it declined to 1.33 lakh hectares in TE 2016-17. This decline in area could be mainly attributed to decline in acreage under black pepper in Kerala. While the share of Kerala state in area under black pepper has declined between TE 2001-02 and TE 2016-17 from about 92 per cent to 64 per cent, the decline in share of production was quite significant from about 85 per cent to 39 per cent. The state of Karnataka has exhibited an increasing trend in area and production, and the state accounted for about 27 per cent share in area under black pepper in India in TE 2016-17 and contributed 51 per cent of the production in the country, which is an indication of the very high productivity of black pepper in the state. The decline in production of about 16,376 tonnes between TE 2001-02 and TE 2011-12 in India could be mainly attributed to the decline in production in Kerala as a result of declining area and low productivity. The increasing area and high productivity in Karnataka contributed positively to production in India, as it was visible from the increase in production from 48,667 tonnes in TE 2011-12 to 52,750 tonnes in TE 2016-17.

Table 2 : Country-wise export of black pepper (tonnes)

Year	Brazil	India	Indonesia	Malaysia	Sri Lanka	Vietnam	Total
TE 1992	33756	24258	52926	25387	2265	15868	161168
	(20.9)	(15.1)	(32.8)	(15.8)	(1.4)	(9.8)	(100.0)
TE 2002	29667	23229	36237	22182	5415	55345	174799
	(17.0)	(13.3)	(20.7)	(12.7)	(3.1)	(31.7)	(100.0)
TE 2012	30849	20213	52029	12955	9263	117407	255850
	(12.1)	(7.9)	(20.3)	(5.1)	(3.6)	(45.9)	(100.0)
TE 2017	40799	22403	30151	10374	12501	153344	286483
	(14.2)	(7.8)	(10.5)	(3.6)	(4.4)	(53.5)	(100.0)

Source: Various issues of Pepper Statistical Yearbook, International Pepper Community

Note: Figures in parentheses indicate per cent to row totals

Area under black pepper in India has shown an increasing trend until 2005-06 and thereafter it started declining. Production and productivity showed slight variability over the years. The productivity showed high instability during this period due to the pest and disease infestation (Yogesh and Mokshapathy, 2013) and due to predominance of senile plantations. The fluctuation in prices was found to be one of the major reasons due to which farmers

Table 3 : Dynamics in area, production and productivity of black pepper in major producing states in India

Year	Kerala	Karnataka	Tamil Nadu	India
Area (ha)				
TE 1991-92	173320	2915	2195	182340
	(95.05)	(1.60)	(1.20)	(100.00)
TE 2001-02	201500	7937	4043	218673
	(92.15)	(3.63)	(1.85)	(100.00)
TE 2011-12	171951	20609	2935	195514
	(87.95)	(10.54)	(1.50)	(100.00)
TE 2016-17	85579	36370	4630	133035
	(64.33)	(27.34)	(3.48)	(100.00)
Production (tonnes)				
TE 1991-92	48710	735	460	50240
	(96.95)	(1.46)	(0.92)	(100.00)
TE 2001-02	55570	1877	890	65043
	(85.44)	(2.89)	(1.37)	(100.00)
TE 2011-12	21547	16413	907	48667
	(44.27)	(33.73)	(1.86)	(100.00)
TE 2016-17	20500	27000	1750	52750
	(38.86)	(51.18)	(3.32)	(100.00)
Productivity (kg/ha)				
TE 1991-92	281	252	210	276
TE 2001-02	276	236	220	297
TE 2011-12	125	796	309	249
TE 2016-17	240	742	378	397

Source: Estimations based on Spice Statistics, Spices Board

Note: Figures in parentheses indicate per cent to row totals

shifted from black pepper cultivation to other crops, which in turn led to increase in area instability. Further, frequent droughts and fluctuating temperature adversely affected the yield of the crop. Although it is a rainfed crop, the yield can be increased by about 50 per cent through irrigation in summer. Contrastingly, the majority of black pepper growing farmers in India being small and marginal, making big investment in sprinkler irrigation remains a daunting task for them (Hema, *et. al.*, 2007). Ravindran (2000) opined that although black pepper had originated in Kerala and had been under cultivation for centuries, the yield of pepper in India was one of the lowest in the world mainly because the intensive cultivation practices were not in vogue, and people had been growing pepper in a casual way (plant and forget). As a result, there was a wide gap existing between the productivity in India which was about 320 kg/ha and that of other countries like Thailand which was as high as 4500 kg/ha (Ravindran, 2000).

The global demand of pepper was projected to increase to 2.8 lakh tonnes by the year 2020, which would further increase to 3.6 lakh tonnes by the year 2050. Among the primary constraints in pepper production, the most important was the absence of an ideotype that combines many positive traits to boost production potential (Nair, 2011).

Export intensity of black pepper production in India

The share of export of black pepper in production has declined in India. The country exported more than three-fourth of the production in TE 1982-83, while it declined to one-third share in TE 2002-03, which further increased to 42 per cent in TE 2016-17 (Table 4). This could be attributed to the increasing domestic consumption of black pepper in India from 22,000 tonnes in 1989 to 58,000 tonnes in 2017 (IPC, 2017) and also increasing competition from other producers, especially, Vietnam.

Table 4 : Share of export in black pepper production in India

Trienniums	Production (tonnes)	Export quantity (tonnes)	Share of export in production (per cent)
TE 1982-83	28443	23188	82
TE 1992-93	50240	24780	49
TE 2002-03	65043	22105	34
TE 2012-13	48667	20517	42
TE 2016-17	52750	22383	42

Source: Calculations based on data published by Spices Board

Growth and Instability in area, production, productivity and export of black pepper in India

Analysis of Growth

The exponential growth function was used to analyse the growth in area, production, productivity and export of black pepper in India for the period from 1980-81 to 2016-17 and the

results are presented in Table 5. The pre-liberalisation period, with compound growth rates of 5.24 and 7.10 per cent respectively, witnessed significant increase both in the area and production of black pepper in the country. Growth rate in the productivity of black pepper during the pre-liberalisation period was 1.48 per cent. Area and production of black pepper during the post-liberalisation period exhibited negative growth rates of 2.24 and 1.16 per cent respectively. The growth rate in production was influenced by growth in area rather than in productivity in all the periods. The negative growth rate in production during the post-liberalisation period was due to negative area growth. In the over-all period, there was only modest growth in area, production and productivity.

From Table 5, it could be observed that there were positive growth rates for quantity, value and unit value of black pepper exports from India during the pre-liberalisation period, whereas in the post-liberalisation period, export quantity has exhibited a negative growth. There was decline in the growth of export value and unit value in the post-liberalisation period compared to the pre-liberalisation period. Even though quantity of exports displayed a negative growth rate during the over-all period, the growth rate of export value was positive which resulted in positive growth rate of export unit value. The growth rate of unit value was positive

Table 5: Growth rates in area, production, productivity and export of black pepper in India

	Pre-liberalisation	Post-liberalisation	Over-all period
Area	5.24*	-2.24***	0.87**
	(0.92)	(1.48)	(0.91)
Production	7.10*	-1.16**	1.74*
	(3.07)	(1.24)	(0.98)
Productivity	1.76***	1.10	0.86**
	(2.18)	(2.15)	(0.83)
Export Quantity	2.63	-2.40**	-1.20**
	(3.58)	(2.25)	(1.05)
Export Value	12.32*	6.42**	8.31*
	(9.09)	(5.41)	(2.41)
Unit Value	9.44*	9.04*	9.63*
	(5.81)	(3.86)	(1.63)

Note: 1. * denotes significant at one per cent level, ** denotes significant at five per cent level,
***denotes significant at ten per cent level

2. Values in parenthesis denote Standard Error

and higher than the export quantity in all the periods, which resulted in the positive growth rate of export value.

Instability analysis

The instability analysis reveals whether the production and export of black pepper are steadily growing or are there any extensive fluctuations. Therefore, to study the variability in area, production, productivity and export of black pepper, instability indices were estimated using Coppock's instability index and results are presented in Table 6.

The instability indices of area, production, productivity and export of black pepper were found to be higher in the post-liberalisation period when compared to the pre-liberalisation period. Even though the instability in area was lower compared to that of production and productivity, the rate of increase in instability was more in area rather than production and productivity in the post-liberalisation period. The magnitude of instability for the overall period was 11.32, 27.98 and 31.9 per cent for area, production and productivity, respectively.

It could be observed from Table 6 that the black pepper export from India was more unstable during the post-liberalisation period in comparison to the pre-liberalisation period, as the restriction for trade in the post-liberalisation period was comparatively low. The instability in export value, quantity and unit value has increased in the post liberalisation period compared to pre-liberalisation period. The increase in instability of export value was influenced by the increase in instability of export quantity rather than that in the unit value instability.

Impact of liberalisation on black pepper production and export

Due to economic reforms of 1991 and the subsequent WTO agreement of 1995, black pepper trade has been under tremendous pressure by heightened international competition. The growth rates in area, production and export of black pepper have declined in the post-liberalisation period, while the instability in area, production and export has increased. As a result of liberalisation policies, main factors responsible for this decline in growth rate and increase in instability were increasing domestic demand, fluctuating share in world exports, rising share in world imports, and the lagged response of production to prices.

Table 6 : Instability in area, production, productivity and export of black pepper in India

	Pre-liberalisation	Post-liberalisation	Over-all period
Area	4.60	17.25	11.32
Production	25.79	37.29	27.98
Productivity	21.58	48.84	31.90
Export Quantity	31.13	50.75	36.72
Export Value	52.92	71.74	54.03
Unit Value	29.61	33.68	27.50

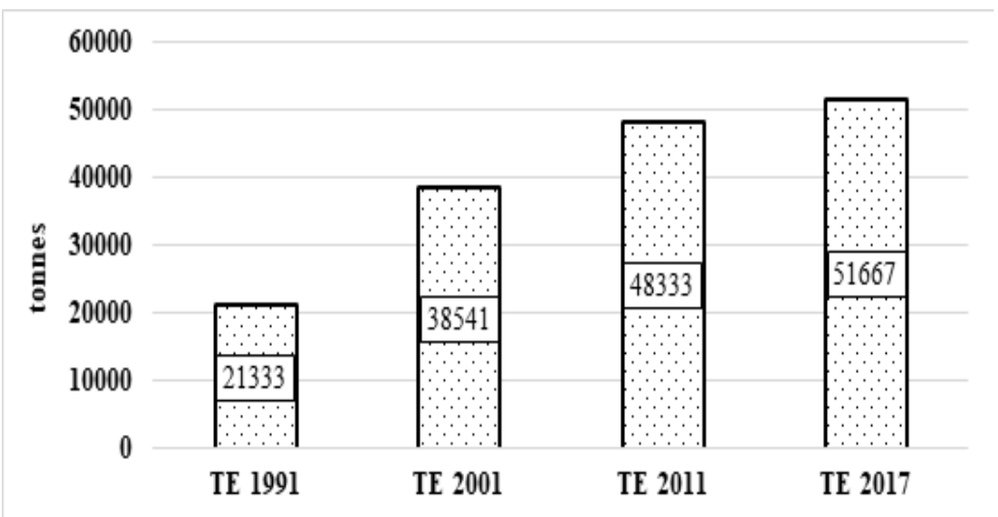
Consumption of black pepper

India is rated as the highest black pepper consuming country in the world. Though demand for black pepper exists throughout the year, a surge is noticeable during the winter months (Yogesh and Mokshapathy, 2013). As per the IPC estimates about 50 to 60 per cent of Indian production is consumed in the country itself. The domestic consumption consists of black pepper for culinary usage, grinding, extraction of oil and oleoresins, pharmaceutical companies etc. This shows that the consumption is increasing in various sectors in India. The domestic consumption of black pepper in India increased from 21,333 tonnes in TE 1991 to 51,667 tonnes in TE 2017 (Figure 2). After liberalisation, the rate of increase in domestic consumption was found to be higher. With the increase in consumption and decrease in production of black pepper in India, the country has become an importer of black pepper especially to meet the demand for value addition and processing industry (Sabu and Kuruvila, 2016).

Export and import of black pepper

Agricultural trade policies prior to 1991 were inward looking and highly protective (Ghosh, 2016). The liberalization of external trade was undertaken from the export-import policies of 1992 through lifting of restrictions on exports and reduction of tariff duties on imports of agricultural commodities (GoI, 2009). Like any other commodity, black pepper trade also faced challenges due to liberalisation policies. As evident from Figure 3, the exports of black pepper from India showed a declining trend from 20,535 tonnes in 1991-92 to 16,840 tonnes in 2017-18, whereas the import increased from 1,686 tonnes in 1991-92 to 29,650 tonnes in 2017-18. The increasing consumption and declining production have made Indian black pepper more domestic oriented, as the imports have registered a higher growth rate of 13 per cent per annum from 1981 to 2000 and 4.02 per cent during 2001-16 (Cariappa and Chandel, 2020). India's black pepper import orientation is evident from the figure 4, as the Balance of Trade which means value of export minus value

Figure 2 : Consumption of black pepper in India (tonnes)



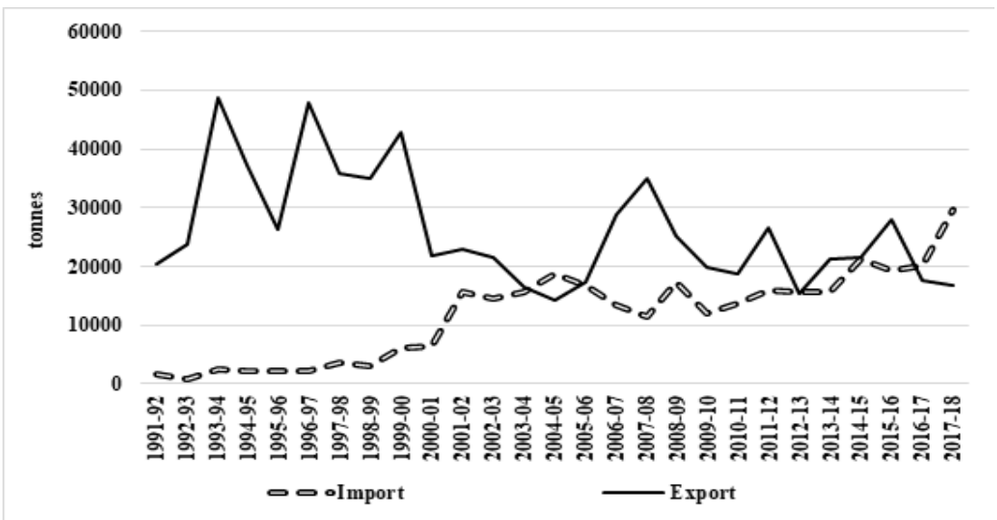
Source: Various issues of Pepper Statistical Yearbook, International Pepper Community

of import decreased from 85,065 thousand US$ in TE 1990 to 24,174 thousand US$ in TE 2018. It can now be said that India's black pepper trade is progressively becoming import oriented. The value of black pepper import has increased from 1847 thousand US$ in TE 1990 to 1,69,790 thousand US$ in TE 2018.

Relationship between production and price of black pepper

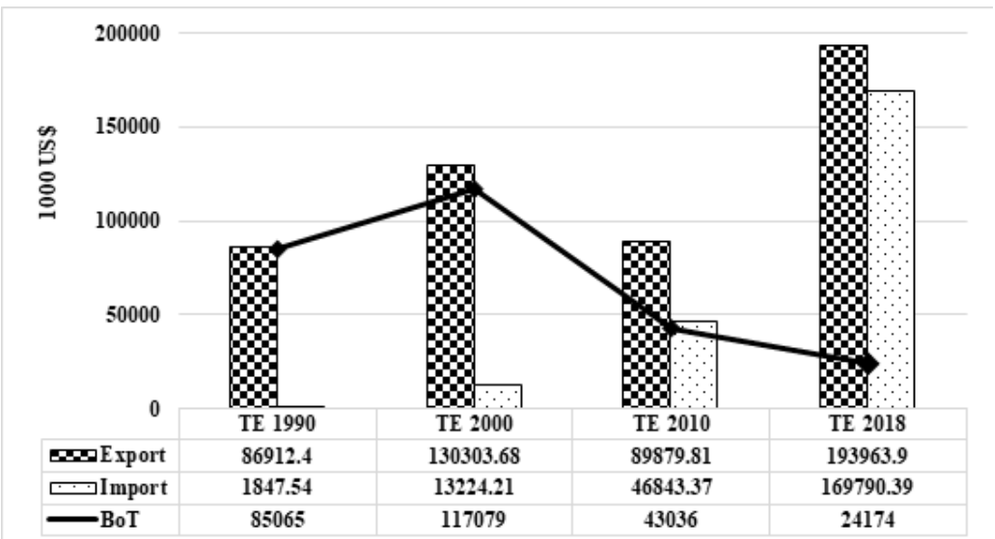
An inverse relationship between production and price of black pepper in India could be observed in Figure 5. Black pepper being a perennial crop, its production response by increase in area to rise or fall in price in a particular year will be at a lag of three to four years. When world black pepper prices are high, new vines are planted and fertilizer usage goes up. The exporters also try to reduce their stocks during the periods of high price. Then, as the

Figure 3: Export and import of black pepper in India (tonnes)



Source: Data published by Spices Board

Figure 4: India's Balance of Trade (BoT) of black pepper with world



	TE 1990	TE 2000	TE 2010	TE 2018
Export	86912.4	130303.68	89879.81	193963.9
Import	1847.54	13224.21	46843.37	169790.39
BoT	85065	117079	43036	24174

Source: Data published by Spices Board

newly planted vines start to yield, production increases and the prices fall. When the world black pepper prices are low, producers neglect the management of pepper vines and decrease the fertilizer usage. This leads to the reduction of pepper production which tighten the supply situation. This cycle of black pepper production and prices continues.

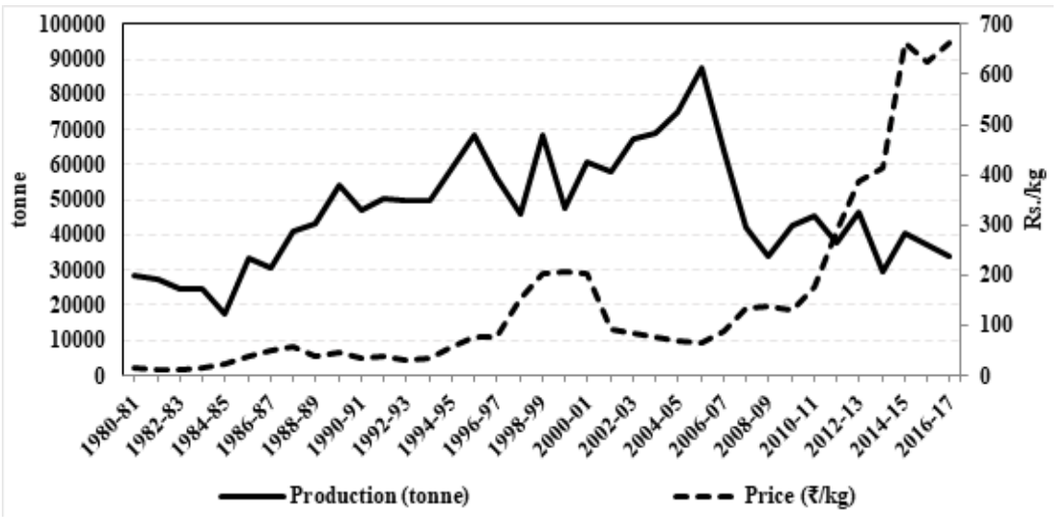
CONCLUSION

India is fast losing its status as a leading producer and exporter of black pepper, as production and cultivated area of this spice have dwindled in the country. Kerala, the major black pepper growing state in India, has come down sharply in the production and export of black pepper during the recent decades. The increased production in black pepper growing countries, especially Vietnam after 1999, has given a stiff competition to India, which has also resulted in the downward spiralling of prices. Due to the glut in global production, the prices have at times even plummeted below the cost of production. India is also a very large consumer of black pepper and because of the increasing domestic demand over the years only a limited amount of black pepper is exported from the country as compared to its competitors. The growth rates in area, production and export have declined in the post-liberalisation period, while the instability in area, production and export has increased. As a result of liberalisation policies, main factors responsible for this decline in growth rate and increase in instability were increasing domestic demand, fluctuating share in world exports, rising share in world imports, and the lagged response of production to prices. The black pepper production in India is adversely affected by pest and diseases and also fluctuating prices, forcing farmers to neglect the crop in prime growing areas. In order to revive the black pepper production and export, immediate attention should be given to the cultivation and trade aspects of the crop.

References

Cariappa, A. G. A. and Chandel, B. S. 2020. Why are the pepper prices declining? An analysis of

Figure 5: Relationship between production and price of black pepper



Source: Data published by Spices Board

changing production and trade scenario in India. *J Plantation Crops* 48(1): 60-69.

Ghosh, J. 2016. *25 years of economic reforms: agriculture* [online]. Available: http:// www.macros can.org pdf [05 June 2019].

Hema, M., Kumar, R., and Singh, N. P. 2007. Volatile Price and Declining Profitability of Black Pepper in India: Disquieting Future. *Agric. Econ. Res. Rev.* 20: 61-76.

IPC [International Pepper Community]. 2017. Pepper Statistical Yearbook-2017. IPC, Indonesia, 152p.

Nagoor, B. H. 2010. Trade aspects of plantation sector of India. NRPPD Discussion paper No. 8. Centre for development studies. Thiruvananthapuram. 29 p.

Nair, K. P. 2011. Agronomy and economy of black pepper and cardamom: the King and queen of spices [on-line]. Available: http:// www.sciencedirect.com /science/article/pii/ S0065 211303820 059 [12 Nov 2019].

Ravindran, P.N. 2000. Conclusions: Constraints and yield gaps in black pepper. In: Ravindran, P.N. (ed), Black Pepper (*Piper nigrum*). Hardwood Academic Publishers, Amsterdam, pp. 489-95.

Sabu, S. S. and Kuruvila, A. 2016. Price instability in black pepper: a comparative analysis of pre-liberalisation and post-liberalisation periods. *J. Trop. Agri.* 54: 41-49.

Thomas and Sanil, P. C. 2019. Competitiveness in spice export trade from India: A review. *J. Spices Aromatic Crops.* 28 (1): 01-19.

WITS [World Integrated Trade Solutions]. 2019. Export and import of black pepper [Online]. Available: https://wits.worldbank.org [10 April 2019].

Yogesh, M. S. and Mokshapathy, S. 2013. Production and export performance of black pepper. *Int. J. Humanities Social Sci. Invention.* 2(4): 36-44.

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STATUS PAPER ON PATHOGENS ASSOCIATED WITH STORED SPICES

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Introduction

Spices constitute a natural compound or a mixture of natural compounds that is extracted from the seeds, fruits, flowers, or trunks (skins, roots, leaves) of several plants that are indigenous or exotic origin, aromatic or with strong taste, used in minute quantities and added to food preparation and processing throughout the world in order to provide colour, taste, smell, or flavor (Ayres, 1980, Anonymous, 2000, Bulduk, 2004). Spices occupy a prominent place in the traditional culinary practices and are indispensable part of daily diets of millions of people all over the world. They are essentially flavoring agents used in small amounts and are reported to have both beneficial effect and antimicrobial properties, if properly stored (Atanda, 2006). However very little information is available on the mycoflora of spices worldwide (Elshafie, 2002). Soil and air are the main inoculum source for causing contamination in crude spices in field (Kneifel and Berger, 1994). As with many other agricultural products, spices may be exposed to a wide range of microbial contamination during pre- and post-harvest. Although spices are present in foods in small amounts, they are recognized as important carriers of microbial contamination mainly because of the conditions in which they were grown, harvested and processed. In addition, these contaminants can compromise spices quality and safety since they can produce secondary metabolites (mycotoxins) that are harmful to humans, animals and environment. (Zinedine, *et al .*, 2006, Mwangi, 2014). Fungal contaminants and mycotoxin problem are aggravated by warm humid tropical conditions and inadequate drying which provide optimal conditions for fungal growth and subsequent production of mycotoxins.

Small cardamom (*Elettaria cardamomum* Maton)

Small cardamom is a large perennial and herbaceous plant. It is a native of the most evergreen forests of the Western Ghats of southern India. The cardamom of commerce is the dried ripened fruit (capsules) of cardamom plant. This is often referred as the "Queen of Spices" because it has very pleasant aroma and taste, and is highly valued from ancient times. The major use of cardamom on a worldwide basis is for domestic culinary purpose in whole or ground form. Cardamom can add a lingering sparkle to many dishes, both traditional and modern. In the Middle East, religious ceremonies, social functions and celebrations are not complete without serving Gahwa or Arab coffee (cardamom - flavoured coffee). In Indian system of medicine - *Ayurveda, Sidha* and *Unani,* cardamom is used as a powerful aromatic stimulant, carminative, stomachic and diuretic. It also checks nausea and vomiting and is also

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reported to be a cardiac stimulant (Anonymous 2009) Whole or ground cardamom is stored in an air tight container and used to keep in wooden box. The fungus such as *Aspergillus flavus, A. niger, A. alternate, A. aculeatus , A. ochraceous, Rhizopus oryzae, R.arrhizus* are affecting stored cardamom due to lack of proper storage. Proper processing and storage can prevent these pathogens. It should be stored in plastic bags or gunny bags with plastic covering. Properly dried cardamom can stored for long period.

Black pepper (*Piper nigrum* L.)

Black pepper is mainly cultivated and exported from India. The crop had its origin in the tropical rain forests of Western Ghats of India. This is often referred as the "King of Spices". The methods of cultivation of pepper vary from intensive cultivation as a monocrop and also as an intercrop in homestead garden in combination with coffee, cocoa and areca nut. Pepper is a smallholder crop and more than two lakh farmers are dependent on it for their livelihood. This crop is used for flavouring of various food preparations, confectionaries, beverages and liquors. This is also used for medicinal purpose, both in allopathy and ayurvedic systems. The relative humidity and temperature prevailing in pepper growing regions cause problems during storage. When drying is inadequately done or when stored with high moisture content fungus appears on some berries, which later spreads to whole lot depending on moisture content, environmental conditions and period of storage. The stored pepper can be affected by many of the pathogens such as *Alternaria alternata, Aspergillus candidus, A. flavus, A. tamari. A.niger. A.oryzae, A. sydowii, Alternaria* sp., *Fusarium graminearum, F. verticillioides*. The bacteria *Salmonella* is also seen as contaminant in stored pepper. The quality of pepper can be maintained when berries are properly dried, sieved, and winnowed to remove dust and other impurities and packed in polythene or gunny bags coated with polythene.

Clove (*Syzygium aromaticum*)

The clove is one of the most important tree spices of the world. The clove of commerce is the air-dried unopened flower bud obtained from evergreen medium sized tree. These dried flower buds are used for flavouring of various food preparations, confectionaries, beverages and liquors. This is also used for medicinal purpose, both in allopathy and ayurvedic systems The stored cloves may affected by different pathogens such as, *Penicillium* spp, *Rhizopus nodosus, Ulocladium botrytis, Aspergillus niger, A. flavus.* Dried cloves are filled in gunny bags and kept in stores piled on wooden platforms.

Nutmeg (*Myristica fragrans* Hout)

Nutmeg is an evergreen tree with conical crown and dense foliage. Nutmeg and mace are used as culinary spice and also as flavouring agent. The mace and nuts are dried separately on cement floor which is made perfectly neat and clean. The fresh mace is scarlet in colour but its colour is changed on drying to yellowish brown. *Aspergillus niger* cause spoilage of nutmeg during storage. Proper drying and storage helps to prevent the pathogen.

Cinnamon (*Cinnamomum verum* P.)

Cinnamon is a spice obtained from the inner

bark of several tree species from the genus *Cinnamomum*. Cinnamon is used mainly as an aromatic and flavouring additive in a wide variety of foods. Dried and stored cinnamon is affected by pathogens such as *Colletotrichum dematium, Mucor hiemalis, Penicillium* spp, *Aspergillus niger* etc.,

Turmeric (*Curcuma longa* L.)

Turmeric is India's pride among spices. Turmeric is the boiled, dried, cleaned and polished rhizomes of *Curcuma longa.* It is used to flavour and to colour foodstuffs. It is a principal ingredient in curry powder. Turmeric oleoresin and the aqueous extracts have biopesticide properties. Turmeric rhizomes get infection with fungal pathogens during storage. Increase in relative humidity and temperature during the rainy season causes sudden rotting of rhizomes. *Aspergillus niger, A. fumigates, A. tubinginsis* are the pathogens affecting the turmeric rhizomes during storage.

Chillies (*Capsicum annuum* L)

Chillies by far constitute the largest and most widely cultivated food commodity among the spices grown in India. India is also the largest producer of chillies in the world. The occurrence of mycotoxigenic fungi and elaboration of their toxins in agricultural commodities including chilli has been viewed with great concern world over, mainly because of their potential health hazards to humans and live stocks and also its impact on economy. Several mycotoxigenic fungi belonging to species of *Alternaria, Aspergillus, Cladosporium, Curvularia, Fusarium* and *Penicillium*, are known to contaminate food and agricultural commodities. Amongst mycotoxigenic fungi, *Aspergillus* flavus group continues to be the predominant fungi and occupies wide variety of human habitats. The mycotoxin contamination in some spices is suspected for two reasons; (1) many spices are cultivated and processed in warm tropical areas, where conditions favour growth of naturally occurring fungi; (2) most of the spice producing countries are developing countries where the drying and storage practices are not satisfactory. It has been estimated that roughly 25% of the world's food crops are affected by mycotoxin contamination annually (Magan and Aldred, 2003). The most significant mycotoxigenic Aspergilli are *A. flavus, A. parasiticus* and *A.nomius* which produce aflatoxins, *A.ochraceus,* which produce ochratoxins, and A.versicolor, which produce sterigmatocystin. *Aspergillus flavus* is of ubiquitous occurrence in nature and produces aflatoxin B_1 and B_2, while *Aspergillus parasiticus* produces these same metabolites along with G_1 and G_2 (Mclean, Dutton 1995). Moisture loss induces loss of food value or quality and moisture gain induces change in colour or other quality parameters. The harvested chillies properly dried and stored in the gunny bag coated with plastic to maintain the proper moisture and avoid spoilage.

Ginger (*Zingiber officinale* R.)

Ginger is one of the most important rhizomatous spices. It is best suited as intercrop in plantation crops. Ginger is full of aroma which is pleasant and spicy, the taste is pungent and slightly bitter. In storage, seed borne contamination causes considerable loss The storage pathogens such as *Aspergillus flavus, A. niger, A.terreus, Penicillium sp*, and *F. oxysporum* are identified during the storage affecting the quality of the rhizome. Storing selected healthy

rhizomes under clean and dry conditions have long shelf life.

Garlic (*Allium sativum* L.)

Garlic is widely used as a spice and condiment. It is the second most important among the cultivated Alliums after onion. Storage of garlic is a serious problem both for growers and traders. Garlic is stored in a dry, low-humidity environment. Garlic will keep longer period if the tops remain attached. During storage certain pest and diseases cause harm to stored garlic bulbs. If the moisture content is higher, it will result in infection by the pathogens such as *Aspergillus flavus, A. niger, A. terreus, Penicillium* sp, *Rhizopus* sp, *Fusarium* etc.

Fenugreek (*Trigonella foenum-graecum* L.)

Fenugreek seed is the ripe fruit of an annual herb. It is grown for use as condiment, leafy vegetable, medicinal purposes and also as fodder. This robust herb has light green leaves, 30-60 cm tall and produces slender, beaked pods, 10-15 cm long, each pod contains 10-20 small hard yellowish brown seeds, which are smooth and oblong, about 3mm long, each grooved across one corner, giving them a hooked appearance. *Aspergillus niger* is the pathogen which affects during storage. Fenugreek is stored in well ventilated under ordinary conditions in order to avoid the storage pathogen.

Coriander (*Coriandrum sativum* L.)

Coriander is an important spice crop having a prime position in flavouring food. The plant is a thin stemmed, small, bushy herb. All parts of the plant are edible, but the fresh leaves and the dried seeds are the parts most commonly used. The dried seeds are affected by many of the storage pathogens such as *Penicillium* spp, *Alternaria alternata, Aspergillus niger, A. flavus, A. aculeatus, Rhizopus oryzae, Gliocladium* sp. The dried seed should be filled in plastic or gunny bags lined with plastic sheet. The mouth of the bag should also be sealed and stored under clean dry and ventilated place to avoid the contamination by these storage pathogens.

Cumin (*Cuminum cyminum* L.)

Cumin is the popular spice in the world after black pepper. It has been grown and used as a spice since ancient times. India ranks first in terms of the acreage and production of the seed spice. After post harvest many pathogens infect the cumin seed. The cumin seeds are dried in the sun, and the ideal moisture content is about 10%. More moisture causes fungal infection during storage. Common fungi occurring in cumin under storage are *Fusarium culumorum, Alternaria solani, Aspergillus niger, A. aculeatus, A. flavus, Penicillium* spp. The dried, cleaned and graded, produce is packed in the optimum sized standard packs/ containers to maintain the quality of cumin.

Bay leaf (*Laurus nobilis* L.)

The bay leaf is an aromatic leaf commonly used in cooking. It can be used whole or as dried and ground. Both leaves and fruits possess aromatic, stimulant and narcotic properties. In Rome it is considered as a symbol of glory as well as honour and effective protection against thunder and lightning (Naidu, 1992). The bay leaves are harvested by manual pickings and dried under shade. If the leaves are not properly dried it will be affected by pathogens like

Rhizopus oryzae, Penicillium spp, *Aspergillus niger, A. flavus, A. aculeatus* and *Fusarium culumorum.* Fully dried leaves are packed in air tight containers. The product remains intact for about one to one and half year without deterioration in quality.

Fennel (*Foeniculum vulgare* M.)

Fennel is one of the important seed spices. Dried fennel fruits have a fragrant odour and pleasant aromatic taste. Fennel contains important flavoring compounds like Anethole and Fenchone. Its taste is similar to that of aniseed and the two are often confused with each other. Fennel seeds are oval-shaped and have grooves. They are yellowish-brown or yellowish-green in colour once dried. The pathogens such as *Rhizopus stolonifer, Fusarium solani, Aspergillus niger, A. flavus, Colletotrichum dematium* and *Ulocladium botrytis* are infecting fennel seeds under storage due to more moisture content.

Caraway seed (*Carum carvi* L.)

Caraway is the fruit of a biennial herb. The fruit when ripened splits into narrow elongated carpel, 4 to 6.5 mm long, curved, pointed at ends with 5 longitudinal ridges on the surface. The dried fruit is brown in colour has pleasant odour with sharp taste. Seeds are hard and sharp to touch. Caraway is widely used as a spice for culinary purposes and for flavouring bread, biscuits, cakes and cheese. It is also used for seasoning sausages and as medicine. The store pathogens are *Aspergillus niger, A. flavus, Penicillium* spp, *Rhizopus barrhizus , R. nodosus,* and *Gliocladium* spp affecting the quality of the seed.

Thyme (*Thymus vulgaris* L.)

Thyme is an important and well known spice plant. It is widely grown in small and scattered area. This herbal spice has antiseptic quality, the name in its Greek form was derivative of a word meaning "to fumigate", "courage", "sacrifice" (Naidu, 1992). Thyme leaves contain essential oils. It is marketed in whole or ground form. The flavour is aromatic, warm and pungent. Fully dried leaves are kept away from moist condition. *Hyalodendron diddeus* and *Penicillium* spp are the pathogens affecting the quality of thyme.

Aniseed (*Pimpinella anisum* L.)

Aniseed is an annual plant with an average height of 30 to 50 cm. The plant is completely covered with fine hairs. Aniseed is grey to greyish brown in colour, 3 to 5 mm in length, and oval in shape with short stalk attached. It has a characteristic agreeable odour and a pleasant aromatic taste. It is used mainly as a flavourant, culinary, household, cosmetic and medicinal. The pathogen affecting the spices during storage are *Acremonium strictum, Alternaria alternata, Aspergillus niger, A. sydowii, Mucor racemosus, Penicillium brevicompactum, Rhizopus stolonifer* and *Stemphylium botryosum.*

Saffron (*Crocus sativus* L.)

Saffron the most expensive spice in the world is derived from the dry stigma of the plant Crocus sativus. Saffron is used as a culinary seasoning and food additive. The quality of saffron is maintained when dried under shade. *Aspergillus clavatus, A. niger, Eurotium repens, Penicillium arenicola, P. oxalicum* and *Rhizopus stolonifer* are the pathogens that affect saffron

during storage. Dried material is packed in moisture proof polythene bag or containers to maintain the quality of Saffron.

Oregano (*Origanum vulgare* L.)

Oregano is a perennial herb with creeping roots, 30-90 cm high, branched woody stems and opposite, petiolate and hairy leaves (1.5 cm long). Oregano is used in meat, sausages, salads, stews and soups. In food industry, oregano oil and oleoresin is used in food and beverages. Mature leaves are used fresh and dried. The pathogens affect Oregano are *Rhizopus* sp, *Penicillum* sp, *Aspergillus* sp, *A. niger, A. versicolor and Fusarium* sp. Heat treatment can prevent these pathogens. Packaging of leaves and seeds is done in air tight containers and store away from dark and damp place to maintain the quality.

Mustard (*Brassica juncea* L.)

Mustard is an annual herb cultivated as oil seed crop or as vegetable or as fodder, of which, 3 species are known for its condiment value. They are pale yellow or white mustard, brown mustard, and black mustard. The harvested material is kept for drying on clean floor under sun to reach seed moisture content below 10%.

Sl.no.	Name of Spices	Moisture content of spices (%) as per ISO (International Organization for Standards) & ISO number	
1	Cardamom	13	882
2	Pepper	14	959
3	Clove	12	2254
4	Nutmeg	10	6577
5	Cinnamon	14-Srilanka, 15-Madagaskar	6539
6	Turmeric	12	5562
7	Ginger	12	1003
8	Garlic	8	5560
9	Fenugreek	11	6575
10	Coriander	9	2255
11	Cumin	9(gradeI),10(g-II),13(g-III)	6465
12	Bay leaf	8	6576
13	Fennel	12	7927-1
14	Caraway seed	13(Binneal black), 12(Annual blond)	5561
15	Thyme	12	6754
16	Aniseed	12	7386
17	Saffron	12	3632-1
18	Oregano	12	7925
19	Mustard	10 (Loss of mass in 103Â°C)	1237

Aspergillus spp., affects mustard during post harvest storage. The seeds are stored in gunny bags lined with polythene.

CONCLUSION

Spices under storage are vulnerable to deterioration by the growth of fungi and bacteria. Hence it is always advised to store the product in bags lined with plastic sheet. The moisture content of the dried produce should not exceed 8 -14% depends on the stored spice products so as to avoid the growth of moulds. The moisture content (%) of various spices as per the ISO (International Organization for Standards) is given below.

The storage pathogens usually produce toxins which make the spices unsuitable for consumption. Hence avoiding contamination of microbes during the storage period is very important for export of spices and consumption. Farmers, Dealers and Exporters have to maintain the moisture (%) specific to each spices to avoid the growth of stored pathogens.

Acknowledgement

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Reference

Anonymous. 2000. *Turkish Food Codex-Spice Paper.* Republic of Turkey Ministry of Agriculture and Rural Affairs, Official Gazette, 31.07.2000/24126, Paper No. 16.

Anonymous. 2009. *Cultivation Practices for Cardamom.* Spices Board, Ministry of Commerce and Industry. India. 35-38.

Atanda, O., Akpan, I. and Oluwafemi, F., 2006. The potential of some spice essential oils in the control of *A. parasiticus* CFR 223 and aflatoxin production. *Elsevier*1-7.

Ayres, G.I., Mund, T.I. and Sondin, E.W., 1980. Microbiology of Food Spices and Condiments. *A Series of Books in Food and Nutrition. edn.* Schmeigert, 249pp.

Bulduk, S., 2004. *Food Technology.* 2nd edition, Detay Publishing, Ankara, Turkey

Elshafie, A.E., Al-Rashdi., Tahiya, A., Al-Bahry., Saif, N. and Bakheit, C.S., 2002. Fungi and aflatoxins associated with spices in the Sultanate of Oman. *Mycopathologia* 155: 155- 160.

Kneifel, W. and Berger, E., 1994. Microbial criteria of random samples of spices and herbs retailed on the Austrian market. *J. Food Prot.,* 57: 893-901.

McLean, M. and Dutton, MF. 1995. Cellular interactions and metabolism of Aflatoxin: An Update. *Pharmacology and Therapeutics.*65: 163-192.

Magan, N. and Aldred, D. 2004. mailto:N.Magan/D.Aldred @ Cranfield.ac.uk.

Mwangi, W.W., Nguta, C.M. and Muriuki, B.G., 2014. Aflatoxin contamination in selected spice preparations in the Nyahururu Retail Market. *J. Scient. Res. Rep.;* 3(7):917-923.

Naidu, R., 1992. *Herbal Spices: Cultivation and Usage.* Indian Cardamom Research Institute, Myladumpara. 6:16.

Singh, S.P., 2007. *Production Management of Spices.* Agrihortica publication. 27:387.

Zinedine, A., Brera, C., Elakhdari, S., Catano, C., Debegnach, F. and Angelini, S., 2006.Natural occurrence of mycotoxins in cereals and spices commercialized in Morocco.*Food Control.*17:868-874.

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SENKAAMBU - UNIQUE CURRY LEAF IDEOTYPE OF TAMIL NADU

R. Chitra and P. Jansirani*

Curry leaf (*Murraya koenigii* Spreng.) plays an important role as a condiment in the culinary preparation of South Indian dishes. It is a perennial nutritious herbal spice crop grown for its aromatic leaves. Being a rich source of protein, carbohydrate, vitamin A and vitamin C, these are said to be used in many Ayurvedic and Unani medicines. Curry leaf trees are naturalised in forests and waste land throughout the Indian subcontinent except in the higher parts of the Himalayas. Curry leaf plant is commonly found in tropical and subtropical forests throughout India and Andaman Islands up to an altitude of 1500 m MSL. It occurs in wild form from Garhwall hills in Uttranchal to Sikkim, West Bengal and Assam. It is also found growing in Bengal, Madhya Pradesh, Kerala, Karnataka, Tamil Nadu and Andhra Pradesh. In Tamil Nadu, curry leaf is cultivated in Coimbatore, Erode, Madurai, Salem and Tiruchirappalli districts. Curry leaf has a huge demand in India and abroad which has made the commodity of immense trade value. The fresh leaves of curry leaf are exported to Gulf, European and African countries etc.

The leaves of this plant have slightly pungent, bitter and feebly acidic taste. It retains their flavour and other qualities even after drying and is being used for long period. It is used as a natural flavouring agent in various curries, sambar, rasam and chutneys in South India. Ground curry leaf with mature coconut kernel and spices form an excellent preserve.

The leaves, bark and the root of the plant are used in indigenous medicine as a tonic, stomachic, stimulant and carminative. An infusion of the roasted leaves is used to stop vomiting. It is also used to cure eruptions and the bites of poisonous animals using external application. The green tender leaves are eaten as raw to cure dysentery. A decoction of leaves is sometimes used as a febrifuge. It has also been used as an antiperiodic and dry leaf powder is mixed with honey and juice of betelnut which is widely recommended in the Ayuruedic system of medicine. The aqueous extracts of the leaves, when administered parenterally to female guinea pigs, not only raise the phagocytic index, but also mobilize a greater number of leucocytes to take part in phagocytosis. The juice of the root used as a medicine for ensuing of kidney problem. Apart from leaves, fruit is also edible which yields 0.76% of a yellow volatile oil with a neroli-like odour and peppery taste, accompanied by an agreeable sensation of coolness on the tongue. The wood (43-50 Ib/cft) is grayish-white, hard, even, close-grained, and durable. It is used for making agricultural implements.

In Tamil Nadu, as there is no released variety in curry leaf, farmers prefer the popular local variety *viz*., 'Senkaampu' an ideotype grown in

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different parts of Tamil Nadu especially in Karamadai tract of Coimbatore district. The petiole is purplish red in colour. The leaves have good aroma and flavour due to high essential oil content. The production of Senkaambu in Karamadai tract is around 40,000 tonnes with an area of 936 ha during 2016-17 (Subthra and Ravikumar, 2017). These tract have emerged at the most popular for Senkaambu curry leaf production because of the best suited climate, soil, irrigation facilities, skill and intensive area. Villages in and around Mettupalayam are the largest producers of Senkaambu curry leaves in Tamil Nadu. Besides Mettupalayam, Sirumugai,Therampalayam, Kurudampalayam, Mungampalayam, Ponmudi, Ramampalayam, Sennampalayam, Karamadai and Marudur are the major Senkaambu curry leaves cultivating areas, from where the leaves are exported to countries like Singapore, Dubai, Malaysia as well as supplied to several states within India.

Presently it is largely cultivated under organic farming in this district. However, inorganic fertilizers are applied at the rate of 100g of NPK mixture per plant after every pruning which is generally followed before supplemental irrigation after monsoon showers. In general, three crops are harvested in a year with 3-4 months interval. The winter season generally fetches very good market price since the leaf production is very limited in this season (Goudra and Madalagiri, 1992).

Description of Senkaambu type

* Senkaambu type is an attractive and aromatic shrub
* The bark is purplish red in colour.
* The leaves are imparipinnate, ovate, obtuse or acute. The base is usually oblique, almost glabrous above, pubescent beneath, gland dotted and strongly aromatic attributes.
* The flowers are in terminal corymbose cymes, white colour and good fragrant.
* The berries are sub-globose, purple-black when it ripens and 2-seeded embryo.
* The roots are woody, widely spread and produce many suckers.
* The tree bears blossoming of flowers from February-May and fruit setting from August - September.
* The flowers are self-pollinated, diploid chromosome number is 2n=18

Field View of Senkaambu Curry leaf

Purplish red branches/twigs

Purplish red petiole

Flowers and Fruits of Senkaambu curry leaf

Quantitative and qualitative characters of Senkaambu curry leaf			
1.	Plant height (cm)	:	90 - 110
2.	Secondary branches number	:	25 - 30 Nos.
3.	Inter nodal length between two compound leaves (cm)	:	2.00 - 2.50
4.	Length of a matured shoot (cm)	:	80 - 90
5.	Number of compound leaves per matured shoot	:	45 - 50
6.	Number of leaflets per compound leaf	:	15 - 18
7.	Leaf yield (t/ha)	:	5 - 6 t @ once in 3 months
8.	Leaf Iron content (per cent)	:	3.02
9.	Leaf Calcium content (mg per100g)	:	760.12
10.	Essential oil content (per cent)	:	0.122
11.	Oleoresin content (per cent)	:	3.12
12.	Shelf life (unpacked condition) (Days)	:	1
13.	Shelf life with five per cent ventilation (Days)	:	2

Cultivation techniques of Senkaambu curry leaf

Soil and climate

Though curry leaf can be cultivated in a wide range of soil conditions, red sandy loam with good drainage is ideal for its normal and fleshy growth which results in a better leaf yield. It can with stand drought by some extent. Heavy clay with poor drainage is not suitable for its cultivation. It can tolerate a maximum temperature ranging from 26° to 37°C, if the temperature falls below 16°C, the vegetative buds become dormant arresting the new growth of the plant.

In nearby Karamadai tract, the soil is sandy clay loam and red loam. The temperature of this area is ranging from 23° to 32°C. The soil type and climate are highly suitable for curry leaf cultivation in this area. The most of the farmers cultivate Senkaambu under organic cultivation in Karamadai tract. Based on discussion with farmers, the following organic production techniques are ensuing for Senkaambu cultivation.

Field preparation and planting

Curry leaf planting can be done in all the seasons. Apply 15 tonnes of farm yard manure in one acre land and the field must be ploughed twice without any lumps. The raised bed will be prepared with 30 cm height and 100 cm width. Based on the topography of land, length of the bed can be prepared. The space should be provided for each and every bed is about 45 cm and drip line along with fertigation unit to be placed on the raised beds.

The seeds of Ragi, Sorghum, Bajra, Foxtail millet, Kodo millet, Little millet, Green gram, Sesame and Horse gram are to be mixed together @ 20 kg and sown on the raised bed and irrigation should be done immediately. The plants raised from mixture of seeds will be ready for transplanting on 40th day after sowing. At that time, the seedlings are uprooted and put them on top of the bed and covered with the soil as green manuring. After 7th day, Senkaambu curry leaf seedlings should be transplanted in a pit with a depth of 15 cm and distance of 75 cm from the centre of the bed. Hence, 4,600 seedlings per acre is recommended for good agricultural practices.

Intercultural operations

Irrigation should be given in 10 days interval through drip irrigation will suppress the weed growth. Spraying of Panchagavya to be given once in a month (3 litres / 100 litres of water). The plants may attain the growth quickly with good colour development. Three months after planting, neem cake (50 g/plant) must be applied near to root zone.

On a full moon day of every month, 100 litres of water is mixed with 40 g of cow horn manure and kept for one hour. The nutrient solution is to be spray as the form of mist. This spray leads to produce highly fragrant curry leaves and increases the shelf life.

Pruning

Initially, the terminal bud is allowed to grow to a height of 1 m. After attaining this height, it is cut off to encourage basal branching. This will maintain the plant in a bushy state so as to facilitate the harvesting and other operations. In total, 5-6 branches are maintained per bush. The vertical branches are to be removed for avoiding as a tree type.

Plant Protection

Herbal insecticides (400 ml / 10 litres of water) can be sprayed on the plant in the morning hours at 15 days interval to control the leaf folder, leaf spot and moulds.

Harvest and yield

The first harvest to be done at 6th month after planting. The subsequent harvest to be done at three months interval. The yield will be less at the first harvest and gradually increased from the subsequent harvest. In the first year, the yield will be about 5 to 6 tonnes. In the second year onwards, the yield will be about 8 to 10 tonnes. After every three harvest, the plants need to be pruned by leaving a one foot height away from the ground. Then, the seeds of millet mixture are to be sown in between the plants as cover crops. On 40th day, the seedlings of cover crops are uprooted and used for mulching purpose. By repeating this method every year, the plants will get adequate nutrient uptake and suppress the weed growth.

Organic curry leaf cultivation will reduce the cost of cultivation to get an increased yield. The regeneration capacity of curry leaf is good and the crop can be maintained upto 25 years. Curry leaf can be harvested at four times in a year. The farmers get a remunerative price for curry leaves during the months of February to December. They also get minimum of Rs.4 per kg and maximum of Rs. 40 per kg of curry leaves.

In the Karamadai tract, traders from Kerala, use their labours for harvesting and weighing purpose. The farmer's need not to spend money for harvesting, transportation and commission

Cost of cultivation of Senkaambu curry leaf (per acre)

Particulars	**Expenditure (Rs.)**	**Income (Rs.)**
Ploughing charge	2,400	
Farm yard manure application	22,000	
Formation of raised bed	3,000	
Sowing of seeds of millet mixture cum mulching	1,200	
Seedlings and planting cost	10,750	
Preparation of herbal formulation and spraying	4,500	
Cow horn manure	1,000	
Neem cake	3,500	
Pruning	4,000	
Income from 8 tons curry leaves		1,60,000
Total	**52,350**	**1,60,000**
Net income		**1,07,650**

Note: The cost incurred for drip system was not included in this list.

Curry Leaf seedlings

Farmers Training on Curry leaf cultivation

District level Seminar on Curry leaf cultivation

agents involve in the loading and unloading operations. The average market price for green leaves is Rs.20 per kg and the farmer can earn the annual income of Rs.1,60,000 per acre.

A study on cost and returns of curry leaf cultivation in Coimbatore district was conducted by Subathra and Ravikumar (2017). They reported that the average yield of curry leaf is 20 tonnes/year/acre. The share of variable cost is about 89 percent of the total cost. The total cost of the cultivation for curry leaf was estimated at Rs.1, 66,460 in the study area and the net income was worked out to be Rs.1, 33,540. It was observed that the higher net income was obtained by the curry leaf farmers.

Programmes supported by Directorate of Arecanut and Spices Development for expansion of Curry leaf cultivation

The Directorate of Arecanut and Spices Development, Calicut supported the development of spices through GOI-MIDH programme.

(i) Production of quality planting material of Spices

Under this programme, Tamil Nadu Agricultural University produce and supply of Senkaambu curry leaf seedlings to the farmers of Tamil Nadu, Andhra Pradesh and Karnataka.

(ii) Transfer of Technology

Tamil Nadu Agricultural University and Directorate of Arecanut and Spices Development, Calicut jointly organized two numbers of farmers training and two numbers of District level Seminar for popularization of curry leaf cultivation techniques.

References

Goudra, B. K. and Madalagiri, B. B. 1992. Effect of nitrogen nutrition on yield and yield component of curry leaf (*Murraya koenigii* Spreng). *Indian Cocoa, Arecanut Spices J.* 16(2):66-68.

Josekutty, K. A. 2008. Curry Leaf. *Spice India*, 21(5):28:31.

Subathra, K. and Ravikumar, R. 2017. A study on cost and returns of curry leaf cultivation in Coimbatore District. *Int. J. Res. and Dev.*: 110-114

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METHODS OF FERTILIZER APPLICATION IN ARECANUT

U. K. Priya, Bhavishya and Ravi Bhat*

Introduction

Area under arecanut is increasing consistently all over India. There is an increase in area of arecanut from 445.31 thousand hectares in 2013-2014 to 518.71 thousand hectares in 2017-2018 (DASD, 2020). The high net return on each rupee invested by farmers on arecanut cultivation is drawing the rural youths to areca farming. Now arecanut cultivation is spreading from the conventional areas to non-conventional areas like Tamil Nadu and Andhra Pradesh. Under these circumstances, application of correct quantity of fertilizer in required forms and methods requires emphasis for increasing resource use efficiency and yield. Further this will reduce the wastage of costly inputs and increases the health of the palms.

Arecanut is predominantly cultivated in deep gravelly laterite soils to fertile clay loam soils with irrigation during prolonged dry spells. The establishment of areca garden should be carried out after ensuring that the soil is at least 2 m deep and there are adequate drainage facilities. Water logging can affect the root growth, nutrient uptake and yield of the palms adversely. Arecanut planting may be avoided in reclaimed paddy fields or wetlands.

Importance of soil testing and leaf analysis

Soil testing in areca gardens is essential to find out the nutrient status in the soil and undertake corrective measures if needed as both excess and deficit nutrients adversely affect arecanut. Injudicious application of fertilizers and improper management strategies will lead to nutrient imbalances that impair the growth and performance of areca palm (Bhat *et al*, 2012). It is advised to go for soil testing before the establishment of a new garden and once in three years for established gardens. Soil should be collected two feet (60 cm) away from the base of arecanut at 30 cm depth using soil auger or a spade. Soil should be collected in such a way that it's a representative sample of the whole field including all the variations in topography and management. While taking soil samples care should be taken to avoid sampling from extremely wet or dry soils and or soil from basin immediately after fertilizer application. In gardens showing deficiency or toxic symptoms soil testing should be followed by leaf analysis. The leaf should be collected from middle of the fourth leaf from either side.

Methods of fertilizer application in arecanut

In arecanut mainly two methods of fertilizer application are commonly adopted. The first is the conventional method of basin application of fertilizers, *i.e.* traditionally followed by the farmers. Second is the application of the fertilizers through drip, referred to as fertigation. In fertigation, compared with the conventional system, fertilizers are applied in liquid form to the palms. Foliar spraying of nutrients is also recommended in fields for immediate recovery of deficiency symptoms which are prominently visible.

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Conventional method of fertilizer application

The conventional method of basin application is followed by the farmers on a large scale. In this method fertilizers are applied in the basin of the palm. Fertilizer has to be applied in basins around the palm after basin opening. The opening of basins is essential to loosen the soil that will ascertain optimum aeration which in turn will help in increasing the root growth and nutrient absorption.

Fertilizers have to be applied in a radius of 0.5-0.75 m leaving 20 cm from the base of the palm at a depth of 15-20 cm where the feeder roots are concentrated. Application of fertilizer is followed by the rolling up of soil and covering with organic matter. Fertilizers should be applied in field only when the soil is moist. Fertilizer application shouldn't coincide with heavy rainfall or dry periods to maximise nutrient uptake by arecanut palms.

The recommended dose and time of fertilizer application in basin

Fertilizer doses vary with the age of the areca palm. Application of lime or dolomite is recommended only if the pH of soil is less than 5.5. Application of fertilizers should be done along with the addition of 20 kg of FYM or 12 kg of green leaf manure or 12 kg compost.

When fertilizers are applied in basins, two split applications are recommended during the May- June period after the receipt of summer showers, before the onset of South -West monsoon. The second split dose is to be applied during August- September along with organic manure. Under irrigated conditions, it is always better to apply fertilizers in splits during bearing time from December to May. Doubling fertilizer doses in areca palms with more than 3 kg nut yield proved to be beneficial and economical. Fertilizer schedules are given in Table 1.

Application of fertilizers through fertigation

Fertigation is the practice of supplying fertilizers through irrigation system. Usually in fertigation soluble fertilizers are used as the source of nitrogen, phosphorus and potassium. In arecanut, fertilizers can be effectively applied through drip. The fertilizer mixtures have to be diluted 10 times when applied to the field. Fertigation studies conducted at ICAR-Central Plantation Crops Research Institute, Regional Station, Vittal has proved significant increase in uptake of nutrients and the yield of arecanut (Sujatha and Bhat, 2013). The time of application of fertilizers coincides with the fruit setting in arecanut and hence it promises higher yield than the conventional basin application of fertilizers. Since the fertilizers are provided through drip along with irrigation water, labour requirement can be reduced significantly. Another advantage is that recommended dose of fertilizers can be reduced when compared to the basin application. The initial cost for setting up of drip in arecanut is Rs.80,000/- per hectare that has a life span of more than 10 years. The increased yield, requirement of lesser fertilizers, lower weed growth and few labours makes this technology advantageous and beneficial over the basin application of fertilizers (Bhat and Sujatha, 2006).

Drip fertigation system consists of a water tank of suitable capacity for providing irrigation. A sand filter and screen filter to avoid the suspended particle from entering into the drip to prevent the clogging of micro tubes. A ventury injection system or fertilizer tank for

Table 1 : Fertilizer doses to be applied to arecanut at different stages

Nutrient requirement (g/palm/year)	**First year of planting**	**Second year of planting**	**Third year onwards**
Nitrogen	33	55	100
Phosphorus	13	26	40
Potassium	46	92	140
***Fertilizer requirement (g/palm/year)**	**Fertilizer source is Urea, Rock Phosphate or Single Super Phosphate and Muriate of Potash**		
Urea	72	144	220
Rock Phosphate (RP)	65	130	200
Single super phosphate (SSP)	83	167	250
Muriate of potash (MOP)	77	154	230
****Fertilizer requirement (g/palm/year)**	**Fertilizer source is Urea, Di Ammonium phosphate , Muriate of potash**		
Urea	61	121	182
Di Ammonium phosphate (DAP)	29	58	87
Muriate of potash(MOP)	77	154	230

* In soils having pH less than 6.0 the fertilizer source for N, P and K can be urea, rock phosphate and MOP.

** If soil pH is greater than 7.0 one can use DAP or SSP as nutrient source for phosphorus which can also supplement some amount of nitrogen.

injecting or mixing of soluble fertilizers. Micro tubes or drippers (two to three numbers per palm) of suitable capacity that can deliver 20 litres of water per palm in 40- 45 minutes can be utilized.

In pre bearing palms application of 50 percent of the recommended dose of fertilizers was sufficient to give high CGR (Crop Growth Rate) and RGR (Relative Growth Rate) (Sujatha *et al.*, 2002). In bearing palms 75 percent of the recommended fertilizer dose was sufficient to attain improved root spread, nutrient uptake and high yield (Bhat and Sujatha, 2008).

Fertigation has to be followed during the months of December to May in 20 days (9 splits) or 10 days interval (18 splits) through drip. It is advised to start irrigation 10 minutes prior to fertigation as enough moisture will be retained in soil to maximise absorption of nutrients. Fertigation can be continued for a period of 20 minutes. The fertigation period shouldn't be prolonged as it will cause the nutrients to be leached to deeper soil layers which reduce the absorption of nutrients by palms. The solution obtained should be free of suspended particles and Di Ammonium Phosphate (DAP) should be soaked for overnight so as to prevent clogging of tubes. Table 2 provides the fertilizer requirement per palm basis for fertigation.

Table 2 : Fertilizer schedule in drip irrigation

Recommended dose of fertilizers for fertigation	75 g N, 30 g P2O5 and 105 g K2 / palm / year	
Recommended dose in terms of Urea DAP and MOP	135g Urea, 65 g DAP, 175 g MOP / palm / year	
Frequency of application	**Fertilizer**	**(g/ palm/ interval)**
10 days interval	Urea	7.5
	DAP	1.7
	MOP	9.7
20 days interval		
	Urea	15
	DAP	3.4
	MOP	19.4

Micronutrients through drip is not standardised, Hence can be supplied as per the soil test report as foliar spray or soil application.

Conclusion

Proper method of fertilizer application in arecanut is an effective measure to increase the areca palm health and attain sustainable high yields. Following appropriate fertilizer application methods and rate of fertilizers will ensure maximum fertilizer uptake, minimize the losses and improve yield of the palms with minimum adverse effect on the environment. The use of drip fertigation will enhance the nutrient uptake, increase the water use efficiency, increase yield and reduce the labour requirement thus ensuring high economic returns to farmers.

References

Bhat, R. and Sujatha , S.2006. Cost-Benefit analysis of ferti-Drip irrigation in arecanut (*Areca catechu* L.).*J. plantation crops*, 34(3), pp. 263-267.

Bhat, R. and Sujatha, S. 2008. Root distribution of arecanut (*Areca catechu* L.) as influenced by drip fertigation in a laterite soil. Available online http:// krishi. icar.gov.in/jspui/handle/ 123456789/12387

Bhat, R., Sujatha, S. and Jose, C.T. 2012. Assessing soil fertility of a laterite soil in relation to yield of arecanut (Areca catechu L.) in humid tropics of India. Geoderma, 189, pp. 91-97.

DASD, 2020, Directorate of Arecanut and Spices Development (DASD), Calicut, Kerala, India. https://www.dasd.gov.in/adminimage/ Arecanut_area_and _prodn. pdf (Date accessed 20-05-2020).

Sujatha, S., Balasimha, D., Bhat, R. 2002. Fertigation requirement of arecanut (*Areca catechu* L.) during pre-bearing stage, Plantation crops research and development in the new millennium, pp.328-332. Available online https:// www.researchgate.net/profile/ Sujatha_S/ publication/ 283343071.

Sujatha, S. and Bhat, R., 2013. Impact of drip fertigation on arecanut-cocoa system in humid tropics of India. *Agroforestry systems*, 87(3), pp.643-656.

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CURATIVE PROPERTIES OF ESSENTIAL OILS

G. Raviraja Shetty*

Introduction

The modern way of life can be extremely stressful at times and can easily become overwhelming. Many people long for what they believe to be quieter times gone by, though they are aware this is likely to be a case of the grass being greener on the other side.

One thing that we can learn from our ancestors is the power of natural extracts to make us feel better. Generations of humans from all cultures, countries and climates have made use of plants and minerals in medicines and for relaxation. This knowledge has not been lost, despite the appearance of extremely effective medicines in modern times; natural extracts especially essential oils are still widely used in aromatherapy (Buckle, 1993).

Essential oil or ethereal oils are the volatile organic compounds extracted from plants, are insoluble in water in organic solvents and are obtained either by hydro distillation or by solvent extraction methods. Aromatics have the tremendous importance in the life of people since ancient times. Ancient people believed that earthly prosperity result from spirituality in which fire and fragrant smoke play an important role. Even today the end of back to nature is coming up. Essential oils are used worldwide for stress, tension, depression, insomnia, constipation, blood pressure and many other ailments. The use of essential oils stimulates and increases the oxygen orient of the cells thus increasing the fundamental balance of the skin and rejuvenates it (Singh *et al.*, 2001). Ayurveda and Aromatherapy offer a modern approach to alternative healing. By using the right formulations, individuals can be healed by the restoration of imbalance, essential oil enhances aura, energize the energy points relatives the state of mind and pulsates the chakras. (Chandrashekar and Joshi, 2004)

Chemistry of Essential Oils

For the safe practice of use of essential oils, it is essential to have at least understanding of the chemistry of these oils. The list of physiological and pharmacological properties of aromatic molecules encompasses almost all the organs and all functions of the organism, from the skin condition to physiological disturbances (Gangrade, 1990) Carbon, hydrogen and oxygen are essential to the life self and all the three contained in every essential oil. The important biochemical families constituting the essential oils area as detailed in Table 1.

Mode of Action

Essential oils follow three main pathways to gain entry to the body

- Absorption through skin
- Through oral intake
- Olfaction through nasal passage.

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Table 1: Chemistry of Essential Oils.

SI. No.	Biochemical family	Medicinal property	Example
1.	Terpenes	Analgesic, Expectorant, Stimulating, Anti-inflammatory and spasmolytic	Linalool, Geraniol
2.	Alcohols	Anti-infective, Bactericidal, Antiviral and Stimulating	Patchoulol
3.	Phenols	Bactericidal, Stimulate nervous and immune system and antidepressant	Carvacrol, Methyl chavicol
4.	Aldehydes	Antiviral, Anti-inflammatory, calming, vasodilators and antipyretic	Citral, cinamic aldehyde
5.	Ketones	Sedative, Analgesic, digestant, Anti-inflammatory, expectorant	Laevocarvone
6.	Easters	Antifungal, antispasmodic, relaxant tonic	Linalyl acetate
7.	Oxides	Expectorant, mucolytic, blood circulation activators	1, 8-cineole
8.	Lactones	Mucolytic and expectorant	Jasmone

(Shirley and Len , 2000)

Skin: Essential oil applied to the skin. Skin is slightly permeable to water and water soluble substances and water itself and essential oils.

Essential oils are lipopholic substances; they are soluble in lipids found in the stratum of cells, they are considered to be easily absorbed. Once they pass the epidermis and enter the complex of lymph and blood vessels, nerves, sweat and oil glands, they are then carried to provide every cell in the body. Essential oils are used by: - directly applied on open wounds such leg ulcers, bed sours, boils etc.

- Gargling,
- Sprays in severe burns
- Massaging

Oral intake: Essential oils enter the body in the form of capsules, drops, foods / mouth wash after removal of tonsils. Then they directly enter the digestive system and follow the same pathway as that of through skin.

Olfaction: Access via nasal passage is indisputably the quickest and effective route in the treatment of emotional problems such as stress and depression (and also some types of headache). This is because the nose has direct contact with brain, which is responsible for triggering the effect of essential oils.

Role of Essential Oils balancing the immune system

Immune system of an organism will depend on balance between emotional and mental

spheres. Assimilation and elimination are interlinked to immunity which depend on two factors,

♦ Adaptation power of the organism to environment in which it is living.

♦ Strength to reject the external toxic to the environment.

Immune system is the equilibrium state linking these two factors. If this balance is broken, organism unity is also broken, creating infections. Treating the patients with essential oils even appears to treat the infectious diseases but not used on only bactericidal and veridical properties of essential oils. It takes physiological factors in to account that contribute to misbalance of personality of patients. (Garg and Jain, 2001)

Undesired effects of essential oils

Essential oils should be used knowledgably and with due caution so that the dangers which cause problems should be avoided. Essential oils are powerful mixtures and have physiological, psychological and pharmacological effects when applied to the body. They are freely and there is no restriction on their sale and use. These essential oils are not harmful but deleterious effects may be observed only in case of overdose or sensitivity of the user. (Shirley and Len , 2000)

Table: 2 Therapeutic properties of Essential Oils.

SI. No.	Property	Essential oil bearing plants
1.	Antibacterial	Pepper mint, Lavender, Basil, Rosemary
2.	Antifungal	Eucalyptus, Thyme, Chamomile, Geranium
3.	Antiviral	Eucalyptus, Pepper mint, Basil, Cinnamon
4.	Analgesic	Citrus spp, Chamomile, Ginger, Coriander
5.	Anti-inflammatory	Lavender, Chamomile, Coriander, Geranium
6.	Antidepressant	Lavender, Citrus spp, Geranium
7.	Cardio tonic	Lavender, Basil, Rosemary, Fennel
8.	Deodorant	Patchouli, Lemongrass, Salvia
9.	Digestant	Thyme, Coriander, Basil, Rosemary
10.	Diuretic	Rosemary, Thyme, vetiver
11.	Hormone like	Fennel, Geranium, Sage, Rosemary
12.	Hyper tensor	Lavender, Pepper mint, Basil
13.	Hypo tensor	Rosemary, Lavender, Marjoram
14.	Immunity	Nutmeg, Patchouli, Thyme
15.	Rheumatism	Coriander, Geranium, Lemongrass
16.	Sedative	Lavender, Passiflora, Citrus spp,

(Shirley and Len, 2000)

1) **Skin irritability:** Strong oils which are found to contain higher proportions of Aldehydes and phenols, may becomes irritable when used frequently. They may cause inflammation, itchiness of other skin problems e.g. Cinnamon leaf oil, clove bud oil and thyme oil.

2) **Mucus membrane irritation:** Oils with phenols can be responsible for irritating mucus membrane. They may cause irritation of alimentary, respiratory and urino-genital tracts. e.g. Spearmint oil and Tegetus species.

3) **Photo toxicity/Photosensitivity:** Some essential oils may render skin hypersensitive to UV rays, producing the protective tannin reaction. It may result in hyper pigmentation or other skin related problems.

   e.g. Orange mint oil, Ruta graviolens oil and cumin oil.

4) **Contact sensitization:** Some oils, which don't cause any reaction during first contact with skin but may, do so on a subsequent application.

   e.g. Turpentine responsible for skin allergy to workers in paint industry.

5) **Nephrotoxicity:** Damage to kidney even when applied externally.

   e.g. Sandal wood oil taken orally in excess cause **kidney damage.**

6) **Respiratory sensitivity:** It may cause some irritation to respiratory tract.

   e.g. Cinnamon oil and clove oil.

Conclusion:

Today's increasing population and raising level of environment pollutants and stressed life style lead to deviation in health balance. Use of synthetic and modern drugs proved unsafe, cause several side effects and fatal to human kind. Use of essential oils is safe and relief to many important health problems (stress, tension, depression, constipation, insomnia etc) of human kind.

References:

Buckle, J., 1993, Aromatherapy - A Clinical Trial. *Acta Horticulture,* 332: 253-264.

Chandrashekar, K.S. and Joshi, A.B. 2004, Antimicrobial efficacy of essential oil of Cymbopogon species. *Indian perfumer,* 48(3): 327-329.

Deans, S.G. and Katerina, P.S. 1989. Antibacterial activity of summer savory (1998) essential oil and its constituents. *J. Horti. Sci.* 64(2): 205-210.

Gangrade, S.K., Shrivastva, R.D., Shrama, O.P., Moghe, M.N. and Trivedi, K.C. 1990. Evaluation of some essential oil for antibacterial properties. *Indian Perfumer*, 34(3): 204-208.

Garg, S.C. and Jain, R.K. 2001. Antimi-crobial efficacy of essential oil of *Eletteria cardamomum. Indian perfumer,* 34(3): 204-208.

John, E.T., Minija, J., Tajo and Denna. 1999. Microbial potential of essential oil of *Ocimmum adscendens. J. Med. Aroma. Plant Sci.* 22(2): 256-267.

Lucia, B., Fabio, M., Miriam, L., Gabriela. M., Anionina, S., Caludio, M.M. and Vincenzo, 2003. Effect of limonin and nomilin on HIV-1 replication on infected human monoculture cells. *Planta Medica,* 69: 910-913.

Pratibha, Y., Dubey, N., Joshi, V.K. and Chinsoyria. 1999. Antidermatophytic activity of essential oils of Cinnamomum as herbal ointment for cures dermatomycoses. *J. Med. and Aroma. Plant Sci.* 21: 347-351.

Rao, C.C., Dash, S.K. and Mishara, R.K. 2001. Antimicrobial activity of essential oil of the leaves of *Pimento dioca* L. (Family: Myrtaceae).

Indian Drugs, 38(9): 458-461.

Rath, C.C., Dash, S.K. and Rajeshwar, B.R. 2005. Antifungal activity of rose scented geranium (*Pelargonium spp.*) essential oil and its six constituents. *J. Essential Oil Bearing Plants*, 8(2): 218-222.

Singh, G., Kapoor, I.P., Pandee, S.K., Singh, O.R., Singh, U.K. and Singh, R.K. 2001. A note on antibacterial activity of volatile oils of some aromatic plants. *Indian Perfumer*, 45(4): 275-278.

Sushil, K.S., Amritesh, C.S. and Anupam, D. 1999. Antifungal studies of some essential oils at various pH levels for betterment of antifungal drug responses. *Current Sci.* 77(5): 703-706.

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राजभाषा संबंधी निरीक्षण

सुपारी और मसाला विकास निदेशालय में राजभाषा हिंदी के प्रगामी प्रयोग की स्थिति का जायजा लेने के लिए दिनांक 10–11–2020 को श्री. सुनील कुमार, निदेशक (राजभाषा), श्रीमती. गरिमा सिंह, कनिष्ठ अनुवाद अधिकारी और श्री. आशीष यादव, आशुलिपिक द्वारा राजभाषा संबंधी निरीक्षण किया गया।

निरीक्षण के दौरान निदेशालय के अनुभागों की पत्राचार से संबंधित फाइलों, राजभाषा अधिनियम 1963 की धारा 3(3) के अंतर्गत जारी कागज़ात, बैठकों की कार्यसूची और कार्यवृत्त, विज्ञापन और प्रचार पर किए गए व्यय, हिंदी में प्रवीणता प्राप्त अधिकारियों और कर्मचारियों द्वारा हिंदी में किए गए काम, हिंदी प्रशिक्षण की वर्तमान स्थिति और कंप्यूटर पर हिंदी में काम की समीक्षा की गई। इसके अलावा निरीक्षण के दौरान वेबसाइट और अन्य प्रचार सामग्रियों के द्विभाषीकरण की भी समीक्षा की गई।

निरीक्षण के बाद डॉ. होमी चेरियान, निदेशक की अध्यक्षता में चर्चा के लिए बैठक आयोजित की गई। बैठक में अधिकारियों के साथ चर्चा के पश्चात् श्री. सुनील कुमार, निदेशक (राजभाषा), ने निदेशालय में निरीक्षण के दौरान पाई गई कमियों पर विस्तार से चर्चा की और उन्हें सुधारने का सुझाव दिया।

निरीक्षण दल ने निदेशालय में लगाया गया राजभाषा प्रदर्शनी का दौरा किया।

श्री. सुनील कुमार, निदेशक (राजभाषा), और अन्य अधिकारियॉ डॉ. होमी चेरियान, राजभाषा अधिकारी एवं निदेशक, श्री. बाबुलाल मीणा, हिंदी अधिकारी एवं उप निदेशक और डॉ. पी.एन.ज्योति, कनिष्ठ अनुवादक के साथ राजभाषा प्रदर्शनी में।

Indian Journal of Arecanut, Spices & Medicinal Plants Vol. 22(4) : 44-46 (2020)

CULTIVATION OF MEDICINAL PLANTS FOR HEALTH AND PROSPERITY IN KASHMIR

T.H. Masoodi, S.A. Gangoo, Peerzada Ishtiyak and Khurshid Hussain*

Medicinal and Aromatic plants (MAPs) have a great ecological and socio-economic significance particularly for world's rural poor, and are used, consumed and traded by nearly 1.5 billion people around the globe. FAO estimates the contribution of NTFPs vis-à-vis Medicinal Plants at US$ 88 billion with an annual growth rate of 15 to 25%, and the demand is likely to increase more than US$ 5 trillion by 2050.

In Kashmir, medicinal plants are being used traditionally since ages to treat the different ailments afflicting humans and domestic animals. Wild collections of prominent species also contribute to the household income and livelihood security of rural communities; thereby play a significant role in the socio-economic development of millions of people. Kashmir valley cradled in the lap of Himalayas harbours a good number of valuable medicinal plants like *Sussurea lappa; Aconitum heterophylum* and *Podophyllum hexandrum* among others. However, the development of medicinal plant sector did not receive much attention till very recently. The over-exploitation of valuable species with inadequate attention towards sustainability caused severe threat to the existence of unique medicinal plants wealth of the valley. Out of 1178 traded species in India, around 700 are reported from the Kashmir Himalayan region. This emerging sector has a vast scope for providing required raw material for manufacturing plant based drugs and high-grade cosmetics having ever-increasing demand. Therefore, the sector is considered as commercially important for the region with a huge scope of income and employment generation.

On the other hand, the demand for high value MAPs has increased by 50%, while availability in the wild has decreased by 26 %. The increase in demand for medicinal plants has exhausted the natural resource base of these species, hence provides an opportunity for their large scale cultivation in and outside forests. While, some medicinal plants have been brought under cultivation, several species (about 95% extracted and traded from Kashmir) continues to be sourced from the forests, which has put the populations of several valuable species under different categories of threat. Therefore, cultivation (both *in-situ* and *ex-situ*) is not only vital for the conservation and sustainability of these species, production of uniform material, good income to farmers, opportunity for utilizing waste and unproductive lands, sustainable supply of raw materials but holds a promise of employment and economic prosperity in this least industrialised Himalayan region.

In-situ conservation is usually the preferred strategy for conserving medicinal plant pockets

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in their natural habitats. However it is important that *ex-situ* options are also taken up side by side in the conservation programme of medicinal plants. *Ex-situ* conservation involves the process of protecting endangered species and developing it outside its natural habitat. It involves production of quality growing stock, raising of nurseries, seedling supply, plantations and establishing medicinal plant gardens. The choice of species for *ex-situ* conservation is made on the basis of the current local importance of the species, economic value for the subsistence of local population, ecological and geographic considerations and capacity for natural regeneration and the current conservation status. There is an immense need of identifying high yielding germplasm of medicinal plant species for mass cultivation. In order to initiate systematic cultivation of medicinal plants, there is a need of mass production of planting material of important species. Cultivation of medicinal plants and eventual returns from such cultivation is largely dependent upon the quality of planting material used and expertise of the grower. In view of the above mentioned facts, Faculty of Forestry (FoF), SKUAST, Kashmir while recognising its potential and responsibility joined hands with DASD, Calicut to take forward the mission of training local youth for entrepreneurship development through cultivation and trade of Medicinal and Aromatic crops.

Faculty of Forestry (FoF), SKUAST, Kashmir has been significantly contributing to the society and the medicinal plants sector since 2007, through impeccable teaching and innovative research. FoF is also designing and conducting different training programmes for diverse strata of society like farmers, students and professionals from various line departments. It has facilitated various individuals in successful establishment of their entrepreneurships since last few years. Considering that many medicinal plants are critical for livelihood of millions of people, Faculty of Forestry, SKUAST, Kashmir has proactively channelized its resources for the development of this sector, and the 25 days training programme on "Medicinal Plants Grower" is one of those many efforts. The Directorate of Arecanut and Spices Development (DASD), Calicut sponsored second consecutive 25 days skill development training programme on "Medicinal Plants Grower" under MIDH was conducted at Faculty of Forestry, SKUAST, Kashmir from 18th February to 13th March, 2020.

This training programme is being conducted for unemployed youth of Kashmir to train and motivate them for taking up medicinal plants based entrepreneurships. During the last two years (2018-19 and 2019-20) this training programme has been generously supported by the DASD, Ministry of Agriculture and Farmers Welfare, Govt. of India, Calicut, Kerala and certified by Agriculture Skill Council of India. The 200 hours (Theory: 70 Hrs, and Practical: 130 Hrs) training is conducted as per the approved qualification packs (QPs) of ASCI and the training delivery plan developed by Faculty of Forestry, SKUAST, Kashmir. The participants are trained for different theoretical and practical aspects of medicinal plants cultivation, harvesting and post-harvest management, marketing, and health and safety practices at work place among others. The trainees are also taken to field exposure visits to relevant institutes and farmers'

field. A medicinal plant growing tool kit is given to the candidates for starting their own business units and till date around eight (8) trainees have registered with us, among whom three (3) candidates have successfully established their medicinal plants growing and trade units in different districts of Kashmir. These candidates are (i) Ms. Nusrat Amin of Safapora area Bandipora district (ii) Mr. Syed Mohammad Mustafa of Zadibal area of Srinagar District and (iii) Mr. Bilal Ahmad of Gund, Ganderbal district.

Ms. Nusrat Amin, a Post Graduate was looking for a job, when she saw an advertisement of our training programme on "Medicinal Plants Grower" in a local news paper. After successful completion of training, Nusrat started her own medicinal plants nursery on a two *Kanal* (*One Kanal is equal to 506 m^2 area - it is a local land measuring unit in Kashmir*) land at Safapora area of District Bandipora. She started with the production of planting material of *Rosmarinus officinalis* and is planning to switch over to commercial cultivation and production of Rosemary oil in future.

Mr. Syed Mohammad Mustafa was pursuing his MBA, when he heard about this training through a local news paper. He joined the training and after successful completion started with the cultivation of *Valeriana jatamansi* on a two *kanal* land. Mr. Mustafa is now expanding its commercial cultivation on another 12 *kanal* land in Budgam district of Kashmir. He aims at establishing a processing unit in future.

Mr. Bilal Ahmed who was a daily wage labourer had his own land of 5 *kanals* at Kangan Ganderbal. After successful completion of training at Faculty of Forestry, he started cultivating *Saussurea lappa* on same piece of land. He wants to expand his cultivation area in future.

We strongly believe that our little efforts will motivate more candidates in future to take up the medicinal plants cultivation, processing and trade as an entrepreneurship, therefore to contribute in the economic growth of the country and the pursuit to *Atmanirbhar Bharat.*

Glimpses of Skill Development Training on "Medicinal Plants Grower"

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XXXI ANNUAL WORKSHOP OF ICAR- AICRP ON SPICES

Sharon Aravind, K. S. Krishnamurthy, Santhosh J Eapen, E. Radha and John George*

The XXXI Workshop of ICAR-All India Coordinated Research Project on Spices (AICRPS) was conducted during 29-30 September, 2020 at ICAR- Indian Institute of Spices Research, Kozhikode through virtual platform. The workshop was inaugurated by Dr. R. Chandra Babu, Hon'ble Vice Chancellor, Kerala Agricultural University, Thrissur on 29 September, 2020. In his inaugural address, he emphasized on the necessity to facilitate adoption of technologies by the farming community and to develop climate resilient and high quality spice varieties with minimal pesticide residue so as to improve the export potential. Dr. A. K. Singh, Deputy Director General (Horticultural Science), Indian Council of Agricultural Research, New Delhi presided over the function. He pointed out the rise in export demand of spices at the global level despite the COVID-19 pandemic situation and urged the scientific community to utilize the opportunity to produce quality spices suitable for export market. Dr. Vikramaditya Pandey, Assistant Director General (Horticultural Science), ICAR, New Delhi was the Guest of Honour and he highlighted the various researchable issues related to spices and the need to work on problem solving mode to satisfy farmers, industry as well as consumers. Dr. Santhosh J Eapen, Project Coordinator, AICRPS welcomed the gathering. During the inaugural session the "Best AICRPS Centre Award 2019-20" was presented to AICRPS centre at IGKV, Raipur (Raigarh), Chhattisgarh. Ten booklets/pamphlets on spices production technologies in English and local languages from different AICRPS centres were released during the occasion. Also one video showcasing the activities of AICRPS centre at Pasighat, Arunachal Pradesh was released. Dr. Homey Cheriyan, Director, DASD, Kozhikode, Dr. Gopal Lal, Director, ICAR-NRC for Seed Spices, Ajmer and Dr. K. Nirmal Babu, Former Director, ICAR-IISR & Project Coordinator (Spices), Kozhikode offered felicitations. Dr. K. S. Krishnamurthy, Principal Scientist, ICAR- IISR, Kozhikode proposed the vote of thanks.

The workshop was organized in six Technical Sessions *viz.*, Genetic Resources and Crop Improvement, Crop Management, Crop Protection, Variety Release, Technology Transfer and Plenary Session. During the workshop, four varieties (1 ginger, 2 turmeric and 1 fenugreek) *viz.*, IISR Vajra (high quality bold and plumpy ginger variety by ICAR-IISR, Kozhikode), Lam Turmeric 1 (lemon yellow colour turmeric powder and high dry recovery by Dr. YSRHU, Guntur), Rajendra Haldi 1 (high yield and high curcumin turmeric variety by Dr. RPCAU, Dholi) and HM-257 (high yielding powdery mildew and downy mildew resistant fenugreek variety by CCSHAU, Hisar) were recommended for release. In addition, one technology on the management of insect pest of large cardamom using Spinosad (45 SC @

***All India Coordinated Research Project on Spices , ICAR-Indian Institute of Spices Research, Marikunnu, Kozhikode-673012, Kerala.**

0.3 ml L-1) or neem based oil (Azadirachtin 0.15% EC) 1500 ppm @ 3 ml L-1) was recommended under organic protection practice for large cardamom.

In the Plenary session of the XXXI Annual AICRPS workshop held on 30 September, 2020, Mr. D. Sathiyan IFS, Secretary, Spices Board, Kochi was the chairperson along with Dr. N. K. Krishna Kumar, Former DDG (Horticulture), ICAR, New Delhi. The Secretary, Spices Board suggested to undertake collaborative research programmes with ICAR institutes, SAUs, Spices Board, Directorate of Arecanut and Spices Development and other line departments with intervention of stakeholders to resolve problems encountered by the farming community. Dr. N. K. Krishna Kumar, Former DDG (Hort.), ICAR suggested to focus on protected cultivation and to strengthen the activities of AICRPS at Andaman and Nicobar islands and North eastern regions apart from strengthening research on frontier areas of research.

Glimpses of the workshop

New spice varieties recommended for release

IISR Vajra

Lam Turmeric 1 (LTS-2)

Rajendra Haldi 1

HM 257

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जीरा में समन्वित नाशीजीव प्रबंधन

अभिषेक शुक्ला *

जीरे (*क्यूमिनम सिमिनम*) का मसालों में मुख्य स्थान है। इसके दानों में पाये जाने वाले वाष्पशील तेल के कारण इसमें जायकेदार सुगंध आती है। इसी सुगंध के कारण जीरे का मसाले के रूप में उपयोग होता है। मसाले के रूप में जीरे का प्रयोग हर प्रकार की सब्जीयों, आचार, सूप व पनीर की सुवासित करने के लिये किया जाता है। जीरे में मूत्रवर्धक, वायुनाशक तथा अग्निदीपक गुण भी होते है जिसके कारण कई देशी तथा आयुर्वैदिक दवाओं में भी जीरे का उपयोग होता है। इन्हीं सभी गुणों के कारण से जीरे को एक महत्वपूर्ण मसाला फसल माना जाता है। जीरे के उत्पादन को अनेक कारक प्रभावित करते है इन्हीं में कीटो–रोगों का प्रकोप भी बहुत ही महत्वपूर्ण है इससे न केवल जीरे का उत्पादन प्रभवित होता है बल्कि उसकी गुणवता (Quality) पर भी विपरीत असर पड़ता है जिससे अंततः किसान को भारी नुकसान उठाना पड़ता है। प्रस्तुत लेख में जीरे को प्रकोपित करने वाले कीटो–रोगों के समन्वित प्रबंधन के विषय में सविस्तार जानकारी दी जा रही है जो कि किसानों के लियें उपयोगी सिद्ध होगी।

मुख्य नाशीजीव

(अ) राष्ट्रीय महत्व के नाशीजीव

- **कीट :–**

मोयला – *मायजस पर्सीकी, ब्रेविकोर्न ब्रेसीकी, एफीस गोसीपी* आदि
थ्रिप्स – थ्रिप्स टेबेसाई

- **रोग :–**

उखठा – *फयूजेरीयम ऑक्स्पोरीयम*
झुलसा – *अलटरनेरीया बर्नसी*
पाउडरी मिल्डयू – *इरीसाइफे पोलीगोनी*

(ब) क्षेत्रीय महत्व के नाशीजीव

- **कीट :–**

पत्ते खाने वाली सूंडी – *स्पोडोप्टेरा लिटुरा*
कटुआ सूंडी – *एग्रोटीस प्रजाति*
फुदका – *एमरास्का बिगटूला*
सिगरेट भृंग : *लेसोडर्मा सीरेटस*
औषधीय भृंग : *स्टेगोबीयम* प्रजाति

- **भूरी माईट –** *पेट्रोबीया लेटेन्स*
- **सूत्रकृमि :**

जड़गाठ सूत्रकृमि : *मेलेडोगायनी* प्रजाति

नाशीजीव निगरानी :

निगरानी का मुख्य उद्देश्य खेतों में नाशीजीवों के प्रारंभिक विकास के बारे में, उनकी उपस्थिति तथा भविष्य में होने वाले नुकसान का अनुमान लगाने से है इसी के साथ खेत में जैविक नियंत्रण कारकों की उपस्थिति का पता लगाना तथा उनका उपयोग नाशीजीवों के नियंत्रण में भली–भांति करने से भी है।

(अ) रेपिड़–रोविग सर्वे :– एक निश्चित रास्ते पर सर्वे दल को कीटों व रोगों की साप्ताहिक निगरानी रखनी चाहिए। कीट रोगों की उपस्थिति के साथ–साथ प्राकृतिक शत्रुओं की उपस्थिति की भी जानकारी रखनी चाहिए। इससे कीटों–रोगों का पूर्वानुमान लगाने में बहुत अधिक मदद मिलती है। कीट–रोगों तथा प्राकृतिक शत्रुओं की उपस्थिति के सभी रिकॉर्ड रखने बहुत आवश्यक है। एफिड की जनसंख्या को 30 पौधे (100 पत्तीयों) पर रिकॉर्ड करनी चाहिए। प्रत्येका 10 कि.मी. के बाद खेतों का चयन करना चाहिए।

(आ) फील्ड स्काउटिंग :– कीटों की आर्थिक क्षम्य (ETL) को ज्ञात करने के लिये साप्ताहिक अन्तराल पर फील्ड–स्काउटिंग करनी भी अत्यंत ही आवश्यक होती है। रस चूसने वाले कीटों की संख्या ज्ञात करने के लिये प्रति पौधा तीन पत्तियों (ऊपरी. मध्य तथा नीचे वाली) को देखना चाहिये। ऐसी तरह से कटुआ सुंडी तथा पत्तियों को खाने वाले कीटों के नुकसान को जानने के लिये कुल पौधे तथा क्षतिग्रस्त पौधों को गिन

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कर प्रतिशत नुकसान का अनुमान लगाया जा सकता है। जब वातावरणीय अवस्थाओं जैसे कि अधिक नमी, रूक–रूक कर बरसात होना, आदि हो तब खेतों में कीट संख्या की निगरानी करना अत्यंत ही जरूरी होता है।

(इ) एग्रे–इकोसिस्टम एनेलेसिस (AES) :– साप्ताहिक सर्वेक्षण के आधार पर कीटों की आर्थिक क्षम्य मान तथा प्राकृतिक शत्रुओं की संख्या क सही–सही अनुमान लगाया जा सकता है तथा ऐसी के आधार पर प्रसार कार्यकर्ता किसानों को इनके सही नियंत्रण हेतु आवश्यक कार्यवाही करने के लिये कह सकते है।

(ई) पीले चिपचिपे ट्रेप से कीट निगरानी :– मोयले/सफ़ेद मक्खी की निगरानी के लिये पीले चिपचिपे ट्रेप @ 10 ट्रेप प्रति हेक्टेयर के हिसाब से लगाने चाहिए। इसके लिये स्थानिक तौर पर उपलब्ध पीले टीन पर ग्रीस अथवा वेसलीन का लेप लगा कर उन्हें खेतों में लगाना चाहिए। इससे भी रस चूसने वाले कीटों की निगरानी में मदद मिलेगी।

जीरे में समन्वित नाशीजीव प्रबंधन रणनीति :–

जीरे में विभिन्न विधियों को अपना कर नाशीकीटों का प्रबंधन करा जाता है जो निम्न्न प्रकार से है –

(1) **कर्षण क्रियाएँ :–**

(क) गर्मी के मौसम में खेत की गहरी जुताई करनी चाहिए। इससे कीट/रोग की विभिन्न अवस्थाएं जमीन के ऊपर आ जाती है तथा सूर्य की तेज़ रोशनी तथा गर्मी से नष्ट हो जाती है।

(ख) भूमि का प्लास्टिक की शीट से सौलरीकरण करने से भूमि में उपस्थित कीट, रोग तथा सूत्रकृमि आदि भी समाप्त हो जाते है।

(ग) फसल–चक्र अपनाने चाहिए तथा इसमें चवला–जीरा, चवला–गेहूं–जीरा तथा चवला–सरसों–जीरा अथवा बाजरा/ज्वार को फसल चक्र में शामिल करना चाहिये जिससे कीट रोगों के प्रकोप में कमी लाई जा सके।

(घ) हमेशा रोगरहित स्वस्थ बीजों को बुवाई के लिये काम में लेना चाहिए।

(ड) सदैव जीरे की कीट रोग सहिष्णु/प्रतिरोधक किस्मों का प्रयोग करें (*तालिका–क)*

(च) पाउडरी मिल्डयू रोग की तीव्रता को कम करने के लिये हमेशा फसल को सही समय पर बोना चाहिये तथा फसल की देरी से बुवाई नहीं करनी चाहिये।

(छ) सदैव ऐसी जमीन में जीरे की खेती करनी चाहिये जहां पर जल निकासी की सही व्यवस्था हो।

(ज) जरूरत से अधिक पानी देने से बचना चाहिए इससे उखटा (Wilt)रोग के प्रकोप में कमी लाई जा सकती है।

(झ) बीज बनते समय खेतो में पानी नहीं देना चाहिए।

(ञ) बादल तथा अधिक आद्रता युक्त मौसम में खेतों में पानी देने से बचना चाहिए।

(ट) खेतों में जैविक पदार्थ जैसे कि अरंडी या नीम की खली को 2–3 टन/हेक्टेयर के हिसाब से देना

तालिका –क : जीरे की कीट रोग प्रतिरोधक किस्में

क्रम संख्या	किस्म	रोग/कीट के प्रति सहिष्णु/प्रतिरोधक
1.	गुजरात जीरा–1	उखठा, झुलसा, पाउडरी मिल्डयू
2.	गुजरात जीरा–2	उखठा, झुलसा, पाउडरी मिल्डयू के प्रति सहिष्णु
3.	गुजरात जीरा–3	उखठा
4.	यू.एस.– 60	उखठा
5.	यू.सी.– 41	उखठा
6.	एम.सी.–43	उखठा, झुलसा, मोयला
7.	एम.सी.–43–47	उखठा, पाउडरी मिल्डयू
8.	आर.जेड.–19	उखठा, झुलसा, पाउडरी मिल्डयू
9.	एस.–404	पाउडरी मिल्डयू
10.	आर.जेड.–209	उखठा, झुलसा के प्रति सहिष्णु
11.	यू.सी.–198	अखठा, झुसा
12.	आर.एस.–1	उखठा, झुलसा, पाउडरी मिल्डयू के प्रति सहिष्णु

चाहिए।

(ठ) पूर्ण रूप से परिपक्व फसल को काटने में देरी नहीं करनी चाहिए।

(ड) भंडारण के दौरान सिगरेट भृंग तथा ओषधिय भृंग के प्रकोप को रोकने के लिये जीरे का भण्डारण उसकी पर्याप्त नमी के आधार पर ही करना चाहिए।

(2) **यांत्रिक नियन्त्रण :–**

(अ) कीट–रोग ग्रस्त पौधों तथा उनके भागों को तोड़ कर नष्ट कर दें।

(ब) कटुआ कीट तथा पत्तियों को खाने वाली सुन्डीयों को सुबह के समय हाथों से एकत्र करके नष्ट कर दें।

(3) **जैविक नियन्त्रण :–**

(अ) बीजों को बुवाई से पूर्व ट्राईकोडर्मा हर्ज़ेनियम या ट्रा. विरीडी @ 4 ग्राम/कि.ग्रा. बीज की दर दे उपचारित करके बोयें।

(ब) खेतों में परभक्षी कीटों जैसे लेडी बर्ड भृंग, क्रायसोपा तथा सिर्फिड मक्खी व परजीवी *ट्राईकोग्रामा* आदि का संरक्षण तथा संवर्धन करें।

(स) मोयला तथा अन्य रस चूसक कीटों के नियंत्रण के लिये *कोक्सीनेला सेप्टमपकटाटा* @ 5000 भृंग प्रति हेक्टेयर की दर से छोडे.।

(द) नुकसानदायक कीटों की सुंडीयों तथा पतंगों का शिकार करने के लिये परभक्षी पक्षीयों के खेतों में बैठने की व्यवस्था @10–15 प्रति हेक्टेयर के हिसाब से करें।

(य) शाम के समय पर एच.एन.पी.वी. @ 250 एल.ई/है. की दर से छिडकाव करें जिससे कि *हेलीकोवर्पा* की संख्या में कमी लाई जा सकती है।

(4) **रासायनिक नियन्त्रण :–**

(अ) बीज को बोने से पूर्व करबेन्डाजिम @ 2 ग्राम/कि. ग्राम. बीज की दर से उपचारित करके बोयें।

(ब) खेतों में रस चूसक कीटों के प्रबंधन के लिये डाईमिथोएट (0.03%) का छिडकाव करे।

(स) यदि खेतों में पत्ती खाने वाले कीटों की संख्या अधिक हो तब इस का छिडकाव करें।

(द) नीम बीज सत 5% की छिडकाव करके भी कीटों की संख्या में कमी की जा सकती है।

(य) कीटनाशकों का घोल बनाते समय इसमें स्प्रेडर अथवा चिपकने वाले पदार्थ की 2–3 बुँदें अवश्य मिलावे।

जीरे में फसल की अवस्था के मुताबिक समन्वित नाशीजीव प्रबंधन

अवस्था	नाशीजीव	नाशीजीव प्रबंधन युक्ति
बुवाई से पुर्व	मृदाजन्य रोग	– ग्रीष्म कालीन गहरी जुताई – जमीन का सौलरीकरण – फसल चक्र अपनाना
बुवाई के समय	जमीन तथा बीज जन्य रोग कीट तथा सूत्रकृमि	– सदैव स्वस्थ तथा बढिया बीज का चुनाव करें। – जमीन में कार्बनिक सुधारकों को मिलावे जैसे कि सरसों, नीम अथवा अरंडी की खली @ 2–2.5 टन है। – कीट/रोगप्रतिरोधक किस्मों को बोने के लिये चुनना। – समय पर फसल की बुवाई करें। – बीज को बोने से पूर्व करबेन्डाजिम @ 2 ग्रीम/कि.ग्रा. बीज की दर से उपचारित करें।
वनस्पतिक (Vegetative) वृद्वि अवस्था के दौरान	रोगों का प्रकोप	– आवश्यकता से अधिक सिंचाई से बचें। – फसलों पर रोग के प्रकोप दिखने पर बुवाई के 30–40 दिनों बाद मेन्कोजेब 2% या कॉपर ओक्सीक्लोराईड @ 0.2% + नीम आधारित कीटनाशक दवा का छिडकाव करें।

	मोयले तथा अन्य रस चूसक कीट	– परभक्षी कीटों जैसे लेडी बर्ड भृंग, क्रायसोपा ताथा सिर्फिड मक्खी व परजीवी *ट्राईकोग्रामा* आदि से संरक्षण करें। – *कोक्सीनेला सेप्टमपकटाटा* @ 5000 भृंग प्रति हेक्टेयर की दर से छोडे.। – नीम बीज सत 5% का छिडकाव करें। – यदि जरूरत पडे. तो डाईमिथोएट (0.03%)का छिडकाव करें।
प्रजनन (Reproductive) अवस्था के दौरान	रोगों का प्रकोप	– आवश्यकता से अधिक सिंचाई से बचें। – फसलों पर रोग के प्रकोप दिखने पर बुवाई के 30–40 दिनों बाद मेन्कोजेब 0.2% या कॉपर ओक्सीक्लोराईड @ 0.2%+ नीम आधारित कीटनाशक दवा का छिडकाव करें।
	मोयले तथा अन्य रस चूसक कीट	– परभक्षी कीटों जैसे लेडी बर्ड भृंग, क्रायसोपा तथा सिर्फिड मक्खी व परजीवी *ट्राईकोग्रामा* आदि से संरक्षण करें। – *कोक्सीनेला सेप्टमपकटाटा* @ 5000 भृंग प्रति हेक्टेयर की दर से छोडे.। – नीम बीज सत 5 % का छिडकाव करें। – यदि जरूरत पडे. तो डाईमिथोएट (0.03%) का छिडकाव करें।
भंडारण के दौरान (Storage)	कीट तथा रोग	– सदैव जीरे का भंडारण उचित नमी रख करके जूट के बोरों में करें।

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सुपारी और मसाले के लिए जनवरी–मार्च, 2021 के कृषि कार्य

सुपारी

पौधशाला

- जनवरी में सुपारी के बीजों की लभ्यता के अनुसार पूरे साल सिंचित स्थितियों में रखे गए बागों में अंकुरण नहीं हुए तो उनमें पुनः रोपाई की जा सकती है। 3 महीने की आयुवाली पौदों को प्राथमिक नर्सरी से द्वितीय नर्सरी या पॉली बैगों में पुनः रोपाई करें। द्वितीय नर्सरी में क्यारियॉ 150 से.मी. चौडाई, 15 से.मी. ऊॅचाई और सुविधानुसार लंबाई में बनाया जाए। पौदों की प्रतिरोपाई करते समय 30–45 से.मी. की दूरी होनी चाहिए।

- द्वितीय नर्सरी में आधार खुराक के रूप में सडे हुए गोबर की खाद 5 टन प्रति हेक्टर की दर से प्रयोग करें। होस/स्प्रिग्लर/फाइन मिस्टिंग से क्यारियों में रोज सिंचाई करें।

- नियमित रूप से निराई करें और दुर्बल पोधों को हटाए।

- पौधशाला में छॉव जाल/सुपारी के पत्तें/प्लेटड नारियल पत्तों से छॉव दें और छॉव जाल को ठीक स्थान पर रखने के लिए नियनित निगरानी करें।

- पौधशाला में रखे पाइपों और खंभों में पड़ने से बचने के लिए जालों को चुस्ती से बॉध लें।

- मार्च के दौरान पौधशाला के पूरे भाग को इस तरह ढॅक लें ताकि हल्का धूप मिल सकें।

नया बाग

- हर पेड़ को 20 लीटर प्रतिदिन की दर से 5 दिनों में एक बार होस सिंचाई या रोज़ ड्रिप सिंचाई करें।

- यदि तरूण पौदों को छॉव देने के लिए रखे गए नारियल पत्ते सड़ गए या नष्ट हुए तो नए सामग्रियों से छॉव देना चाहिए।

- खरपतवार निकालने के बाद काटे गए खरपतवार और पत्तों को कतारों के बीच के ऊसर मिट्टि में बिखरा दें ताकि ये पल्वार के रूप में काफी लाभप्रद होगा, साथ ही मिट्टि की जैविक क्षमता में वृद्वि भी हो जाएगी। नए बागों में प्रति कि.ग्रा. गोबर खाद के साथ हरे पत्ते या कॉयर खाद से पल्वार करने से गर्मी के मौसम में बागों में नमी का संरक्षण कर सकता है और मिट्टी की भौतिक गुणों में वृद्वि लाई जा सकती है।

- मिट्टि तथा नमी के अनुरक्षण के लिए कोंटूर बंटिंग, टेरासिंग आदि उपायों को अपनाया जा सकता है।

- केले और अन्य छायेदार पेड़ों को अंतराफसल के रूप में लगाकर सूर्यताप से बचा लें। *काजुरीना* या *ग्लिरिसिडिया* को भी सीमा में छॉव के लिए और हवा से बचाने के लिए लगाया जा सकता है।

पुराना बाग

जनवरी के दौरान पके बेरियों की तुड़ाई और सुखाना जारी रखा जाए। सूखे नटों के छिलका निकालना और श्रेणीकरण करें। पश्चिमी तटों में फरवरी के सूखे मौसम में अच्छी बढ़ोत्तरी एवं उपज मिलने के लिए 6 दिनों में एक बार की दर से बागों में सिंचाई करें। पानी की किफायती प्रयोग के लिए ड्रिप सिंचाई करें। 4 से 7 दिनों में एक बार 175 लीटर पानी की दर से होस सिंचाई करें। ड्रिप सिंचाई के द्वारा 20 लीटर पानी प्रति पेड़ प्रति दिन दिया जा सकता है। सिंचित बागों में 50 ग्राम नत्रजन, 70 ग्राम पोटाश और 20 ग्राम फोसफोरस प्रति ताड़ की दर पर उर्वरकों का प्रयोग करें।

सुपारी के बागों को दक्षिण–पश्चिम धूप के दुष्प्रभाव से संरक्षण के लिए तने के हरे भाग को सूखे पत्तों या पत्तियों से और अपारदर्शी पॉलिथीन कवर से ढॅक लें या चूने का लेपन करें। पेड़ों के आधार में जैविक पल्वार, हरे या सूखे जंगली पत्ते, सूपारी पत्तियॉ आदि से पल्वार करने से मिट्टी की नमी बनायी रखी जा सकती है और मिट्टी को हल्के खोदने से वायु संचार और पानी के अवशोषण में वृद्वि होगी। गुच्छों में डाइबैक देखा जाए तो इसका नियंत्रण करें।

सामान्यत : गर्मी के महीनों में कीटों का आक्रमण अधिक होगा, इसलिए निगरानी करना बहुत महत्वपूर्ण है। माइट और पुष्पक्रम सूँडियों का नियंत्रण किया जाए। सुपारी के पेड, विशेषकर खुले बागों में होनेवाले, माईट का आक्रमण का शिकार होते हैं।

स्पिंडल बग का आक्रमण मुकुट के अविकसित पत्तों में काली रेखाओं के रूप में देखा जा सकता हैं। संक्रमित क्षेत्रों के सुपारी पेड़ों के स्पिंडिल में डिमेथोयेट (रोगर 30 ई सी) 15 मि.लि प्रति 10 लिटर पानी की दर पर छिड़कने से इस कीट को प्रभावपूर्ण ढंग से रोका जा सकता है। दिन के धूप के घंटों को छोड़कर, बहुत महीन छिड़काव करना चाहिए।

माइट्स के आक्रमण को रोकने के लिए पत्तियों के निचले सतह पर डाइमेथोएट (रोगर 30 ई सी) 1.5 मि.लि. प्रति लीटर पानी की दर पर छिड़कना चाहिए। यदि कीटों का संक्रमण फिर भी देखा जाएँ तो, 15-20 दिनों के अंतराल में छिड़काव दुहराया जाएँ। कई कोलियोप्टीरन कोक्सिनेल्लिड्स माईट को खा लेते हैं।

मसाले

काली मिर्च

पौधशाला

पोट्टिंग मिश्रण तैयार करके 30-45 दिनों तक सौरीकरण के लिए रखें। सौरीकृत पोट्टिंग मिश्रण को मिट्टी संदूषण से बचाने के लिए जैवीक नियंत्रण एजेंट यानी *ट्राइकोडेर्मा हर्जियानम* या टी.विरिडे (1ग्राम प्रति कि.ग्रा.पोट्टिंग मिश्रण की दर से), *स्यूडोमोनास फ्लूरोसेन्स* (स्ट्रेयिन पी 1) (20 ग्राम 1 लिटर पानी में विलीन करें और 50 मि लीटर प्रति कि.ग्रा.पोट्टिंग मिश्रण), वी ए एम / ए एम एफ (100सीसी प्रति कि.ग्रा.पोट्टिंग मिश्रण) से मिला देना चाहिए (जैवीक नियंत्रण एजेंट को नर्सरी मिश्रण से मिला दें, यद्यपि सौरीकृत नहीं किया गया है)।

15X10 से. मी. के आकार वाले पोली बैगों (काफी छिद्र सहित) में उपचारित नर्सरी मिश्रण भरा दें। मुख्य बेलों से भूस्तारियों को हटाकर रखें। ज़्यादा कोमल या ज़्यादा कठोर बेलों को मत लें। इन भूस्तारियों को दो या तीन गॉठों के साथ काटा जाना चाहिए। यदि इनके साथ पत्ते है तो, इन्हें निकालना चाहिए, और तना के साथ पत्ते का थोड़ा-सा डंठल भी रखें।काटे हुए बागों को स्यूडोमोनास (250 ग्राम 750 मि.ली.

पानी में) 20 मिनट तक रखना चाहिए। उपचारित गाँठों को एक बैग में 3-5 की दर से लगाया जाए और 20 मिनट तक मिस्ट चेंबर में ऊष्मायित करें। जब गॉठें अंकुरण शुरू होता है, इन्हें मिस्ट चेंबर से बाहर निकालें।

इनमें अमुकुलित या रोग संक्रमित गाँठों को हटा दें । निम्न तापमान और उच्च नमी को बनाए रखने के अनुकूल तरीके से सिंचाई करें। एक पक्ष के अंतराल में पौधों को *स्यूडोमोनास फ्लूरोसेन्स* 2%(स्ट्रेप्टोसाइक्लिन पी 1या ऐ ऐ एस आर -6) का छिड़काव करके उपचार करें। मीली बग से संक्रमित गाँठों को क्लोरपाइरिफोस 0.075% से उपचारित करें। यदि गोल थ्रिप्स या स्केल कीट देखा जाए तो डाइमेथोएट(0.05%) का छिड़काव करें। यदि फाइटोफ्तोरा रोग देखा जाए तो पोटासियम फोस्फोनेट 0.3% या मेटालाक्सिल मैंकोज़ेब 0.125% (1.25 ग्राम प्रति लीटर) का छिड़काव पाक्षिक अंतराल में करें। पत्तों में एकांतर रूप से 1% बोर्डो मिश्रण और 0.2% कोप्पर ओक्सीक्लोराइड छिड़का दें। रोग के फैलाव को रोकने के लिए रोग संक्रमित बैगों को हटा दें। पौधे परजीवी निमेटोड से होने वाले जड़ रोग संक्रमण (जड़ गलन) के परिणामस्वरूप पौधों की वृद्वि खराब होकर पत्तियॉ पीले हो जाती है और कभी–कभी जड़ कलमों के पत्तियों में अंतःशिरा क्लोरोसिस होती है। इसके निवारक उपाय के रूप में, नर्सरी मिश्रण को 1–2 ग्राम/कि. ग्रा. मिट्टी, सब्सट्रेट के प्रति ग्राम 10^6 सीएफयू कवक युक्त उत्पाद वाले टाल्क आधरित जैविक नियंत्रण एजेंट जैसे, पोचोनिया क्लामिडोस्पोरिया, ट्राइकोडेर्मा हर्जियानम से उपचारित किया जा सकता है। रोग संक्रमण के लिए नर्सरी को नियमित रूप से जॉच करें। यदि कुछ है तो, ऐसे तीव्र संक्रमित बैगों को नर्सरी से हटाना चाहिए। रोपाई के समय नीम खली 1 कि.ग्रा./गड्ढे की दर पर प्रयोग करने से भी निमेटोड संक्रमण को रोका जा सकता है।

बाग

बेलों के बीच वाली जगहों में और आधार भागों में निराई करें और सूखे पत्तों से पल्वार करें। पुराने पौधों से ढंकने वाले बेलों को हटा दें।

तरुण बेलों को सूख जाने से बचाने के लिए ढ़ँक लें। फाईल्लोडी और स्टंट (वाइरल) रोग का निरीक्षण करें और संक्रमित पौधों को हटा दें।

परिपक्वता के निशानी के रूप में जब बेल के एक या दो फल हरे रंग से नारंगी या लाल रंग के हो जाएगा, तब तुड़ाई शुरू करें। काली मिर्च को सुखाने केलिए हमेशा साफ-सुथरे माध्यमों को अपनाना चाहिए यानी, हाथ से या यांत्रिक थ्रेषर से बेरियों को अलग कर दें । साफ़ उपज मिलने के लिए क्रान्क्रीट की स्वच्छ ज़मीन, बाँस की चटाई या पॉलिथीन शीट पर बिछाकर सुखाना चाहिए ।

नया बाग

काली मिर्च बेलों को चढ़ाने के लिए अप्रैल माह में मुरिक्क् (*एरित्रीना वरीगेटा*) कारायम या किलिंजिल (*गरुगा पिन्नेट्टा*), ऐलान्थस स्पी., *ग्लिरीसीडिया* स्पी. कटहल का पेड़ आदि को आधारी पेड़ों के रूप में रोपित करें। ऊँची इलाकों में दलाप (*ई.लिथोस्पेर्मा*) और सिल्वर ओक (*ग्रेविल्लिया रोबस्टा*) को सहारे वाले पेड़ों के रूप में उगाया जा सकता है। जहॉ गाल वास्प देखा जाता हैं वहॉ एरित्रीना सुबुमब्रान्स आधार पेड़ के रूप में उपयोग करें। आधारों को मिट्टी में दृढ़ रखने के लिए मिट्टी को अच्छी तरह से दबाया जाना चाहिए। काली मिर्च की रोपाई करने के 2-3 वर्ष पहले शिल्वर ऑक और कटहल के पौदों की रोपाई करें। समतल में 3 x 3 मीटर की जगह दें। आधारों के पौदों को 40–50 से.मी.गहरी छोटे छेदों में रोपाई करें। ढ़लान में पौधों के बीच में 2 मीटर और कतारों में 4 मीटर की जगह दें। मानसून शुरू होने तक सहारे वाले पेडों की सिंचाई करें।

अदरक

परिपक्वता की निशानी देखते ही अदरक की कटाई करें। बीज सामग्री के रूप में उपयोग करने के लिए पहले से चिह्नित पौधों की कटाई अलग से करना चाहिए।

आवश्यकतानुसार बीज सामग्री के लिए रोगमुक्त मोटी प्रकन्दों को चुनना चाहिए । चुनी हुई प्रकन्दों को मृदु गलन रोग से बचाने केलिए रोगनिवारण उपाय के रूप मे सर्वप्रथम डाइथेन एम-45, 3 ग्राम प्रति लिटर पानी की दर से या बाविस्टिन 2 ग्राम प्रति लीटर पानी में 30 मिनट तक उपचारित करना चाहिए । यदि बीज प्रकन्द राइजोम स्केल से प्रभावित है तो उसे भी 0.05% मालथयोन या डिमेथोएट से उपचारित करना चाहिए। सतह की आर्द्रता को हटाने के बाद बीज प्रकन्दों को 10-15 से.मी.गहरे गड्ढों में सुविधानुसार खुले रूप में रखकर लकडी के तख्तों से ढँकना चाहिए। हवा आने जाने केलिए तख्तों में एक छोटा छेद रखना चाहिए और शेष भाग पर मिट्टी से लेप कर देना चाहिए ।

हल्दी

खेती के सभी मुख्य केन्द्रों में कटाई जारी रहेगी। हल्दी में आकर्षक रंग एवं विशेष गंध लाने के लिए कच्ची हल्दी की ताज़ा खोदी गई राइजोम संसाधित करना ज़रूरी है। अधिकतम सूखी हल्दी प्राप्त करने के लिए 37 हफ्तों की परिपक्वता पर कटाई करना लाभप्रद होगा । लेकिन मूल्य वर्धित उत्पादों के द्वारा आर्थिक लाभ प्राप्त करने के लिए 29 हफ्तों की परिपक्वता के बाद हल्दी की कटाई की जा सकती है। छोटी प्रकन्दें और बल्बें साफ पानी में झाग और सफेद धुआँ आने तक (विशेष गंध के साथ) अलग अलग उबालना चाहिए। इसके बाद 10-15 दिनों तक इन्हें धूप में शुष्क एवं कड़ा होने तक सुखाना चाहिए।

बीज सामग्री के लिए सुविकसित, स्वस्थ एवं रोगमुक्त प्रकन्दों को चुन लेना चाहिए । इन प्रकन्दों को कोप्पर ओक्सीक्लोराइड से उपचारित करके अगले बुआई मौसम तक शीतल एवं सूखी जगह पर रखना चाहिए।

मिर्च

काली मिट्टी में 20-25 दिनों और लाल दुमट मिट्टी में 7-15 दिनों के अंतराल में सिंचाई करना चाहिए । फल-वेधकों के नियंत्रण के लिए (*स्पोडोप्टीरा लिट्चूरा, हीलियोतिस एर्मिजेरा*) फेरोमोन ट्राप के ल्यूर को बदलना चाहिए। बागों की सीमा में सूर्यकांति पौधों की रोपाई करने से ओविपोसिटिंग मोत जैसे कीटों को आकर्षित करके मुख्य फसलों को रोग संक्रमण से बचाया जा सकता है। विषैले बेइट (bait) 8:1:1 चोकर, जागरी और क्लोरीपाइरीफोस (25 कि ग्रा प्रति हेक्टर की दर से) पौधों के पास रखने से आप्रवासी स्पोडोप्टीरा सूँडियों को नियंत्रित करने में प्रभावपूर्ण सिद्ध हुआ है। फल-वेधकों के संक्रमण की प्राथमिक अवस्था में *बासिल्लस तुरिन्जिएन्सिस(बीटी)* का छिड़काव पत्तों में करें (उदाहरण के लिए दिपल का प्रयोग 4 मि.लीटर प्रति लीटर की दर से या एक लीटर प्रति हेक्टर की दर से छिड़का दें)। रोग की फैलाव की स्थिति में इन्डोक्साकार्ब 1 मि.लीटर प्रति लीटर या स्पिनोसाड 0.3 मि.लीटर प्रति लीटर की दर से छिड़काव करना प्रभावपूर्ण है। रोग संक्रमण की प्राथमिक अवस्था में स्पोडोप्टीरा और हेलीकोवेर्पा के लिए न्यूक्लियार पोलीहेड्रोसिस वाइरस (NPV) 500 LE प्रति हेक्टर से प्रयोग करना प्रभावपूर्ण है।

डाइ- बैक और फल गलन को नियंत्रित रखने के लिए 1.5 ग्राम काप्तान या 2.5 ग्राम मेंकोज़ेब या कोप्पर ओक्सीक्लोराइड 3 ग्राम प्रति लीटर पानी की दर से छिड़कना चाहिए । 10-15 दिनों तक धूप में रखने के बाद मिर्च की पहली तुड़ाई की जानी चाहिए। खुली जगहों पर बिछाने से संदूषण/ रंग फीके पड़

जाने की संभावना है। इससे बचने के लिए यांत्रिक मिर्च ड्रायर / सोलार मिर्च ड्रायर का उपयोग करें। हमेशा पोलिथीन शीट या साफ सूखे हुए फर्श पर सुखाना चाहिए। सूखे फलियों को 8-10% तक की नमी में रखना चाहिए।

वृक्ष मसाले

जायफल और लौंग के लिए नियमित सिंचाई करनी चाहिए और इसका सख्त पालन करना चाहिए। तरुण पौधों को घूप से बचाने के लिए पर्याप्त छाया करनी चाहिए । लौंग और जायफल की फसलों की तुड़ाई और सुखाई जारी रखी जाए।

वानिला

मौसम और आवश्यकता के अनुसार सिंचाई जारी रखी जाए। हमेशा कार्बनिक सामग्रियों से पल्वार करना चाहिए। जहाँ आवश्यक हो, बेलों को सहारे वाले पेड़ों से बाँधना चाहिए। पुष्पण के दिनों में सुबह 6 बजे से 1बजे तक कुशल कारीगरों से परागण कराना चाहिए। यदि स्लग और घोंधे पौधों को नुकसान पहुँचाते तो हाथ से पकड़कर नष्ट करना चाहिए। इसके लिए गीला थैलियाँ नीचे बिछाना चाहिए इससे दिन में ये कीट इसके नीचे रहेंगे। नारियल के छिल्के से पलवार नहीं करना चाहिए क्योंकि इसके अंदर रहकर ये कीट बेलों को नुकसान पहुँचाएँगे। आसानी से सड़नेवाली सामग्रियों से पतला पलवार करना चाहिए। वानिला क्यारियों के अंदर मुर्गियों का प्रवेश बंद करें क्योंकि वे पल्वार सामग्रि को खरोचकर जडों को नुकसान पहुँचाएँगे।

यदि प्ररोहाग्र सड़न या पुष्पसमूह सड़न देखा जाए तो इसके फैलाव को रोकने के लिए बेलों पर 0.2% कार्बन्डाजिम का छिड़काव करें। वाइरल संक्रमण की निशानी वाली बेलों को तुरंत ही हटाकर नष्ट करना चाहिए। कटाई जारी रखी जाएगी। गुणवत्तावाली सूखी बीन्स प्राप्त करने के लिए बीन के पतले अग्र भाग पर हल्के पीले रंग आने पर कटाई करनी चाहिए ।

बीजीय मसाले

धनिया

रोपाई के 90–100 दिनों के बाद चौथी सिंचाई करें! रोपाई के 105–110 और 115–125 दिनों के बाद क्रमशः पॉचवीं और छठी सिंचाई करें। चूर्णीय फफूंद एवं एफिड के नियंत्रण के लिए सिफारिश किए गए कीटनाशियों/फफूँदनाशियों का प्रयोग करें।

जब कम से कम 50% बीज परिपक्व होकर भूसे रंग से पीले रंग में बदल जाते हैं, तब फसल की कटाई कर सकता है। कटे हुए फसल को इस तरह से बंडलों में रखा जाना चाहिए ताकि बीज पर सीधे धूप न पडे, जिससे इसके अच्छे रंग और सुगंध नष्ट होने से बचा सके। कटाई के बाद बीजों को छड़ी से हल्के धड़कन से और विनोयिंग से अलग किया जाता है।

सौंफ

मिट्टी में अनुकूल नमी नहीं है तो 15-20 दिनों के अंतराल में सिंचाई करनी चाहिए । रामुलेरिया ब्लाइट के नियंत्रण के लिए 0.2% मैन्कोजेब 75 w.p. या डाइथेन M-45 का 0.2% विलियन छिड़का दें। अच्छे प्रभाव के लिए 1मि.लीटर साबुन विलियन प्रति लीटर पानी की दर से छिड़का दें। आवश्यकतानुसार 10-15 दिनों के अंतराल में 2-3 बार छिड़काव करें। यदि एफिड का आक्रमण देखा जाए तो क्रमिक कीटनाशियों का छिड़काव करना चाहिए ।

फसल की अवधि 170–180 दिन है। सारे फल एक साथ नहीं परिपक्व होने के कारण आर्थिक पैदावार के लिए 10–15 दिनों के अंतराल में 4–5 बार तुड़ाई की जानी चाहिए। इसकी फलियॉ पूर्णतः परिपक्व होने से पहले, यानी फलगुच्छ का रंग हरीले पीत रंग हो जाने पर इसकी तुड़ाई की जा सकती है। कटे हुए फल,

खासकर हरे सौंफ के लिए काटे फल, अच्छी तरह से वातित परिस्थितियों में छाया में सुखाया जाए।

जीरा

दूसरे पक्ष में निराई करनी चाहिए और यदि मौसम सूखा है तो पौधों की सिंचाई करनी चाहिए। मौसम बादल से भरा हुआ है तो सिंचाई स्थगित करना चाहिए। चूर्णी फफूँद से बचाव केलिए 300 मेश सल्फर चूर्ण 25 किलो. ग्राम प्रति हेक्टेयर की दर से छिड़काव करना चाहिए या 15 दिनों के अंतराल में सुबह में 0.25% आर्द्र सल्फर (केरातेन) का छिड़काव करना चाहिए । एफिड्स के नियंत्रण के लिए 0.03% डाइमेथोएट (एक मि.ली.प्रति लीटर पानी की दर से) छिड़कना चाहिए । 20-25 दिनों के अंतराल में सिंचाई करनी चाहिए । 80–90 दिनों की परिपक्वता में फसल कटाई के लिए तैयार हो जाता है। बीजों को बिखरने से बचाने के लिए कटाई सुबह के समय में की जाए।

मेंथी : 20–25 दिनों के अंतराल में पौधों की सिंचाई करनी चाहिए। एफिड, थ्रिप्सस और जसिडों के नियंत्रण केलिए किसी भी प्रणालीगत कीटनाशक का छिड़काव करें। यदि आवश्यक है तो, 10–15 दिनों के बाद छिडकाव दुहराना चाहिए। जहाँ चूर्ण फफूँद देखें, इसके नियंत्रण केलिए 5% सल्फर चूर्ण 15 कि.ग्राम प्रति हेक्टर की दर से प्रयोग करें और रोमिल फफूँद के नियंत्रण के लिए 1% बोर्डो मिश्रण का छिडकाव करें। फसल की कटाई तब करें, जब फली पीली हो गई हों और निचली पत्तियॉ गलने लगी हों।

अजवाइन

1-2 बार जुताई के बाद 2 या 3 बार गुड़ाई करके पाटा चलाकर प्रतिरोपण के लिए मिट्टी तैयार करना चाहिए। प्रथम पखवाड़े में पौध का प्रतिरोपण करना चाहिए। मिट्टी तैयार करते समय 25-30 मेट्रिक टन गोबर की खाद प्रति हेक्टेयर की दर पर और प्रतिरोपण के पहले 40 कि.ग्राम नत्रजन, 40 कि.ग्राम फोसफोरस और 20 कि.ग्राम पोटाश प्रति हेक्टेयर की दर से मिला देना चाहिए। अच्छी तरह जड़ पकड़ने के लिए प्रतिरोपण के बाद पौध की सिंचाई करनी चाहिए। 15-20 दिनों के अंतराल में सिंचाई दोहरानी चाहिए। प्रतिरोपण के 20-25 दिनों के बाद पहली गुड़ाई की जानी चाहिए।

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FARM OPERATIONS FOR ARECANUT & SPICES JANUARY-MARCH, 2021

ARECANUT

Nursery

- Based on the availability of seed nuts, in January re-sowing can be done in ungerminated bags in nurseries, which are in operation throughout the year with water facilities. Sorting and repotting of 3 months old sprouts from primary nursery to secondary nursery or into poly bags. Secondary nursery beds of about 150 cm width, 15 cm height and with convenient length can be prepared and a spacing of 30-45 cm may be given for replanting sprouts.
- The secondary nursery should be given a basal dose of decomposed farmyard manure @ about 5 tonnes per ha. Watering daily through hose/sprinkler/fine misting.
- Regular weeding and removal of weak seedlings
- Overhead shade maintenance with shade net/thatched areca leaves/plaited coconut leaves may be provided in the nursery and regular supervision of shade net position should be done.
- Tie the nets tightly without bending over the permanent pipes and pillars in the nursery.
- During March the entire nursery area may be covered to allow filtered sunlight.

Young garden

- Hose irrigation may be given once in five days or drip irrigation on daily basis @ 20 litres/palm/day
- If the existing plaited coconut leaves provided as shade to young seedlings decomposed or damaged, replace with new one.
- After weeding, the cut weeds and palm leaves can be spread over the barren soil in between rows, which will act as mulching material and enrich the organic content of the soil. Mulching with green leaves/coir compost/5 kg FYM will conserve the moisture in the young garden during summer and enrich the physical properties of the soil.
- Measures such as contour bunding, terracing etc. can be taken up in sloppy lands for soil and moisture conservation.
- Shade management with intercropped banana and other shade trees in the borders to reduce the effect of sun. Casuarina and Glyricidia are also being grown in borders for shade and as wind breaks.

Old garden

During January harvesting and drying of ripe nuts may be continued. Also dehusking dry nuts and grading may be done. It is necessary to irrigate the garden during long dry spell in west coast once in 6 days during February for proper growth and yield. For efficient water

use, drip irrigation is recommended. Hose irrigation may be given once in 4 to 7 days at the rate of 175 litres of water per application. 20 litres of water/palm/day may be applied through drip irrigation system. In the irrigated gardens application of fertilizers to supply 50 gm N, 20 gm P_2O_5 and 70 gm K_2O per palm may be carried out.

South west side of arecanut garden may be protected from sun scorch by wrapping the green portions of the stem with dry areca leaves, leaf sheaths or opaque polythene film or painting with lime. Application of organic mulches, green/dried forest leaves, areca husk etc. to the base of the palm helps in conservation of soil moisture, loosening heavy soils, increasing aeration and water intake. Inflorescence die back may be noticed and controlled.

Generally, attack of pests will be more during summer months and so surveillance is very important. Control for mite and inflorescence caterpillar may be taken up. Arecanut palms particularly those under exposed conditions, may show symptoms of mite attack.

Incidence of spindle bug can be noticed on the newly unfurled leaves on the crowns as linear black streaks. Spraying the spindles of areca palms in infected areas with dimethoate (Rogor 30EC) 15 ml/10 L of water will effectively control pest. Very fine spraying must be done, avoiding the sunny hours of the day.

Against mite attack spray the under surface of leaves with Dimethoate (Rogor 30 EC) @ 1.5 ml/L of water. Repeat spraying at an interval of 15-20 days if there is recurrence of pest. Many Coleopteran coccinellids are predators against mites.

PEPPER

Nursery

Prepare the potting mixture and put for solarization for 30 to 45 days. Mix the solarized potting mixture with biocontrol agents *viz. Trichoderma harzianum* or *T. viride* (1 g per kg of nursery mixture), *Pseudomonas fluorescens* (Strain P1) (20 g dissolved in 1 litre water and 50 ml of this solution to be used for one kg of nursery mixture) and VAM/AMF (vesicular arbuscular mycorrhiza /arbuscular mycorrhizal fungi) @ 100 cc per kg of nursery mixture, *Pochonia chlamydosporia* (1-2 g/kg of nursery mixture). Such solarized nursery mixture mixed with above biocontrol agents would prevent root infection in the pepper cuttings. (The biocontrol agents can also be mixed with nursery mixture, even if it is not solarized).

Fill the polybags of size 15 x 10 cm (with enough perforations) with treated nursery mixture. Separate the runner shoots from the mother plant. Avoid using, too tender or too woody shoots. Cut the selected runner shoots into 2 to 3 node pieces. Leaves, if any are clipped off leaving a small portion of petiole on the stem. Treat the cuttings with cut ends dipped in *Pseudomonas* formulation (250 g in 750 ml water) for 20 minutes. Plant treated cuttings @ 3 to 5 per bag and incubate in mist chambers for 20 days. When cuttings start sprouting, they are taken out or removed from the mist chamber.

Remove unsprouted and infected cuttings, if any from the nursery. Water the plants at the required frequency so as to maintain low

temperature and high humid conditions. Spray and drench the plants at fortnightly interval with 2% *Pseudomonas fluorescens* (Strain P1 or IISR-6). Drench the infested bags with Chlorpyriphos 0.075%, if meal bugs damage is noticed. Spray with dimethoate (0.05%), if gall thrips or scale insects incidence is noticed. Spray with 0.3% Potassium phosphonate or Metalaxyl mancozeb 0.125% (1.25 g/litre) at fortnightly interval, if *Phytophthora* disease incidence is noticed. Alternatively spray the foliage with 1% Bordeaux mixture and drench with 0.2% copper oxychloride. Remove bags with infected cuttings to prevent spread of disease. Root infection (root rot) due to plant parasitic nematodes would result in poor growth, foliar yellowing and sometimes interveinal chlorosis of leaves of the rooted cuttings. As a preventive measure, nursery mixure may be fortified with talc based formulation of biocontrol agents such as *Pochonia chlamydosporia* or *Trichoderma harzianum* @ 1-2 g/kg of soil, the product containing 106 cfu fungus/g of substrate. Regularly check the nursery for nematode infection, if any, and remove such bags with severely infected cuttings from the nursery. Application of neem cake @ 1 Kg /Pit at the time of planting may also prevent nematode infestation.

Plantation

Undertake slash-weeding of the interspace and hand-weeding at the basins of the vines and mulch the basins with dry leaves. Remove hanging shoots in older plants.

Cover the young vines so as to prevent drying. Inspect and remove plants showing symptoms of phyllody and stunt diseases (viral).

Harvesting may be done by observing the right maturity as indicated by the colour change in one or two berries in a spike from green to orange or red. Always ensure threshing of pepper by hygienic means either manually or using mechanical pepper thresher. Use only clean floor made of concrete, bamboo mats or polythene sheet surface for drying to get clean produce.

New plantation

During the month of April, plant live standards like "Nadan Murikku" (*Erythrina variegata*), Karayam or Kilinhil (*Garuga pinnata*), *Ailanthus* sp., *Glyricidia* sp., Jack fruit tree etc. are suitable live standards / supports recommended for trailing pepper. In high altitude areas, Dadap (*Erythrina lithosperma*) and Silver oak (*Grevillea robusta*) can be successfully used as standards for pepper. *Erythrina subumbrans* may be used as standarad in areas where gall wasp is noticed. The soil should be well pressed to keep the standards firm in the soil. Seedlings of Silver oak, Jack etc. are to be planted 2-3 years before planting pepper. The spacing recommended is 3 x 3 m on plain lands. The cuttings of standards are to be planted in narrow holes of 40 to 50 cm depth. On sloppy land, 2 m between plants in rows across the slope and 4 m between rows. Irrigate the standards till the monsoon starts.

GINGER

Harvesting Ginger may be done after seeing the indication of maturity. Harvest the already marked plants separately for seed purpose.

Select plumpy rhizomes, free from disease as seed materials to the extent required. The

selected seed rhizomes are first treated with Dithane M-45 @ 3 g/L or Bavistin @ 2 g/L for 30 minutes as a prophylactic measure against soft rot disease. If the seed rhizomes are infested with rhizome scale they may also be treated with 0.05 % Malathion/Dimethoate. After draining the surface moisture the seed rhizomes are put loosely in pits of convenient size upto a height of 10 to 15 cm from the top and covered with wooden planks. A small hole is provided in the plank for aeration and the surface plastered with mud.

TURMERIC

Harvesting may be in progress in all the major centres of cultivation. Curing of raw turmeric rhizomes freshly dug out of earth is essential both for the development of an attractive yellow colour and characteristic aroma. For maximum recovery of dry turmeric, it is beneficial to harvest the rhizomes at about 37 weeks maturity, but for economic retrieval of the value-added products, rhizomes can be harvested at 29 weeks maturity. The fingers and bulbs are boiled separately in pure water until froth and white fumes appear in plenty and then they are drained and dried in the sun for 10-15 days until they become dry and hard.

Select well developed, healthy and disease free rhizomes for seed purpose. Treat the rhizomes in Copper oxychloride and store in cool dry place till the next sowing season.

CHILLI

Irrigate once in 20-25 days in black soils and once in 7 to 15 days in red loamy soils. Change the lure of pheromone traps for monitoring pod borers (Spodoptera litura, Heliothis armigera). Planting sunflower along the borders can attract ovipositing moths, thereby saving the main crop from infestation. Use of poison baits (8:1:1 bran, jaggery and chloripyriphos) and placing them close to the plants proved effective in controlling immigrating Spodoptera caterpillars (25 kg bait is sufficient for one ha). Foliar spray with Bacillus thuringiensis (Bt) at recommended dose (for example, a product such as dipel can be applied @ 4 ml/litre, ie, 1 litre/ha with power sprayer) at early stage of pod borer infestation can provide effective control. In case of epidemic situations, application of indoxacarb @ 1 ml per litre or spinosad @ 0.3 ml per litre will be effective. Also, for *Spodoptera* and *Helicoverpa*, application of nuclear polyhedrosis virus (NPV) @ 500 LE per ha at the early stage of the pest infestation proved to be an effective control.

Spray Captan 1.5 gm or Mancozeb 2.5 gm or Copper Oxychloride 3 gm/litre of water to control die-back and fruit rot disease. Start first picking of Chilli and then the produce is exposed to sun for 10-15 days. Spreading on open yards leads to contamination/ discoloration. To avoid this, use mechanical Chilli drier/Solar Chilli drier wherever possible. Always dry in polythene sheets/or clean drying yard. The moisture content of the dried pod is to be kept between 8-10 %.

TREE SPICES

Nutmeg and clove may require regular irrigation and has to be very scrupulously followed. Young plants may be given adequate protection from exposure to sun. Harvesting and curing of Clove and Nutmeg may be continued.

VANILLA

Irrigation to be continued based on weather condition and necessity. Always ensure adequate mulch material with organic debris. Tying of vines with the standard to be continued as and when required. Pollinate the flowers manually between 6 am to 1 pm on the day of flowering. If slugs and snails found damaging the vines, collect them manually and destroy. For this spread wet gunny sacks around the base as slugs and snails will come and hide inside the sack during day time. Avoid mulching with coconut husk as these insects may hide inside and damage the vines. Use only decomposable mulch and that too lightly. Always avoid the entry of chicken inside the vanillary as they may damage the roots by scratching the mulch materials.

If shoot tip rot or inflorescence rot is found spray the vines with 0.2 % Carbendazim to reduce the disease spread. Vanilla vines exhibiting any viral symptoms are to be immediately removed and destroyed. Continue harvesting. Harvest when light yellowing is observed at the distal end of the bean to ensure better quality of cured beans.

SEED SPICES

CORIANDER

Fourth irrigation may be given 90-100 days after sowing. Fifth and sixth irrigation should be given 105-110 days and 115-125 days after sowing respectively. To control the powdery mildew and aphids spraying of pesticides/ fungicides is recommended.

The crop can be harvested when 50 % of the seeds mature as indicated by the change of straw color to yellow and should be kept in bundles down in such a way to avoid direct sun rays on the seeds to get good colour and also to avoid loss of flavour. After drying the harvested material, the seeds are separated by light beating with stick and winnowing.

FENNEL

Crop may be irrigated at an interval of 15-20 days if optimum moisture is not available in the soil. To control Ramularia blight at the initial stage, spraying of 0.2 % Mancozeb 75 WP may be done or spraying of 0.2 % solution of Dithane-M-45 is effective to control this disease. Add 1 ml soap solution / litre of water for better efficacy. Subsequently, 2-3 sprayings should be done at an interval of 10 to 15 days on need basis. Spray any systemic insecticide to control aphid, if observed.

The duration of the crop is 170-180 days. All the fruits do not mature at a time and therefore resort to four to five harvestings at 10 to 15 days interval for economic yield. Harvesting must be done before the fruits are fully ripe, that is when the umbels attain a greenish yellow colour. The harvested umbels may be dried in the shade under well aerated conditions particularly for green fennel.

CUMIN

Weeding may be done and crop should be irrigated if clear weather condition prevails. Irrigation must be postponed if cloudy weather condition prevails. To control powdery mildew, dust 300 mesh Sulphur @ 25 kg/ha in early morning hours or spray wettable Sulphur (Kerathane) @ 0.25 % at 15 days interval. For the control of aphids, spray Dimethoate 0.03 %

(one ml. per litre of water). Irrigation may be followed at an interval of 20-25 days.

The crop will be ready for harvest in about 80 to 90 days maturity. Harvesting may be done in the early morning hours to prevent shattering of seeds.

FENUGREEK

Crop should be irrigated at an interval of 20-25 days. To control the aphid, thrips & jassids, spray any systemic insecticides. Repeat the spray after 10-15 days based on necessity. Powdery mildew wherever noticed may be controlled by dusting Sulphur @ 15 kg/ha and against downy mildew, spray Bordeaux mixture 1%. The crop should be harvested when the pods have become yellowish and lower leaves start shedding.

CELERY

Land should be prepared by 1-2 ploughings followed by 2 or 3 harrowing and planking for transplanting. Seedlings may be transplanted during first fortnight. 25-30 MT of FYM per ha is mixed in the soil at the time of land preparation and 40 kg Nitrogen, 40 kg Phosphorous and 20 kg Potash per ha applied as basal dose before transplanting. Seedlings may be irrigated after transplanting for better establishment. Irrigation may be repeated after 15-20 days interval. First intercultural operation/ hoeing should be done 20-25 days after transplanting.

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बाज़ार समीक्षा (जुलाई–सितंबर, 2020)

MARKET REVIEW (JULY TO SEPTEMBER, 2020)

सुपारी

समीक्षाधीन तिमाही के दौरान कोची और मैंगलोर बाज़ारों में सूखी सुपारी के भाव में स्थिरता का रूख दर्शाया। मैंगलोर में लेन–देन तुलनात्मक रूप से कम था और उपरोक्त अवधि के दौरान नई सुपारी का भाव 34,500 रूपए प्रति क्विंटल पर रहा। तलश्शेरी, कासरगोड और पनाजी बाज़ारों में सुपारी के भाव में बढ़ाव का रूख रहा। कासरगोड बाज़ार में पुरानी सुपारी का भाव 32,000 रूपए प्रति क्विंटल से 35,000 रूपए प्रति क्विंटल तक बढ़ गया।

काली मिर्च

बाज़ारों में काली मिर्च के भाव में बढ़ाव का रूख रहा। कोची बाज़ार में अनगारबल्ड काली मिर्च का भाव, जो जुलाई, 2020 के प्रथम सप्ताहांत के दौरान 30,700 रूपए प्रति क्विंटल था, वह सितंबर, 2020 के अंतिम सप्ताहांत के दौरान 33,100 रूपए प्रति क्विंटल तक बढ़ गया। कोषिक्कोड बाज़ार में नाडन और वयनाडन काली मिर्च की भाव अत्यल्प बढ़ गया।

अदरक

प्रायः सभी बाज़ारों में अदरक के भाव में बढ़ाव का रूख दर्शाया। तिमाही के दौरान कोची में सूखे अदरक के भाव में 1,000 रूपए प्रति क्विंटल की वृद्वि हुई। चेन्नै में सितंबर, 2020 के अंत में सूखे अदरक के भाव में 3,500 रूपए प्रति क्विंटल की वृद्वि हुई। कोषिक्कोड़ में सूखे अदरक का लेन–देन कम था और ताजे अदरक के भाव में 3,000 रूपए प्रति क्विंटल की वृद्वि हुई।

ARECANUT

Arecanut (dry) price has expressed an unvarying trend in Cochin as well as Mangalore markets during the quarter under review. In Mangalore, transactions were comparatively less and price of New Supari stood at Rs. 34,500/quintal during the above period. In Thalassery, Kasaragod and Panaji markets, the price of arecanut exhibited an upward trend. Price of old arecanut in Kasaragod market increased from Rs. 32,000/quintal to Rs. 35,000/quintal during the period.

BLACK PEPPER

Pepper market witnessed an increasing trend in prices. The price of ungarbled black pepper in Cochin market, which was Rs. 30,700/quintal during the first weekend of July, 2020, had increased to Rs. 33,100/quintal during the last weekend of September, 2020. In Kozhikode, the prices of both Nadan and Wayanadan pepper registered a marginal increase.

GINGER

Ginger prices displayed an increasing trend in almost all the markets. The price of dry ginger in Kochi market had increased by Rs. 1,000/quintal during the quarter. In Chennai, dry ginger prices increased by Rs. 3,500/quintal by the end of September, 2020. In Kozhikode, there were less transactions for dry ginger. Fresh ginger prices have increased by Rs. 3,000/quintal in Kozhikode.

मिर्च

टूटिकोरिन बाज़ार में मिर्च के भाव में बढ़ाव का रूख रहा और प्रति क्विंटल 1,500 रूपए की वुद्वि हुई। समीक्षाधीन अवधि के दौरान चेन्नै में रामनाड और सम्बा–।। किस्म के भाव में क्रमशः 500 रूपए और 3,500 रूपए प्रति क्विंटल की गिरावट हुई।

हल्दी

कोची बाज़ार में हल्दी का भाव मजबूत रहा और जुलाई से सितंबर, 2020 के दौरान प्रति क्विंटल 11,000 रूपए पर रहा। चेन्नै बाज़ार में ईरोड और सेलम हल्दी के भाव में कमी का रूख रहा और प्रति क्विंटल 500 रूपए की गिरावट हुई।

लहसुन

समीक्षाधीन अवधि के दौरान लहसुन के भाव में मिश्रित रूख रहा। मीडियम लहसुन का भाव जो तिमाही के प्रारंभिक सप्ताहों में प्रति क्विंटल 8,750 रूपए था, वह तिमाही के मध्य में प्रति क्विंटल 10,000 रूपए तक बढ़ गया और तदुपरांत इसका भाव गिरकर प्रति क्विंटल 9,000 रूपए रहा।

बीजीय मसाले

चेन्नै बाज़ार में जीरा के भाव में गिरावट का रूख रहा और प्रति क्विंटल 20,500 रूपए से 17,500 रूपए की गिरावट हुई। इसी अवधि के दौरान धनिया के भाव में अल्पमात्र वृद्वि दर्शायी गई।

जायफल/जावित्री और लौंग

समीक्षाधीन अवधि के दौरान जायफल (छिल्का सहित और छिलका रहित) के भाव में बढ़ाव का रूख रहा। लौंग के भाव में भी वृद्वि

CHILLI

Chilli prices showed an upward trend in Tuticorin market and registered an increase of Rs.1,500/ quintal. In Chennai, the prices of Ramnad and Samba-II varieties dropped by Rs. 500 and Rs. 3,500 per quintal respectively during the period under review.

TURMERIC

In Cochin market, turmeric prices have shown firm trend and ruled at Rs. 11,000/ quintal during July to September, 2020. In Chennai market, the price of both Erode and Salem turmeric have shown a decreasing trend and the prices dropped by Rs. 500/quintal for both the varieties.

GARLIC

Garlic prices in Bangalore showed a mixed trend during the quarter. Price of medium garlic, which was Rs. 8,750/quintal during the initial weeks of the quarter increased to Rs. 10,000 per quintal by the mid of the quarter and thereafter the price decreased to Rs. 9,000 per quintal.

SEED SPICES

The price of cumin showed a decreasing trend in Chennai market and price has decreased from Rs. 20,500/quintal to Rs. 17,500/ quintal. Coriander prices showed a marginal increase during the quarter.

NUTMEG, MACE & CLOVES

The price of Nutmeg (both with shell and without shell) and mace showed an increasing trend during the period under review. Price of cloves also showed an increasing trend. The

दर्शायी गई। इसी अवधि के दौरान लौंग का भाव प्रति क्विंटल 3,000 रूपए तक बढ गया।

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

clove prices increased by Rs. 3,000/quintal during the same period.

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

WEEKLY WHOLESALE PRICES OF ARECANUT

KERALA **(Rs./quintal)**

Month	Week	Kochi	Thalassery	Kozhikode
		Dry	New	Dry (Old)
July-20	1st	19400	28500	32000
	2nd	19400	28200	33000
	3rd	19400	29000	33000
	4th	19400	28600	33000
	5th	19400	29500	33000
Aug-20	1st	19400	29500	36000
	2nd	19400	29700	36000
	3rd	19400	29700	35000
	4th	19400	29500	35000
Sep-20	1st	19400	29800	35000
	2nd	19400	30300	34500
	3rd	19400	31000	35000
	4th	19400	31000	35000

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

KARNATAKA, TAMIL NADU & GOA

(Rs./quintal)

Month	Week	Mangalore	Chennai	Goa
		New Supari	Rashi	Chali (Old)
Jul-20	1st	34500	22500	28000
	2nd	34500	22500	28000
	3rd	34500	22500	28600
	4th	34500	22500	29300
	5th	34500	22500	30000
Aug-20	1st	34500	22500	30200
	2nd	34500	22500	30200
	3rd	34500	22500	30200
	4th	34500	22500	30200
Sep-20	1st	34500	22500	30200
	2nd	34500	22500	30200
	3rd	34500	22500	30200
	4th	34500	22500	30300

Source: Krishi Maratha Vahini, Govt of Karnataka; Economics & Statitsics , Chennai; Directorate of Marketing, Goa

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

Month	Week	Kochi	Kozhikode		Kottayam
		Ungarbled	Nadan	Wayanadan	
Jul-20	1st	30700	29000	31000	33000
	2nd	30200	28500	29000	36000
	3rd	30300	30000	31000	36000
	4th	30600	30000	31000	35000
	5th	30900	30000	31000	35000
Aug-20	1st	31000	30000	31000	33000
	2nd	31500	30000	31000	33000
	3rd	31900	30000	31000	33000
	4th	31900	30000	31000	34000
Sep-20	1st	31800	30000	31000	33000
	2nd	32100	30000	31000	34000
	3rd	32800	31000	31500	34000
	4th	33100	31000	31500	33500

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

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

Month	Week	Kozhikode Fresh	Kochi Dry	Chennai Dry (white)
Jul-20	1st	5500	28000	34500
	2nd	6200	28000	34500
	3rd	6300	28000	32000
	4th	6500	28000	32000
	5th	6500	28000	31000
Aug-20	1st	6600	28000	31000
	2nd	6600	29000	33000
	3rd	7300	29000	35000
	4th	7300	29000	38000
Sep-20	1st	6800	29000	38000
	2nd	6800	29000	36000
	3rd	7000	29000	38000
	4th	7000	29000	38000

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

WEEKLY WHOLESALE PRICES OF CHILLI (Rs./Quintal)

Month	Week	Tuticorin	Chennai	
		Samba - I	Ramnad	Samba-II
Jul-20	1st	10500	18000	12500
	2nd	11000	18000	11500
	3rd	10500	17000	12000
	4th	10500	17000	12000
	5th	10500	17000	12000
Aug-20	1st	10500	17000	12000
	2nd	10500	18000	12500
	3rd	10500	18000	11500
	4th	10500	18000	10500
Sep-20	1st	10000	18000	9500
	2nd	10000	18000	10000
	3rd	11000	18000	9500
	4th	12000	17500	9500

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

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

Month	Week	Chennai		Kochi	Bangalore
		Erode	Salem	Dry	
Jul-20	1st	11000	12000	11000	9250
	2nd	11000	12000	11000	9250
	3rd	11000	12000	11000	9000
	4th	11000	12000	11000	9000
	5th	11000	12000	11000	9000
Aug-20	1st	11000	12000	11000	9000
	2nd	10500	11500	11000	9000
	3rd	10500	11500	11000	8500
	4th	10500	11500	11000	8500
Sep-20	1st	10500	11500	11000	8500
	2nd	10500	11500	11000	8500
	3rd	10500	11500	11000	8500
	4th	10500	11500	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
Jul-20	1st	7950	20500	8750
	2nd	7900	20500	8750
	3rd	7900	18500	9400
	4th	8000	18500	10000
	5th	8100	18500	10000
Aug-20	1st	8100	18500	10000
	2nd	8100	17000	10000
	3rd	8200	17000	9000
	4th	8200	17000	9000
Sep-20	1st	8200	17000	9000
	2nd	8200	17000	9000
	3rd	8200	17000	9000
	4th	8200	17500	9000

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	
Jul-20	1st	28000	44000	150000	61000
	2nd	27000	46000	160000	60000
	3rd	27000	46000	160000	62000
	4th	26000	45000	160000	61000
	5th	28000	47000	170000	61000
Aug-20	1st	28000	47000	170000	61500
	2nd	29000	49000	185000	61500
	3rd	29000	49500	190000	63000
	4th	30000	50500	190000	63500
Sep-20	1st	30000	50000	185000	64000
	2nd	29000	50000	185000	63500
	3rd	30000	51000	180000	63500
	4th	30000	50500	180000	64000

Source: Economics and Statistics, Thrissur.

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