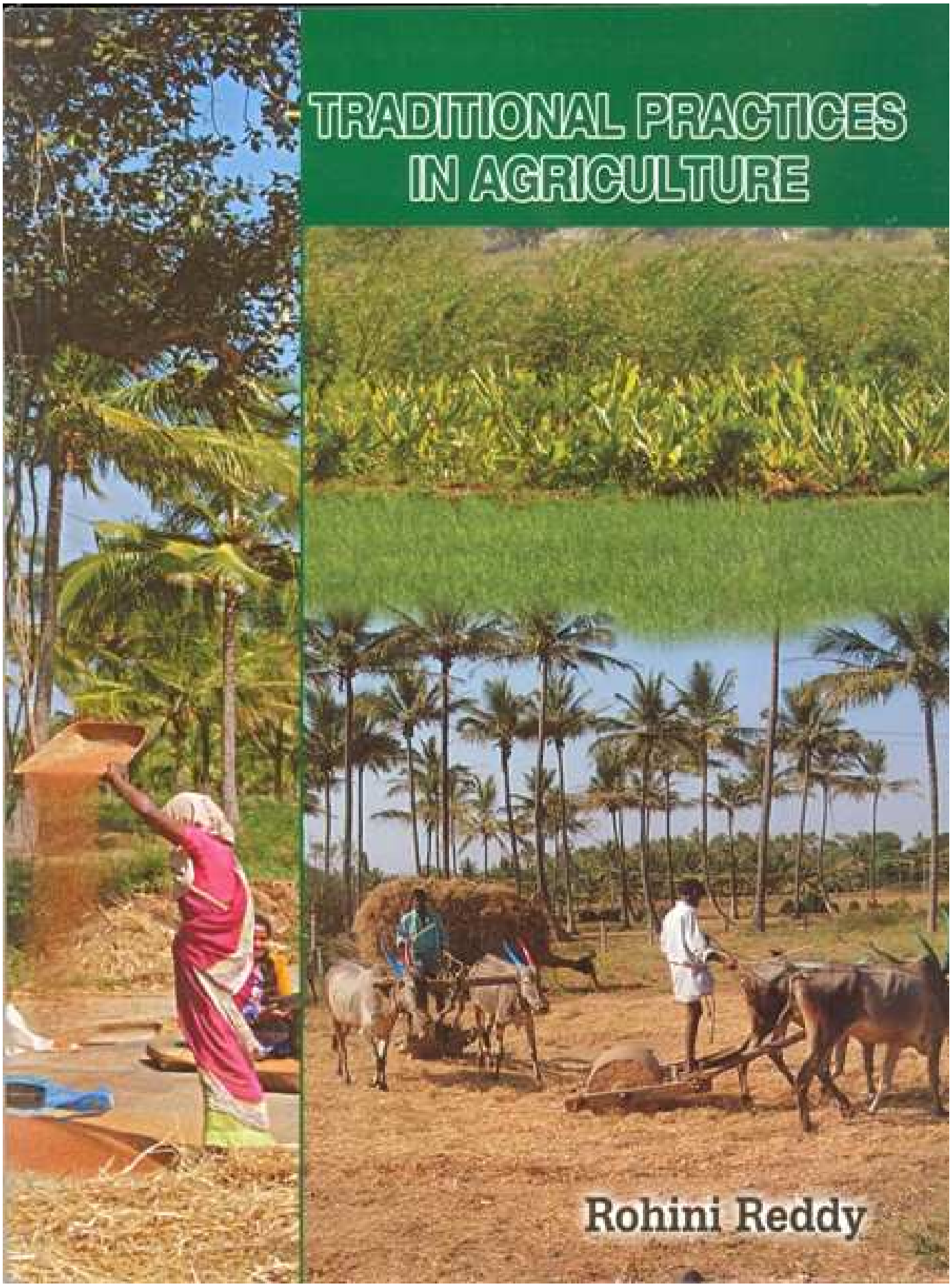
TRADITIONAL PRACTICES IN AGRICULTURE



Rohini Reddy

ACKNOWLEDGEMENTS

Born and brought up in a farming family, I had a long cherished desire to help marginalized farming community to improve their agricultural practices in tune with nature. I take this opportunity to express my deep sense of gratitude to all those who helped me directly or indirectly in the preparation of the present volume. I am particularly thankful to the following for their valuable help and timely support.

The encouragement and financial support from **CARITAS INDIA,** New Delhi enabled me to prepare the present document.

This publication would not have been possible but for the extraordinary support extended by the following individuals and from various institutions.

I was inspired by the experiments of outstanding organic farmers like **Mr. A.P. Chandrasekhar, Dr. L. Naryana Reddy, Mr. Ayappan, Dr. Praful Chandra, Mr. H.R. Jayaram, Mr. Ramesh,** and **Mr. Goutam Dudhoria** who extended valuable support in providing linkages with the traditional farmers from various networks.

My personal interactions with several organic farmers and agricultural scientists from different geographical regions of the country have helped me to document their experiential wisdom which they gained, functioning as demonstration farmers.

I am thankful to all those who spared their time to read and edit the portions of the manuscript. Their comments and criticism helped me refine the document. I could not have completed the document without the constructive help of the specialists like **Prof. Rudraradhya**, JSS- MVP Mysore, **Dr. P.M.Reddy** UNAM,Mexico, **Dr. Gopal**, KVK, Dindigal, **Mr. Sadananda Rai**, Vanavasi Seva Kendra, Adhaura, **Dr, B.R. Dwaraki**, Bangalore, **Dr, Haridas,** and **Sr.Marline Pinto**, CARITAS INDIA, **Dr. Radhika Subramaniyam**, Mysore, **Dr.G.N.Reddi**, IRRM, Kuppam, and **Prof. K. Venkata Reddy**, Punganur.

Mr. Roel Ravanera, AJPN, Philippines helped me to keep my spirits up and my hamstrings in working order. His long term association with the Asian farming community enabled me to incorporate the alternative Perspectives related to food security and sustainable agriculture.

The long term partnership with **Asian NGO Coalition** (ANGOC), Philippines and **International Land Coalition** (ILC) Italy has helped me to develop access to the current situation of the farming community in the context of **liberalization, privatization** and **globalization** (LPG).

Ms. Manjula Chandra Kumar and **Ms. Rohini Mitta** extended their valuable support and assistance in the task of typing. A well-known artist **Mr.Sanjay Daiv** helped in preparing the diagrams.

My grandchildren **Netan Reddy** and **Nicholas Reddy** allowed me to devote my time bringing out this document.

And, Finally this book is **dedicated** to **the farmers** of mother **Earth**

.....Rohini Reddy

FOREWORD

Caritas India, a social action wing of the church in India has always focussed on issues related to the development of people and the country. In recent times, special emphasis has been given by Caritas for ***care for creation*** through its Natural Resource Management and Sustainable Agriculture programmes. The results from some of the pilot projects undertaken in the last eight years have been extremely encouraging.

Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. There is today a growing appreciation of the value of traditional knowledge.

Traditional knowledge can make a significant contribution to sustainable development. Agriculture is the major source of livelihood for 50 percent to 80 percent of the population in Asia. Of this, small farmers make up the majority, i.e., 70 percent to 95 percent. These farmers have been practicing traditional farming methods for millennia. Their traditional knowledge (TK) in the application of these methods have tremendously contributed in harnessing ecological potential of land and conserving and developing biological and genetic resources. Furthermore, as on-site communities with extensive knowledge of local environments, indigenous and local communities are most directly involved with conservation and sustainable use. But for the last few years all these traditional knowledge were shadowed due to the promotion of high tech modern technologies. Hence an effort has been made to elaborate various traditional agricultural practices collected with the help of local communities through this book.

This book will be particularly useful to those working in the development sector in their endeavor to use traditional knowledge and practice in agriculture.

Fr. Varghese Mattamana
Executive Director,
Caritas India

PREFACE

Humans in their quest to realize higher returns from the soil, encountered both success and failure over the time, have developed and perfected certain low-cost or even no-cost **INDIGENOUS TECHNOLOGIES,** relating to various aspects of agriculture.

However, in the recent past of less than five decades, the national Governments of the third world countries, in their anxiety to accelerate the process of agriculture modernization, roped in the farming community for their participation in the externally dependent high input agriculture, which **Ecologically** is Not **Sound**, **Economically** not **viable**, **Culturally** not **adaptable**.

The green revolution technology regime undermined the valuable indigenous heritage and knowledge systems. The mono-cropping patterns all over the globe caused severe damage to the fertility and productivity status of the soils, human health and agro-ecology. Several farmers, agriculture scientists and development activists started questioning the relevance of unsustainable technologies that have favoured the well-to-do farmers by ignoring the resource-poor farmers.

During the past two decades, farmers from different parts of the world, who were totally disillusioned and upset by the unsustainable mainstream agriculture, revolted against it, started searching for viable alternatives. They recognized the need to give due weightage to the indigenous knowledge systems and gained valuable experience while demonstrating the efficiency and effectiveness of eco-friendly agricultural technologies for involving the small and marginal farmers even under semi-arid conditions.

Time seems to be more than ripe now, with all debates on natural farming methods around the globe with slogans like **'Back to Nature'** humming around, to blend native knowledge with scientific spirit.

As *Masanobu Fukuoka* rightly observes
The ultimate goal of farming is not the growing of crops, but the cultivation and the perfection of human beings. (The one straw Revolution).

This slender volume based on the rich and variegated experience of different individuals who have a deep passion for the indigenous agricultural practices, which are on the verge of extinction, is a modest attempt at dissemination of the treasure of native wisdom relating to agriculture. It is hoped that the book will be of considerable value for all those who are interested in the field of modern agriculture. If it stirs the imagination of individuals with independent and original thinking I feel that the purpose of this attempt is more than served.

It will be highly appreciated if this information is passed on to the farmers, who are interested in natural farming with the help of modern agricultural technology.

Rohini Reddy
Executive Director
SARRA.

3.2 PULSES

Idia is very unique related to food culture because of the role of diverse pulses in our agriculture and cuisine. Pulses supply vegetable proteins as essential adjuncts to the predominently starchy diets and therefore they form a very important component of Indian dietary.

Being leguminous crops having nodules in their roots, they fix the atmospheric nitrogen through symbiotic activity of the bacteria in their root nodules. Therefore, growing of pulses invariably enhances soil fertility.

a. Redgram (*Cajanus cajan*)

Redgram also called as pigeon pea is invaribly used almost everyday to provide protein food in peninsular India. It is extensively used as 'Dal' and its green pods are used as fresh vegetable. Husks of pods along with broken or affected seeds form a very valuable cattle feed. It is also planted as a soil renovator to break-up the sub-soil

and as a contour hedge to check soil erosion. In plantations, it is generally grown as a cover crop.

1. Redgram is also grown as an intercrop in sorghum and groundnut and also as a border crop in sugarcane.
2. Five kg of Tobacco waste is dissolved in 10 litres of water and diluted with 50 litres of water to control sucking pests and caterpillars.
3. Redgram seeds are mixed with ant hill soil with little moisture, dried and stored to avoid storage pests.
4. To reduce the incidence of store pests in redgram, smear the seeds with Neem oil / Pognamia oil / Castor oil.
5. Castor seeds are fried, powdered and mixed with redgram seeds to reduce pest attack during storage.
6. Storing the redgram seeds after mixing them with one kg of 'sweet flag' (*Acorus calamus*) powder, will be sufficient to treat 50 kg of seeds to preserve them for one year.
7. Mix the dried leaves of *Vitex negundo* or Neem leaves with redgram seeds before storage.
8. One kg of Neem or Vitex leaves is powdered, made as a paste with water and mixed with 100kg of redgram seeds.
9. Drying the redgram seeds well and storing them in gunny bags after placing dried leaves of *Ocimum canum* inside them helps to prevent pod borer attack.

10. Putting the pods of dried chilies in the redgram containers helps to control bruchids (beetle) attack.
11. Red gram is heated with caster oil and stored in earthen vessel (vaade) – Cost effective control method and a low cost storage structure – Oil removes glued eggs and acts as physical barrier to pests.
12. Coating red earth to overnight soaked red gram and drying in shade – Reduces insect damage and facilitates milling – Wetting and drying (thawing) process loosens husk from kernel and red earth acts as Physical barrier to the storage insect .

b. Blackgram *(Phaseolus mungo)*

Blackgram attracts high price among all pulses and it is highly rich in phosphoric acid. It is more often used for preparing pappad which is a very popular side dish with any kind of meal, routine or special. Using ground blackgram dhal and mixing with ground rice for preparation of 'Idlis', has made a tremendous impact that even in hospitals, Idlis are

preferred to bread loafs. Diabetic patients who are normally advised to avoid rice are safely recommended to eat Idlis.

1. One hundred ml of Neem oil is dissolved in 10 litres of water and mixed with five gm of detergent powder; and sprayed to control powdery mildew in blackgram.
2. Dry the blackgram seeds well under the Sun to avoid storage pests.
3. Smear the blackgram seeds with castor oil to increase the keeping quality.
4. Mix the blackgram with one kg sweet flag (*Acorus calamus*) powder for treating 50 kg of seed.
5. Blackgram grains broken into halves will escape from weevil attack during storage.

c. Greengram *(Phaseolus aureus)*

Greengram is very similar to blackgram and cowpea in plant habit but it is more drought resistant than the latters. Its cultivation is spread all over the country. Grains, whole or split as dal are used as

pulses. Unlike other pulses, it is easily digestible without producing heaviness or flatulence. Grains are also eaten fresh, whole, parched, salted and boiled with condiments. The crop has a restorative effect on soil. The straw and husk form fodder for cattle.

1. Four kg of Neem seeds powdered, placed in muslin cloth and tied are soaked in 10 litres of water for 24 hours; the content is filtered and 50 gm of soap powder is added to the filtered extract and diluted with 90 litres of water and sprayed in the evening times which will control pod borer.
2. Greengram seeds are coated with Neem oil, Pongamia oil & Castor oil to preserve them as seed for the next season.
3. Mixing the greengram seeds with sand before storage will prevent grams from storage pest attack.

d. Field Bean *(Dolichos lablab)*

Field bean is the most popular pulse crop especially when it is consumed as green and fresh vegetable. It is widely grown in Karnataka and Andhra Pradesh States. Formerly it was limited to *rabi* season only and now with the advent of varieties that could be grown during any season, it is being cultivated throughout the year. It is highly proteinacious and forms a very good combination with

ragi preparations. Being leguminous, it also adds to the fertility of soil. Dried seeds are used both as whole grain and as Dal (broken).

1. Two kg of *Vitex negundo* leaves are chopped and grinded well and two kg of Neem cake powder mixed together in five litres of water and filtered. this is diluted in 50 litres of water, mixed with 25 gm of detergent powder. This will help to control shedding of flowers and pre mature falling of pods in field bean and also helps in pest control.

2. Wood ash broadcasted early in the morning (before sunrise) controls many pests.

3. Green pods with matured seeds are harvested for vegetable purpose.

4. Field beans seeds are mixed with ant hill soil with little moisture, dried and stored to avoid storage pests.

5. Wood ash and dried neem leaves are used in seed preservation of Field Beans.

e. **Horsegram** *(Dolichos biflorus, L.)*

Horsegram is the most extensively grown pulse crop in South India and Karnataka is the lead state. It is the most drought hardy crop and can be relayed with the *Karif* crops at their harvest stage. It is the most common pulse crop used by the poor class. It is an excellent fodder for horses and cattle. It is very good for hay making and for green manuring.

1. Under rainfed conditions, immediately after the harvest of the groundnut. horsegram seeds are broadcasted in between the rows of redgram / field bean and ploughed once only. The seeds germinate and grow in the field by utilizing the residual moisture in the field. No irrigation is given.
2. The crop will be ready for harvest in about 70 days. The plant will be uprooted and made into bundles and Sun dried and seeds are separated from the straw. The straw and plant twigs are utilized as cattle feed and seed as pulse for human and animal consumption.

3. The leaves fallen on the field will be mixed into the soil which add organic matter to the soil. The roots also fix atmospheric nitrogen and thus improve soil fertility.
4. Horse gram is stored in empty common salt bags – insect damage is reduced – Salt prevents hatching of storage pests eggs and also acts as a preservative

f. Cowpea *(Vigna catjang)*

Cowpea is commonly used as a pulse crop. It matures in 75-90 days facilitating the farmers to use it in mixed cropping and multiple cropping. It is also used as a green manure crop. Cowpea when mixed with ground nut at 1 row after every 10 rows of groundnut will help as a catch crop for red hairy catterpillar of groundnut. It is a rich source of protiens. As a fodder it is highly palatable to all types of livestock and it can fed either green or made into hay.

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3.3 OIL SEEDS

India is the home for diversity of oilseeds, which play a very important role in agriculture. It goes without saying that various edible oils form an inevitable component in the preparation of food stuffs and the usefulness of including oils in our dietaries does not warrant any special mention. Seeds like groundnut are directly consumed while in respect of others, oil is extracted and used in food preparations. Oil cakes and plant residues (stalts) have varied uses like cattle feed, soil amendments, pest control and used as manures.

a. Groundnut *(Arachis hypogea, L.)*

Groundnut is one of the chief sources of vegetable oils extensively used for cooking purposes. It is a delicate edible oil and a delicious nut too. Groundnut seeds are rich in proteins and vitamins A, B etc. The oil content of the seed varies from 44 to 50 per cent depending on the variety. It is a very nutritious food for the growing children, pregnant women.

The oil cake contains 7-8% of N, 1.5% of P_2O_5 and 1.2% of K_2O and is used both as a manure and as a cattle feed. The haulms after drying or silage are fed to cattle. Groundnut shell can be used as a fuel and mulching purpose for the plants. It is termed as a pseudo-legume with root nodules and thus is capable of synthesizing atmospheric nitrogen and thereby improve the soil fertility.

1. Summer ploughing is practiced to expose and destroy the pupae of pests.
2. Sheep penning is practiced for better yields.
3. During nights, burning heaps of straw in several places near the fields along with a bucket full of water or castor cake dissolved in water near the fire helps to attract and kill the insects.
4. Grow cowpea as border crop to attract Red Hairy caterpillar (RHC).
5. Grow castor as a border crop (trap crop) to reduce the attack of tobacco cut worms.
6. Adopt crop rotation to control Red Hairy Catter pillar (RHC) pest.

7. After sowing, tying tapes (reflectors) in criss-cross manner in the groundnut field helps to avoid bird damage.
8. White threads or black cloths are tied around the fields to prevent damage by the birds.
9. Empty iron drums are beaten in groundnut fields to ward off the birds and wild boars.
10. Mix neem oil with irrigation water at second or third irrigation to prevent root rot in groundnut.
11. Spray lime solution to control leaf roller, and spraying water also brings down the leaf roller attack.
12. Neem oil solution 4% or neem kernel extract 6% is sprayed to control rust disease in groundnut.
13. Spray neem oil@ 6 lit /ac to control root rot.
14. To control groundnut ring mosaic, dried sorghum or coconut leaves are powdered and boiled in water to 60^0 for one hour, filtered, diluted and sprayed two times at 10 days interval.
15. Grinding well and dissolving 10 kg of the leaves of *Aloe vera* in water and spraying for an acre to control Red Hairy Caterpillar (RHC) in groundnut.
16. Groundnut kernels stored with their shells have longer storage life i.e. even for one year.
17. Sun drying the groundnut seeds for longer period will reduce its viability
18. Seed kennels are stored viable up to three months only.
19. Groundnut seed treatment: Boil water in a container and place the lantana leaves in the hot water. Cover the container with a lid and put weight on it. Allow the leaves in the container

overnight. Filter the solution and add 100 gm of jaggery. Sprinkle the solution on groundnut seeds and mix it thoroughly. It prevents attack by ants, seed rot and dying of young plants.

b. **Gingelly** *(Sesamum indicum)*

Gingelly is a very important oilseed crop. It is extremely medicinal value in Ayurvedic preparation and used in many cuisines worldwide. The seeds will get nutty flavour enhanced by roasting. We can three varieties of Gingelly.

With an oil content varying from 46 to 52 per cent. But in expellers and rotary mills hardly 40-42 per cent oil can be extracted while with village ghanis it varies from 36 to 38 per cent. The fried seeds can be eaten in the form of sweet meats and they are mixed in various preparations to add taste and value to them. Oil is used as a cooking medium in South India. It is also used for anointing the body, preparation of perfumes and medicines. Oil cake is edible and the working class like it and use avidly. It is a highly nutritious food for milching animals.

1. Spray diluted cow urine to control leaf roller.
2. Gingelly seeds are stored in dried outer shells of bottle gourds or small earthen pots
3. Storing gingelly seeds after mixing them with ash helps preventing store pests.
4. Mix gingellly seeds with activated clay for storage.
5. Addition of palm sugar to gingelly during oil extraction gives higher oil recovery.
6. Storing gingelly oil in mud pots increases its keeping quality for more than a year
7. Putting a small piece of palm sugar in to gingelly oil increases its keeping quality.

c. **Coconut** *(Cocos nucifera)*

Coconut is a perennial tree grown in a garden as a plantation crop. It is widely used for culinary purposes, although it is primarily employed for extracting oil from copra. Commercial copra contains about 50 to 75 per cent oil, and it is used in making vegetable ghee and

hard soaps. It is also used as a cooking medium in some places and also for anointing the body.

This plant is called as "Kalpavriksha", because, Husk is used for making coir, Trunk have timber value, shells and nuts are used as fuel, leaves are used for making mats and roofing huts, tender coconut is consumed as sweet drink and has medicinal value, oil cake is used as cattle feed and every part of tree is useful in one way or the other.

1. Mulching by burrying of coconut husks around the tree helps to conserve moisture and to control weeds.
2. Coir waste is applied as mulch around the tree above which a layer of red soil is applied.
3. To retain soil moisture in coconut garden, compost, cow dung and ash are applied in a circular trench around the tree and covered with top soil.
4. Spraying neem oil helps to reduce flower shedding.
5. To prevent button shedding, common salt is applied around the growing tip @ 2 kg /tree during rainy season, which of late is controversial.
6. Apply ash to control button shedding.
7. Kolingi (*Tephrosia purpurea*) and *Calotropis gigantea* are applied in circular basin just before flowering to control button shedding.
8. Application of neem cake in the pits before planting coconut avoids the attack of insect pests and ants.

9. Earthen pots are placed in small pits in coconut gardens and ¾ the of the pot is filled with water and ¼ kg of castor cake. After three days due to the smell, Rhinoceros beetles get attracted, fall in to the pot and die.
10. Crowns of coconut trees are examined during every harvest and adult Rhinoceros beetles are hooked out and killed.
11. Pour neem cake extract on the growing tip and adjoining fronds to control Rhinoceros beetle.
12. A wooden plank is placed on a wide basin filled with water and a chimney lamp is kept in the coconut garden to attract and kill the Rhinoceros beetles.
13. To control stem weevil in coconut, the hole bored by it is cleaned and plugged after putting common salt.
14. While planting coconut seedling one leaf of *Agave* sp. is planted in the pot to retain soil moisture and to control termites
15. Flood the coconut garden to wash off termites
16. Lime washing is done for 2-3 feet height at the base of coconut trees to control termite attack.
17. To control termites, 500 gm of common salt is dissolved in 5 litre of water and poured on the trunk.
18. Poultry birds are reared in coconut gardens to feed on termites.
19. To control Thanjavur wilt of coconut, green manures like kolingi (*Teghrosea purpurea*). Diancha (*Sesbania* sp.) etc. are rised and ploughed *in situ* or well-decomposed FYM is applied followed by the application of neem cake.

20. To control stem bleeding, the bleeding mouth on the trunk is cut to certain extent, cleaned and poured with lime solution.
21. Branches of *Selma karuvel* (*Prosopis juliflora*) or barbed wires are tied around the mid trunk to a height of 2-3 feet to prevent climbing of rats and squirrels.
22. During the first five years, intercrops like groundnut, sunflower, blackgram sorghum etc. are cultivated
23. Add a piece of jaggery (country sugar) in coconut oil to separate the dusts and make the oil more clear.
24. Cow dung slurry and groundnut cake in water is kept in earthen pots in coconut gardens @ 20-25 pots per ha. This minimizes damage by Rhinoceros beetle. Fermenting mixture of cow dung and groundnut cake is known to act as an attractant of this pest
25. Growing red Champak in the vicinity of coconut tree controls coconut stem borer. Champak odour acts as a repellent.

d. Mustard *(Brassica nigra)*

It is a very important in Indian cooking in seasoning. It is an anti-inflammatory, anti-fungicidal, carminative. It is widely used in North India for cooking.

Chapter 3.3
Pic 05

- Mustard is used as an intercrop in vegetable gardens to prevent the pest, and it is also a companion crop with Ragi or *Sorghum*.

- Take raw mustard seeds of 500 gm, make a paste, add 200 gm of turmeric powder, mix it with one litre of cow urine, add 10 ltrs of water and spray for all vegetable crops, to prevent aphids.

e. Castor *(Rocomos communis)*

Castor is grown for its seed having oil content varying from 35 to 58 per cent, the average being 46-47 per cent. Oil is used for medicinal, lubricating and industrial purposes. Cake is a good manure. In sericultural areas, leaves are fed to *Eri* silk worms.

Chapter 3.3
Pic 06

1. Spraying neem oil dissolved in water @ 20 ml per lit. to control sucking pests in caster.
2. Five kg. of neem darnels are powdered, tied in a gunny bag is mixed with soap solution and sprayed to control castor semilooper and soaked in water for 8 hours after which the extract solution
3. Castor is inter cropped with cropped with cotton groundnut etc.

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3.4 VEGETABLES

It is estimated that 20% of daily food of an adult should necessarily comprise of vegetables in order to maintain normal health. In order to improve the diet of the people, it is essential to encourage vegetable production.

It is natural that vegetable growing farmers make good living out of small holdings, and generally they yield higher income in lesser time when compared to other food crops. Vegetables can be produced in succession on the same piece of land, because they are invariably short duration crops and all the family members of vegetable grower can be usefully employed throughout the year.

a. **Brinjal (**Egg Plant – *Solanum melongena***)**

Brinjal or egg plant is a warm season fruit vegetable. This vegetable is consumed when they are still unripe. Brinjal has high nutritive value, rich in Vitamins A and B. They are used as cooked or fried vegetable. This vegetable is among the recommended ones for diabetic patients.

1. Cow dung and poultry manure mixed in 1:1 ratio if applied to brinjal garden during land preparation, gives more yields.
2. Growing castor in brinjal fields as border crop acts as a trap crop for insects.
3. Growing onion / garlic as intercrop in brinjal helps to control many pests including fruit borers
4. Cultivation of Subsige (*Anethum sowa*) in Brinjal controls fruit borer in Brinjal. Subsige (*Anethum sowa*) odour repels fruit borer
5. Grinding 40 kg of Neem seeds and applying to one acre on 50 days old plants, helps in obtaining higher yield.
6. Neem cake 4 kgs (Powdered), and *Aloe vera* 4 Kgs (chopped and crushed finely) are soaked in 100 liters of water and the above mixture is stored in a container closed with lid. After 10 days, the contents are filtered and sprayed to control thrips in one acre of brinjal.
7. Ash and turmeric powder are mixed in 1:1 ratio and sprinkled to control aphids in the morning hours, when the due moisture is there on the leaves.
8. Sprinkling of lime powder helps to control mealy bugs.
9. Cow urine, neem oil and tobacco decoction are mixed in 1:1:1 ratio in one litre of water and sprayed to control all sucking pests.
10. Placing one spoon of neem cake at the root zone helps to control shoot borer and stem rot.

11. Spray neem cake extract to control mites and the spotted beetle *(Epilachana octopunctata*) in brinjal
12. Brinjal fruits are harvested for market before their stalks change from green to brown in colour
13. For seed extraction in brinjal, medium sized fully ripened fruits which are bright yellow in colour are harvested. Then they are cut into 4-6 pieces and softened by soaking in water overnight. Next day, the seeds are removed and washed well with water. After washing add little quantity of wood ash. Dry it in the shade and preserve in a cloth / mud pot.
14. Well matured and ripen brinjal fruits are cut with some portion of the stem. And cut the brinjal into 4 parts and tie it with the thread and hang it (8 to10 feet) above the chullah (chimney). Smoke from the chullah will help the seeds to dry naturally. Extracted seeds are mixed with wood ash and shade dried for 2-3 days and stored upto six months.
15. Take ½ kg cakes of each are soaked overnight in enough water to submerge them. (This quantity is sufficient for an area of 50 sq. meters). The soaked cake should be broadcasted and mixed well with the soil in early morning. It gives good yield and reduces the population of all major brinjal pests like root aphids, fruit and shoot borer, **Epolaehna** beetle and other major pests.
16. 1 Kg of fresh custard apple leaves and 1 kg of neem cake soaked in 2.5 litre of cow's urine overnight, then filtered. The filtered solution is diluted with water in a ratio of 1:3 and

sprayed on foliage. It gives the effect in controlling the pests of **Brown hairy caterpillar**.

17. Take 1 kg of fresh custard apple leaves and ½ kg of Neem cake are soaked in 3 lts of cow's urine overnight. The filtrate is diluted with 8 lts of water and sprayed. It effects against **Epilachna beetle**, and controls **Grub** and adult.

b. Tomato *(Lycopersicon esculentum)*

Tomato is a solanaceous fruit vegetable and necessarily a warm season crop. Fully ripen red and green fruits are consumed as vegetables. Tomato fruits are rich sources of Vitamins A, B and C. Tomato is consumed both cooked and raw (preferred in Salads), and are used to prepare preserves, pickles, etc.

1. Application of tank silt @ 25 t/ ha to irrigated tomato saves cost on plant protection and supplies micronutrients that build resistance to pests

2. Five ml of neem oil, in one litre of water, with one drop of soap liquid (which acts as emulsifier) are mixed thoroughly and sprayed on the plants to control pests attack and also control flower droppings in tomato.
3. Dissolve 500 gm wood ash and 500 gm cow dung in 10 litre of water and spray it to reduce flower dropping in tomato.
4. Grow marigold as border crop in tomato fields to prevent **fruit borer** and **leaf miner** attack.
5. Agriculture and weed waste materials are burnt near the fields along the wind direction, immediately after Sunset, to control many pests, an old practice by the famers.
6. To control most of the pests in tomato, 1½ kg. of pungam (*Pongamia pinnata*) leaves, 1½ kg of Nochi (*Vitex negundo*) leaves and one kg of neem leaves are cooked in a container for two hours from which decoction is prepared and dissolved in 20 litres of water and sprayed during evening hours for three or four times at monthly intervals.
7. One kg of *Asafoetida* tied in a cloth is kept in irrigation channel to control fruit borer. It will be sufficient for one acre
8. Two kg of neem kernels are powdered and soaked in five litres of water for 10 days after which it is filtered, mixed with 50 litres of water and sprayed for one acre of tomato crop to control fruit borer, leaf miner and thrips.
9. 250 gms of dried tobacco leaves are boiled in 4 litres of water for 30 minits, allowed to cool, and filtered. The filtrate is diluted with an equal part of water and 30 gms of bar soap is

added and sprayed. It effects on diamond backmoth and all diamond back die with in one day. It effects against aphids also.

10. Dust wood ash on the crop in the morning hours to control **aphids, thrips** etc

c. Chilli *(Capsicum annuum)*

Chilli also is a solaneous fruit vegetable consumed in both unripe and ripe forms. Chilli fruits are very rich in Vitamins A and B, while green chillies are rich source of Vitamin C. The pungent types of chillies are used in the preparation of condiments and the types with larger fruits with less pungency are consumed raw with salads and are also cooked and used.

1. Application of 250 kg of Neem cake per acre results in higher yield.

2. Growing castor as a border crop acts as a trap for tobacco cut worms.

3. Pruning vegetative branches in chilli enhances plant life and yield and induces fruiting branches.

4. Application of 100 kg of Groundnut cake per acre reduces the flower dropping.

5. *Asafoetida* @ 1kg/ac powdered, tied in a cloth and placed in the irrigation channel will act as a pest repellant.

6. Grow coriander as intercrop or border crop to act as a repellent in controlling all sucking pests.

7. Spray the leaf extract of *Prosopis juliflora* (5kg in 50 litres of water), two months after planting to control leaf spot, powdery mildew and fruit rot in chilies.

8. Four Kg of Neem seeds powdered, placed in muslin cloth and tied are soaked in 10 litres of water for 24 hours; the content is filtered and 50 gm of soap powder is added to the filtered extract and diluted with 90 litres of water; and sprayed in the evening times to control many pests of chillies.

9. Leaf extract of "Bilwapatra" (*Aegle marmelos*) is sprayed to control fruit rot in chillies.

10. Red earth treatment to Chili – Retention of red color – Acts as insulator against temperature and sunlight

d. Lady's Finger *(Abelmoschus esculentus)*

Lady's finger commonly called as Bhendi is a fruit vegetable belonging to Malvaceae family. Unripe fruits are used as vegetables. The fruits are rich source of Vitamins A, B and C in addition to possessing iodine and calcium. Unripe fruits are used cooked or fried as a vegetable.

1. Application of five tons of Sheep / poultry / farm yard manure per acre gives more yields

2. To control yellowing of fruits, four kg of fresh leaves of *Prosopis juliflora* are grinded well; add two litres of water, boil it for 20-30 minutes; allow to cool for 24 hours which is filtered and diluted with 10 litres of water. Add one litre of cow urine and spray on the crop.

e. Small Onion *(Allium cepa var. aggregatum)*

Onions are used for seasoning and flavouring vegetable and meat dishes. They are used for making salads, pickles and extracts in culinary preparations. Onion is an important ingredient in preparing chutneys and is of great medicinal value. Onions are rich in Vitamins B and C.

1. To get bigger sized bulbs in onion, 15 kg of groundnut cake is powdered, placed in muslin cloth, tied and kept in the irrigation water channel.
2. Bunching local small onions and hanging to the roof enhances shelf-life. Hanging prevents rodent damage and the higher temperature and air circulation near the roof have a curing effect.

3. Apply two cart loads (300 kg) of wood ash at 25 days after planting to control onion blight
4. Cow dung is dissolved in irrigation water channels to control onion blight.
5. Broadcasting of 15 kg rock salt per acre of onion crop will improve the colour of the onion bulbs. This has to be done when the crop is 30 days old.
6. Rolling an empty drum of about 10 kg weight in onion field 10-15 days before harvest facilitates removal of stalk and physical breaking of photosynthesis from the bulb.

f. Garden Bean *(Lablab purpureus var. typicus)*

It is a leguminous vegetable having good effect on soil fertility due to its deep penetrating roots and ability to fix atmospheric nitrogen. Green pods with mature seeds rich in protein are consumed as vegetables. They form an excellent source of vitamins and minerals. Green pods when consumed inclusive of their outer cover are good to combat constipation and indigestion.

1. After the *Lablab* vines fully spread on the bower (pendal), tips are clipped off to facilitate more branching and flowering.
2. Dust wood ash early in the morning (before sunrise) to control sucking pests like aphids and thrips.
3. Dissolve 200 gm of detergent soap in 100 litres of water and mix it thoroughly. Spray the above extract to control mealy bugs.
4. One kg leaves of *Prosopis juliflora* is pounded and soaked with one litre of water. After 7 days, filter and dilute with 10 litres of water and spray to control yellow mosaic virus
5. *Lablab* seeds are mixed with either wood ash or ant hill soil with little moisture to hold the mud to cover the skin of the seeds, and stored upto one year.

g. Drum Stick (annual) – *(Moringa oleifera)*

In addition to drumstick fruits, the leaves and flowers are also consumed as vegetables. It is highly rich in Vitamin C and carotene. It has considerable quantity of iron, phosphorus and calcium. These days it is invariably used as a component in *Sambar* preparations on big occasions like marriages as it has a

special preference of taste among the consumers in a big way.

1. Seeds of the drumstick are soaked in the milk and fresh cow dung slurry overnight before planting. This will help to improve the taste and controls soil borne diseases.
2. One week old fully fermented buttermilk is poured near the trunk and watered. The taste of the leaves and fruits will improve, it is believed.
3. Place a pinch of *Asofoetida* just deep into the soil near the roots of drumstick trees to control hairy caterpillars
4. Crop wastes and other residues are burnt around the base of the drum stick tree to control hairy caterpillars.

h. Cucurbits

The crops falling under this category are cucumbers, melons, pumpkins, squashes and gourds. They are mostly trailers with the exception of squashes. They come up well in hot weather conditions. Unripe and tender fruits of most of these crops are cooked as vegetables. However, musk melon and water melon are consumed

Chapter 3.4
Pic. 08a, 08b, 08c, 08d, 08e, 08f

in the form of ripe fruits. Pointed gourd and Coccinia (*Thonde*) are perennial in nature while the rest of them are all annuals. Many of the cucurbitaceous vegetables having more self life and can be stored. They are rich in vitamins and minerals and possess medicinal properties.

1. Soaking the seeds of snake gourd in cow dung solution for ½ hour before sowing helps for early germination and withstanding drought conditions
2. Cucumber and beans seeds dipped in kerosene before sowing, keeps ants away from the field. This acts as an ant repellent
3. Ash is sprinkled on cucumber crop (before sunrise) to control aphids and powdery mildew.
4. *Asafoetida* (25 gm) is dissolved in one litre of water. Spraying the contents helps to control flower dropping.
5. To avoid coiling and to get straight and elongated fruits in snake gourd, small stones are tied at their bottom with the threads when they are ½ foot long.
6. Bitter gourd seeds are pressed on to the cow dung flakes put on mud walls, allowed to dry under the Sun and stored in cool places after drying.
7. Fully matured and dried ridge gourd and bottle gourd fruits are collected and hanged in the house for seed preservation.
8. Cucumber and Pumpkin seeds are extracted from fully ripened fruits, washed well with water, mixed with wood ash, dried and stored up to one year.

i. **Potato** *(Solanum tuberosum)*

It is a very important commercial vegetable crop. The edible portions of this crop are the tubers that are modified stems and they are rich in starch and can be stored for few months without spoilage.

1. Before planting potato, seeds are dipped in cow dung slurry for 30 minutes which helps in controlling tuber rot.
2. Crop rotation of potato with other crops like Marigold and onion, is practiced to control golden nematode.
3. Neem cake powder (150 kg) is broadcasted per acre at planting to control tuber rot.
4. Lime (100 kg) is applied to potato fields at planting to reduce acidity in order to control brown rot.
5. Four kg of Neem seeds are powdered and dissolved in 100 litres of water and filtered. Add 10 litres of cow urine and mix it with 50 gm of detergent powder. Spraying this extract will control many pests and diseases of potato.

6. Forming a trench around the heap freshly harvested potato and filling with water – Enhances shelf – life – Better submerization due to cold storage

j. Cole Crops

Cabbage, cauliflower and knolkhol fall under this group of vegetables and they are essentially winter season crops. Enlarged terminal buds of cabbage, flowering head of cauliflower and enlarged stem of knolkhol form the essential component of vegetables. They are rich in Vitamins A and C.

Chapter 3.4
Pic. 10a, 10b, 10c

1. Grow garlic as an intercrop in cabbage to control diamond back moth attack
2. Grow mustard as an intercrop in cabbage crop at two rows of mustard for every 25 rows of cabbage to control diamond back moth, leaf roller, **Heliothis** worm etc. (also for cauliflower).
3. Cauliflower cultivation is avoided during summer months to reduce diamond back moth incidence.

4. Cauliflower is cultivated on terraces in sloppy lands to avoid soil erosion.
5. Neem oil 100 ml dissolved in 10 litres of water, is mixed with five gm of liquid soap or five gm of detergent powder. Spraying this solution will effectively control **diamond back** moth in cauliflower.

k. Green Leafy Vegetables

Green leafy vegetables have proved over time that they provide more protective energy to human body than any other vegetable. Not only they are rich in Vitamins A, B and C but also are the treasure houses of minerals like iron and calcium.

There are nearly 20 leafy vegetables grown in this country all round the year. They are very easy to grow and mostly propagated from the seeds through direct seeding.

Following are some of the green leafy vegetables grown in the country:

Common Names	**Popular Name**	***Scientific Name***
Fenugreek	Methi	*Trigonella fiebyngraccum*
Spinach	Palak	*Spinacea oleracea*
Love-lies-bleeding	Rajgir	*Amaranthus candatum*
Indian spinach	Bayi Basale	*Basella rubra*
Anethum	Sabsige	*Anethum sowa*
Deccan Hemp	Pundi	*Hibiscus cannabinus*
Indian Sorrel	Hulichikki soppu	*Oxalis corniculata*
Coriander	Kotthumbri	*Coriander sativum*
Dantu (Amaranthus)	Kempu Dantu	*Amaranthus blitum Var. oleracea*
Prince's feather	Chikkire	*Amaranthus polygamous*
Keere (Amaranthus)	Chikka Harive	*Amaranthus tricolor*
Harive (Amaranthus)	Harive	*Amaranthus vividis*
Mentha	Pudina	*Mentha arvensis*
Kirakasale (Amaranthus)	Chilakarive	*Amaranthus blitum*

These are generally cultivated with ease using only farm yard manure. They are seldom attacked by pests and diseases, and that is how they are the most popular vegetables eaten by every common man and their contribution towards common man's diet in India is immeasurable indeed.

General Pest Control Methods and Tips for Vegetables

1. Maize is grown around vegetable gardens which will act as a physical barrier for insects. Insects act as vectors in spread of diseases.

2. Growing *Tecoma* species and *Nerium odorum* (Indian oleander) as border crops, will act as traps and control the insect pests of the main crop.

3. Planting of garlic, onion, mint, marigold and other aromatic plants in between the rows of vegetable gardens will act as a natural pest repellent.

4. Woodash is dusted on the crops early in the morning (before Sunrise) to reduce pest attack in vegetable gardens.

5. Spreading of dried neem leaves powder over the vegetable seedling nursery, helps to control termite damage.
6. Spray a solution made out of 1 kg crushed garlic which is soaked in 200ml of kerosene, mixed with 2 kg green chilli

paste & dissolved in 200 liters of water. This will help in controlling hairy caterpillar and *Heliothis* pest. It also acts as contact insecticide and a repellent**.**

7. Sprinkling with neem leaves, cow urine mixed with water (1:10 ratio) helps to control many pests and diseases.

8. Four kg of Neem seed kernel extract in 100 litres of water is mixed with 50 gm of detergent powder. Spraying the extract will destroy the eggs (**ovicidal properties**) of the insects and also it controls many pests in different vegetables.

9. Cooked rice is spread in the fields which attracts birds and incidentally predate on **semi-looper** and other insects.

10. Take five kg of tobacco powder is soaked in five litre of water and add one litre of cow urine, keep for five days. Filter and dilute with 50 litres of water and spray to control the sucking pests.

11. Take two kg each of custard apple leaves, neem leaves and lantana leaves, crush them finely and boil with five litres of water. Filter this mixture, add one litre of cow urine and five gm of detergent soap. Dilute with 10 litre of water, and spray to control many pests in vegetables.

12. Take 25 kg of weeds from farm or from tank bund areas or from roadside. Add 200 gm each of jaggery, salt and tamarind. Mix all these items in a container adding 100 litres of water. Leave this mixture in a drum for 15 days. This mixture is stirred well, once in every three days. After 15 days the mixture emanates a bad odour and gets converted to liquid form. When this liquid manure is used for vegetable crops, it helps for the luxurious growth of the plant.

13. Take 1 kg each of the plant stems and leaves of *Ipomea fistula*, *Agave americana*, *Datura* spp, *Pongamia pinnata*, *Argemone mexicana*, *Annona- squamos*, shred and soak in a large pot with 10 litre of cows urine, and allow to stand for at least 10 days and then filter. The filtrate is diluted in a ratio of 1:6 with water, and sprayed on the affected vegetable crops. This is effective on all major vegetable pests like **fruit borers, leaf eaters and root damagers.**

14. Take 100 gms of garlic cloves, crush and soak in kerosene, and live overnight. 100 gms of green chillies are ground, soaked in

½ litre of water, and left overnight. Both solutions are filtered and mixed. 30 gm of soap powder is added and thoroughly mixed. The solution is diluted with water in a ratio of 1:5 and sprayed. It is effective on the pests like, **Diamond back** moth, **Fruit borer** and **Leafroller.**

15. Take 10 kg of cow dung, 10 litres of cow urine, two kg of Jaggery, two kg of groundnut cake, two kg of any cereal flour, two kg of Blackgram flour and mix with five litres of water in an earthen pot or plastic container. Allow it to ferment for 10 to 15 days under shade. This liquid is sufficient for vegetables in one acre of land.

16. Application of 200 ml of buttermilk to curry leaf plant every week, improves aroma, ensures availability of enzymes, vitamins and micronutrients.

17. The cut ends of plant cuttings are pasted with cow dung ball – Better sprouting and rooting – reduces desiccation and acts as growth promoter.

18. Root maggots in radish, onions, cabbage and mustard can be controlled by spreading fresh (not hot) wood ash around the plant roots. Ashes are then covered lightly with soil. Snails, slugs and cutworms can be controlled by encircling plants with

3-4 inch-wide and 1-2 inches deep trench and filling this trench with fresh wood ash. Pests will avoid crossing this trench.

19. Tomato flea beetles can be controlled by spraying a mixture of wood ash and water. Cucumber beetles can likewise be controlled by spraying a mixture of equal quantities of wood ash and powdered lime mixed with soapy water.

20. To preserve the bitter guard seeds place the cow dung on the wall like chappati. Take a ripen bitter guard seeds and press the seeds in the cow dung. It will dry automatically and use it for propagation.

21. Wood ash for every kilogram of seed to be stored, add 500 gm of fresh dry but cool wood ash, after the seeds have been put in the container in which the seeds are to be stored.

22. Lime also has insect repelling properties. For every kilogram of seed, use 50 gm of lime. The mixing can be done in the same container in which the seeds are to be stored.

23. Coconut oil or any other vegetable oil is especially for bean seeds. For one kilogram of bean seed add 2 teaspoons of vegetable oil, Mix the oil with 230 gms of seed and pour it into a clean container. Add the remaining seeds and mix till all the seeds are coated with oil. It helps the seeds to prevent from the pest.

24. Chilly seeds are immersed in biogas slurry for half an hour to promote vigorous growth and to impart disease resistance to seedlings

25. Vegetable seeds of bitter gourd, pumpkin, snake gourd and ridge gourd are stored by mixing them with ash. It is wide spread practice to plant these seeds after mixing them with ash that leads to better growth.

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3.5 FRUITS

Fruits are liked by people of all ages for their excellent taste, flavour and food value. They also help the farm families to become commercially viable. They are rich in Vitamins and possess medicinal values. Kadaliphalam (Banana) and Narikela (Coconut) are documented in traditional scriptures and stone sculptures dating back to more than 3000 years.

a. Banana (*Musa Spp.)*

Banana is a very important fruit crop of our country next only to mango. It comprises of several minerals and rich proportions of vitamins and has 27 per cent of carbohydrates thus forming a rich source of energy.

1. For fresh planting of banana, dried leaves, twigs, trashes etc. are burnt on the field to prepare it well.
2. Two kg of farm yard manure, and one kg of powdered neem cake, are applied to pits while planting banana suckers

3. Banana suckers are immersed for 30 minutes in one lit of neem oil dissolved in 100 litres of water, mixed with 50 gm of detergent powder before planting to prevent rhizome rot.
4. Immersing the banana suckers in hot water for 30 minutes before planting them helps to control root grub and rhizome rot.
5. One Kg each of powdered neem cake and tobacco waste are soaked separately in 5 lit of water each. The next day, they are filtered and decanted solutions are mixed together, in which suckers are immersed before planting to prevent nematode attack.
6. Groundnut cake (500 gm) is applied per sucker of banana crop for better yield.
7. Grow Sesbania spp. (trees) as border crop around banana fields to act as a shelter crop in order to prevent the wind damage.
8. Dried outer bark around the banana stem is removed once in four months to prevent primordial root growth and emergence of side suckers there by preventing lodging.
9. Dried drooping leaves are removed once in three months to avoid shade effect, which may produce black spots on fruits, and to reduce wind damage thereby preventing lodging.
10. Onion, tomato, cowpea and lady's finger are grown as intercrops in banana in the early stages i.e. up to 4 months.
11. Side suckers are uprooted (De-suckering) at monthly intervals with long iron rods.

12. Dried and drooping leaves are removed from fifth month onwards
13. Applying 150 gm of neem cake powder per sucker in 3rd and 5th months will prevent nematodes.
14. To control banana wilt, affected plants are removed and burnt and one to two kg of lime is applied to each pit.
15. The oozing out of gummy substances while removing the dried bark indicates stem borer attack. To control this, holes are cleaned and plugged with neem cake powder.
16. To control banana wilt, affected plants are removed and burnt and one to two kg of lime is applied to each pit.
17. For inducing ripening of banana bunches, they are stacked in pits and lined with pieces of cut pseudo stem on the sides. A porous container having pieces of fuming charcoal is placed at the top center. Finally pits are closed air tight with dried leaves.
18. For ripening of banana fruits, banana hands are stacked in a tall copper vessel called 'Anda'. Few fuming incense sticks are kept inside and covered with lid for 24 hours.
19. Neem leaves are put inside a vessel containing banana hands for ripening of fruits. But ripening will take about four days.
20. To induce quick ripening, the leaves of *Basella alba* (Basale) are put into the baskets or gunny bags and bunches are stacked inside and covered air tight.
21. Application of Vaseline, a layer of clay or cow dung ball to the cut end of stalk prevents rotting during ripening and storage.

b. Mango *(Mangifera Indica)*

Mango is the most extensively cultivated fruit crop all over India. It is considered as the king of fruit crops. Fruits are very tasty and rich in Vitamins A and C.

Chapter 3.5
Pic. 02

1. For planting mango grafts, pits of 3x3x3 feet are dug 25 feet apart on either side and allowed to dry for three months so as to kill the weeds. Pests & diseases.
2. Dried leaves and twigs are burnt and fumigated under the tree during early morning before sunrise or late evening after sun set which will help the plants to induce flowering and drive away the hoppers.
3. Sunflower is cultivated in between the mango trees to attract honeybees, which increases pollination and fruit production.
4. To bring the non-bearing trees to bearing, the bark on the trunk is removed at a height of 3-4 feet from the ground level during solar or lunar eclipse day.
5. Non bearing trees are brought to bearing by digging ½ foot deep trench like basin around the tree at 5 feet from the tree base in which green leaf manures are applied and covered with soil.

6. To induce good bearing in mango, excess and useless roots are removed and one kg of bone meal and 50 kg of farm yard manure are applied for 10 year old tree. Incisions are made on the tree trunk above 1 meter from the ground level and the bark removed in circular manner to a width of 2 inches to prevent food materials from going to tree base and make it bleed.
7. Filling mustard oil to a shallow depression on the upper surface of the thickest Mango branch, prevents fruits drop and ascetic layer formation.
8. Planting cashew in mango orchards, reduces **Mango hopper** incidence. Cashew acts as an alternate host for the hopper.
9. Dissolve 400 ml of Neem oil in 100 litres of water and mix 50 gm of detergent soap. Mix thoroughly and spray. It helps to control the hoppers.
10. Dissolve one kg of cow dung in 10 litres of water, add 5 gm of detergent soap, and spray on mango plants which ensures effective control of **sooty mould**. Cow dung is a known disinfectant and physically removes the pathogen by washing off.
11. To get uniform ripening of mango fruits in a week, fruits are spread on paddy straw on the floor and covered with straw and the room is kept closed.

c. Grapes *(Vitis vinifera)*

Grapes are very tasty fruits that supply nourishment to human body and provide a sort of refreshing when consumed. They are easily digestible and possess calcium, phosphorus and iron and other minerals.

1. Long trenches are dug at a spacing of 10 feet three months before planting. In these trenches green leaf manures like Kolingi (*Tephrosia purpurea) Agave* spp. and *Ekka* (*Calotropis* sp.) are applied and covered with soil and allowed to decompose.
2. Neem cake powder is applied at 500 gm per acre to control the nematodes.
3. Cover the grapes bower with coconut or Palm fronds on its sides to avoid wind damage to the fruits, free passage of birds in to the bower and protect from scorching due to heat waves.
4. Groundnut cake is powdered, soaked in water overnight and poured to grapes at one bucket per pit, for better fruit quality and yield.
5. A portion of the berries at the tip of each bunch may be thinned to ensure better fruit size.

d. **Guava** *(Psidium gujava)*

It is a very hardy tree and can withstand prolonged droughts. Cold weather during winter induces heavy fruiting. It is a very popular fruit crop in southern states especially in northern Karnataka. Fruit is very rich in Vitamin C (35-100 mg in every 100 gm of fruit). It is also a good source of minerals like calcium and phosphorus.

1. Pounding two kg of foliage of *Calotropis* spp. with three kg. of neem cake, soaking them in 20 litres of water for four days, dissolving the extract in 200 litres of water and mixing with 50 gm of detergent soap and spraying on one acre helps to control white fly.

e. **Acidlime** *(Citrus aurantifolia)*

This is also called as Kaghzi lime known for its soury juice inside the fruit, which has fetched this species a higher place than the lemons. They are rich in Vitamin C and the rural folk mostly use them for pickles and in cooking especially the '*Gojju'* that makes a very good combination with rice.

1. Pits are dug and allowed to dry for 3 to 4 months.
2. Burrying the dog's carcass at the root zone helps in getting higher yields in acid lime.
3. Applying 10 kg of pig manure per tree, helps to increase the yield and to prevent flower shedding.
4. Four kg of Neem seeds are powdered and dissolved in 100 litres of water and filtered. Add 10 lit of cow urine and mix it with 50 gm of detergent powder. Spraying this extract will control leaf miner pest and other diseases.
5. Dried neem fruits are powdered and applied at 500 gm per tree to control the nematode attack.
6. To control sooty mould, maida flour(500 gm in 5 lit of water) is boiled in water to colloidal stage and it is diluted, filtered

and mixed with cow urine (5 litre) and water (50 litres) and sprayed.

7. Leaves of Kasarka *(Strychnos, nuxvomica*) mixed with cow dung are applied to lemon plants which controls grubs and also has fumigation effect.
8. To bring the lime trees to bearing 4-5 kg of outer seed coat of sorghum or pearl millet is applied at the root zone before the onset of monsoon season.
9. For extraction of acid lime seeds, well ripened, big sized fruits are put in airtight containers for about 15 days rotting. Then the fruits are squeezed, washed with water in bamboo plates and dried under shade.

f. Mandarin Orange *(Citrus reticulata)*

This is also commonly called as *Santra* Orange. Coorg orange in coastal region (Kodagu) has a special place for its sweet taste. It can be grown successfully on a wide range of soils, although medium loam with slightly heavier subsoil is well suited for this crop. Santra orange is usually budded on rough lemon (*Jamberi*).

1. Dried forest leaves are applied as mulch to protect soil moisture and to maintain uniform soil temperature during both summer and winter seasons.
2. Orange trees attacked by stem borer are given lime wash; holes are cleaned and plugged with lime soaked cotton or wrapped with lemon grass.
3. Greenish Aloe Vera plants are cut into small pieces and spread to a radius of 2 feet around the tree during flowering to control powdery mildew.
4. Collected orange seeds are mixed with ash to avoid ant's attack.
5. Prune young trees to build up a strong frame work for better bearing.

g. Pine Apple *(Ananas sativus)*

It is a flavourful fruit rich in Vitamin A, B and C in addition to certain minerals. It grows well both in plains and hilly areas upto 900 metres. It requires well drained soils and does not stand high temperature or frost. It can be propagated by slips and suckers.

1. Growing tip is nipped to obtain fruits with more weight and size.
2. Time of harvest is indicated by the colour change at the base of fruits from green to yellow.

h. **Papaya** *(Carica papaya)*

It is a very common fruit that is consumed daily as that of banana. It is rich in Vitamins A and C. It cannot tolerate low temperature and comes up well under warm climate. Strong winds are highly detrimental to the crop as the hallow stems break easily. Occasional thinning of fruits is necessary to prevent over crowding. Low growing vegetables can be grown as intercrops in papaya. Papaya itself can be grown as a filler crop in plantations of other crops where the spacing is wide enough.

Papaya is not a hermaphrodite and the plant is unisexual. Male plants do not bear any fruit and the function of the male flower is only pollination. Therefore, in papaya gardens it is necessary to have one male plant for every 12-15 female papaya plant.

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3.6 SUGARCANE

Sugarcane is India's traditional crop and is the chief source of sugar. It plays a pivotal role in the economy of the country as a cash crop. People say that jaggery is originated in India. According to Ayurveda, Jaggery is anti-diabetic, high in Vitamins, and minerals like iron, copper, calcium, and phosphorous. This is can be used in the preparation of sweets.

At planting of sugarcane farm yard manure and tank silt are added in bulk to the field. Sugarcane is organically grown using high tonnage of compost and vermi-compost.

Of late organic farmers have deduced an organic formulation termed as "Jeevamrutha", which is prepared by mixing 10 kg of cow dung, 10 litre of cow urine, 2 kg of jaggery and 1 kg of castor seeds which is all mixed in water and allowed to ferment for 8 days. After fermentation this formulation is allowed to mix with irrigation water and fed to sugarcane crop.

Cow urine 1 litre is mixed with 10 litres of water and sprayed on the sugarcane crop once in a month to take care of insect pests.

To control the diseases take 500 gm of garlic, and 3 kg of pungent green chillies, ground them to a paste, mix with 2 to 3 litres of kerosene and sprayed over sugarcane crop.

To prevent lodging and allow diffusion of sunlight and air, the sugarcane leaves are tied up by taking 8 to 10 canes together. It also helps to prevent free dwelling place for rodents, wild boars and foxes.

Common salt 1 kg in 1000 litre of water is sprayed on the sugarcane crop thrice during the crop period which is believed to enhance sweetness in the sugarcane juice.

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4. PEST MANAGEMENT

The outbreak of pests or so-called harmful insects and diseases is now a very serious problem in agricultural practice. Though farmers have been using chemical pesticides to control them, the problems have not been solved, or rather the situation has been getting worse in a vicious cycle.

Agricultural research has been emphasizing how to control the pest problem when it appears, not understanding the root causes of the problem, No problem can be solved without considering the root causes. It is man's lack of understanding of the fact that in a healthy environment, plants grow well, and pests do not attack plants easily. Even if pests do attack, damage is minimal.

We need to break out of the vicious cycle of pest problems and discover a permanent solution.

4.1 Nature of Pest Problems

Man thinks that pests (insects and diseases which attack crops) are absolutely harmful. From the perspective of man's benefit, it seems to be right. However, from an ecological point of view, it is completely wrong. Everything in an ecosystem interacts and all elements are necessary to keep ecological balance in the nature.

The harmful insects are, in ecological terms, consumers of the first order. The role of the insects in the food chain, is not harmful, but rather important and is indispensable. If there are no insects, consumers of the second order cannot survive, and the food chain will be disturbed.

In a well-balanced ecosystem, the number of the insects are kept within certain limits, which are not harmful to plants. But when disturbances come from outside, the insects may break out suddenly and become harmful to plants (crops). If we observe this fact carefully we can realise that the problem is not the insects, but the cause of the imbalance in the ecosystem, which allows the insects to increase.

The insects should be seen as teachers who tell us that we have done something wrong to the ecosystem. Therefore, before deciding that the insects are bad and should be removed, we must discover why the insects have broken out.

The same thing can be said about plant diseases. Plant diseases occur as a result of outbreak of specific micro-organisms or so-called disease germs (e.g. some kinds of nematode, fungi, virus, etc.). These disease germs are usually limited in number, so they are not harmful to plants. But when the soil ecosystem is disturbed and conditions are created in which disease germs can easily break out, then plant diseases occur. The problem is not the existence of the disease germs in the soil but the disturbing factors, which

create the imbalanced soil ecosystem. Therefore, it is very important for disease prevention to remove the disturbing factors (e.g. continuous cropping, use of agricultural chemicals, etc.) and create a balanced soil ecosystem.

4.2 The Vicious Cycle of Chemical Pest Control

The present chemical agricultural practice utilizes chemical pest control. The practice involves the following:

1. Use of chemical poisons which are harmful to all living things
2. Dealing with immediate problems (Symptomatic cure only)
3. No consideration of the root causes.

Insects

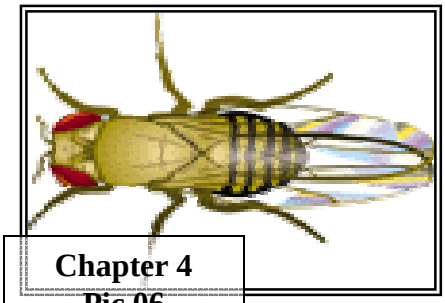
A quick generation cycle and the production of a huge number of eggs at once is the characteristic of insects. This very characteristic enables the insects to develop resistance to the chemical insecticide quickly. So farmers are forced to use more pesticide or other stronger pesticides to control the insects. But again, the new insect generations become resistant to the pesticide. A second factor is the disappearance of natural enemies (e.g. spiders, frogs, birds, etc.), which eat the insects. The natural enemies are fewer in number and have a slower generation cycle and therefore are less productive than the insects. They cannot develop the same resistance against chemical pesticide and consequently are killed and disappear. The result is the creation of an imbalanced

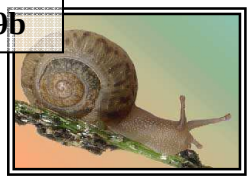
ecosystem in which only the insects can break out. Few examples of such pests affecting our gardens are listed below:

4.3 SOME COMMON GARDEN PESTS

Name Of Pest	Description / Manifestation
 **Aphids** **Chapter 4** **Pic - 01**	**APHIDS**: sucking insects attacking the leaves and stems. When attacked. The leaves and stems of the plants begin to look pale and spindly. Aphids can change color to match plant parts and metamorphose from nymphs to adult, both with and without wings. When the aphids in one plant get overcrowded, they develop wings and fly to another plant host of the same plant family. Aphids mature in 12 days.

 Chapter4 Pic -02 **Borers**	**BORERS**: Boring insects attack the flowers, pods, stems and roots. Borers hatch, eat and grow inside plant part as caterpillars. The sudden wilting of plant tops indicates the presence of borers.
 Chapter 4 Pic 03 **Bugs**	**BUGS:** Sucking insects that attach to plant parts and drain plant juices. In case of mealy bug, eggs are laid in white, cottony masses. Young are crawlers like scale insects. Bugs excrete large amounts of honeydew that attract ants and encourage black mold fungus.

 Chapter 4 Pic 04 **Beetles**	**BEETLES:** Chewing insects, which feed on, leaves, flowers, stems and even roots. They feed on most vegetables. Severe infestation can defoliate plant.
 Chapter 4 Pic 05 **Caterpillars / Worms**	**CATERPILLARS/WORMS**: - Chewing insects usually develop from patches of eggs on the underside of leaves. The larval stage of moths and butterflies. Caterpillars feed on foliage and tender stems.
 Chapter 4 Pic 06 **Flies**	**FLIES:** Feed on foliage of many plants. Grasshoppers are most often found in late summer when fields next to gardens become dry. In severe infestations, large plants may be defoliated. The tender bark may be stripped from trees and shrubs.

 Chapter 4 Pic 07 **Hoppers / Katydid**	**HOPPERS/KATYDID:** Feed on foliage of many plants. Grasshoppers are most often found in late summer when fields next to gardens become dry. In severe infestations. Large plants may be defoliated. The tender bark may be stripped from trees and shrubs.
 Chapter 4 Pic 08 **Scale Insects**	**SCALE INSECTS:** Small insects, covered by protective shells, that attach themselves to stems and undersurfaces of leaves and suck out plant juice. Generally, they are able to move about in younger stages, but become stationary or nearly so in adulthood.
 **Slugs** Chapter 4 Pic 09a & 09b **Snails** 	**SLUGS AND SNAILS:** - Slimy trails and tattered foliage indicate snail and slug invasion. In daytime, they can be found under rocks leaves, densely foliaged plats, boards or any object that rests on the ground. At night, they can be found busily feeding on plant parts.

This vicious cycle caused by the use of chemical pesticide not only makes the pest problem worse but also creates health hazards. The farmers who use the chemical pesticide (poison) are affected first, and those who eat the poisoned products are affected consequently.

Diseases

Diseases follow more or less the same pattern. Diseases will never be controlled by chemical pesticides (fungicide, etc.) Use of agricultural chemicals to control diseases causes the same vicious cycle in the following ways:

1. Specific micro-organisms (the disease germs), which cause plant disease, are very flexible in changing their character to adjust to the change of circumstance. They can easily grow resistant to the pesticide.

There are also certain micro-organisms terms as “Nematodes” which suck the sap from the root zones and cause deleterious effect on the crop yield.

 **Chapter 4** **Pic 10** **Root-knot Nematodes**	**ROOT-KNOT NEMATODES:** Microscopic worms that either stick their heads on a plant to suck the sap or actually spend their lives inside the plant. They attack roots of various plants and form galls or root knots. Infested plants wilt or die due to the inability of the damaged root systems to supply enough water to their tops.

2. The pesticide also kills beneficial microorganisms, which control the disease germs. An imbalance in microorganisms occurs.
3. The resurgence of new and resistant diseases creates a further imbalance of micro-organisms.

Though chemical pest control temporarily demonstrates quick action, it cannot solve the problem permanently. The only permanent solution is pest management, which considers the root causes and deals with the problems based on the rules of nature.

4.4 Natural Pest Management

The basic guiding principle of natural pest management is that there is no such thing as a pest problem. If the ecological balance in the agricultural land is not disturbed then the appearance of the

pest is not a problem but a symptom. If the symptoms appear, we should try to find out the causes (disturbing factors) and remove them in order to recover the ecological balance. Only this approach can avoid the same mistake the next time. There are two measures, preventive and control. The most emphases should be put on preventive measures; however, control measures may be necessary in the initial stages of ecological agricultural practice. If proper preventive measures are taken, control measures will not be necessary.

4.5 Preventive Measures

Preventive measures have indirect effects and are a long-term process. That is why farmers are not very interested in using these methods. From the ecological point of view it is the only way to permanent solution of pest problems. Therefore, much emphasis (more than 90%) should be put on preventive measures.

Create a Balanced Agro – Ecosystem

It is diversity, which has the most important role in building up ecological balance in agricultural land. The elimination of disturbing factors is also very important. Methods include:-

1. Diverse cropping (Section 6.3)
2. Mixed cropping, including insect repelling herbs and medicinal plants (Section 6.5)
3. Planting perennial trees and grasses (Section 5.5)
4. No use of agricultural chemicals (Section 5.1)

Create a Balanced Soil Ecosystem

A balanced soil ecosystem (balance in micro-organisms) is the key element in the health of plants. Almost all plant diseases come from this imbalance which is mainly created by lack of organic matter, continuous cropping and use of agricultural chemicals which kill micro-organisms. Methods to maintain this balance include:

1. Crop Rotation.
2. Regular supply of organic matter
3. Avoid mixing raw organic matter with soil
4. Non-use of agricultural chemicals

Others

1. Good seed selection (no disease contamination, etc.)
2. Planting at appropriate time
3. Appropriate spacing etc.

Actually, the cause of pest outbreak is not simple but very diverse and complicated . If we face a pest outbreak, we should reconsider the methods we are using for growing our crops and find out what is wrong. The insects and diseases are the indicators and not the problem.

Control Measures

Despite preventive measures, some pest problems may occur in the early stages of ecological agricultural practice because the health of the soil is not fully recovered from the ill effects of chemical agricultural practice and the ecosystem is not yet balanced. In this case, it may be necessary to undertake control measures to protect the crops.

Physical Control

This method is very simple and easy, and effective in the early stages of insect outbreak.

1. Hand picking –remove/ catch the insects by hand or net.
2. Light trap-put a light above the water of a bucket; insects come and fall into the water.
3. Stick setting –becomes a place for birds that eat the insects.
4. Scare crow –something which scares birds that eat grain
5. Net cover to protect crops (e.g. cabbage) from insect attack.

Natural Pesticide

There are many natural things, which repel or kill insects. Common natural pesticides are: Ash (Powder), Neem leaves and seeds, Tobacco leaves, Jute seeds (Powder), Chillies, Hydro Piper (*Bishkathali*), locally adapted plant leaves, e.g., Adathoda (the leaves that are not eaten by the goats) etc.,

A way of using the plant leaves is to soak them in water overnight and take extracts, which can be used as a natural pesticide.

4.6 Alternative Pest Management Methods

This is an approach that utilizes different techniques other than the use of chemical pesticides to control pests. It involves natural pest population- control methods, including cultural and biological controls and the use of botanical pesticides as needed.

4.7 Cultural Method of Pest Control

These methods are aimed either at reducing the sources of inoculums or at reducing the exposure of plants to infection. Its primary objective is the prevention of pest damage and not the destruction of an existing and damaging pest population.

a. **Good Soil Preparation:** This is the first important element in pest control strategy. A healthy soil means healthy plants which are relatively more resistant to pests. A soil rich in humus hosts a wide variety of beneficial microflora that traps nematodes and destroy or keep in dormancy disease organisms. Thereby encouraging beneficial insects.

b. **Use Of Indigenous Varieties:-**Traditional varieties are hardier and relatively more resistant to pests. They can withstand harsh environmental conditions better than modern hybrids.

c. **Pest Control Through The Use Of Mesh Screen (Nylon Nets):** Younger plants are usually preferred by insects and they suffer significantly from such attacks when compared to older plants. Therefore, a single netting over the plants during the first 30- 45 days of their growth can reduce pest damage. Also, the net helps diffuse sunlight thereby improving the quality of some vegetables. Finally, the net breaks the impact of raindrops thus:

- Reducing physical damage to the plant and
- Reducing a soil erosion from the beds.

d. **Roughing Or Pruning:** Removal of diseased plants or plant parts prevents the spread of microorganisms to uninfected areas.

e. **Intercropping With Aromatic Herbs:** Several types of odorous plants can be grown together with the main crop to repel insects. The following are some examples:

a. **Allium cepa (Onion)**
b. **Allium odorum (leck)**
c. **Allium Sativum (garlic)**
d. **Artemisia vulgaris (madwort, worm wood)**
e. **Hyptis suave lens (bush-tea)**
f. **Menthe cord folia (mint)**
g. **Ocinum basilicum (sweet basil)**
h. **Ocimum sanctum (sacred basil)**
i. **Tagetes spp.(marigold).**

f. **Encouraging Insect Predators**: Pests can be controlled by their natural enemies. By growing a variety of flowering plants, specifically those belonging to Umbelliferae family, such as fennel (Foeniculum vulgare) and celery (Apium graveolens), insect predators will be attracted insects feed on pests, keeping the pest population below economic injury level.

g. **Multiple Cropping**: This provides genetic diversity to minimize pest increase. Variation in susceptibility among species or varieties to a particular disease is great. Given abundant hosts of a single species or variety, a pest could easily be spread from host to host. When the number of hosts declines, the pest incidence will also decrease for lack of necessary food for the organism.

h. **Crop Rotation:** This is a practice of following a crop susceptible to a pest by a resistant crop. There is no build-up of the organism to a high level since the growth cycle of the organism has been broken.

4.8 Biological Pest Control (Friendly Insects)

Biological pest control is the suppression of pest populations by living organisms such as predators. Parasites and pathogens.

Theses agents are responsible for keeping pests under control most of the time.

Predators are usually other insects and spiders. Both, but particularly spiders, feed on a wide range of insects.
Various kinds of birds, lady bird beetles, snakes, wasps, spiders, dragonflies, frogs, crabs, field lizards, chameleons, crickets etc protect crops from pests by praying on unfriendly pests / eggs/larvae etc.

Name Of Pest	Description / Manifestation
 **Praying Mantis** **Dragon Fly** 	**PRAYING MANTIS, DRAGON FLY**, **DAMSELFLY, ASSASSIN BUGS:** - Feed on all types of insects.

 **Lacewings**	**LACEWINGS**, White- banded clerid, Robber flies: - Feed on aphids and soft-bodied insects.
 **Ground Beetles**	**GROUND BEETLES**, whirligig beetles, rove beetles, Tiger beetles, Green carbide beetles: - Feed on other insects.
	LADYBIRD BEETLES: - Feed on scalars and aphids only. They eat 40-50 insects per day. Their larva eats even more.

 **Toads** **Snakes** 	**TOADS & SNAKES & Spiders** eat insects and other garden pests. Toads eat as many as 10,000 insects and other pests in three months, including cutworms, slugs, crickets, ants, caterpillars and squash bugs.
 **Birds**	**BIRDS**: - Some birds are omnivorous. Some examples from the Temperate zone provides a good illustration of what birds eat. A house wren feeds 500 spiders and caterpillars to her young in one afternoon; a brown trasher consumes 6,000 insects a day; a chickadee eats 138,000canker worm eggs in 25 days; and, a pair of flickers eats 5,000 ants as snack.

Parasitic Insects: These are usually small flies or wasps, which attack one or a few closely, related pest species. They are parasitic in their larval stages but free-living as adults.

Tachinid Flies, Braconid Wasps: Complete their life cycle on insect pests. They usually attack the egg of the host pest or the caterpillar by laying an egg into its body. The wasp larva hatches inside the caterpillar body and feeds on it.

Trichogramma Spp: Attacks eggs of butterflies and moth. This wasp produces very few side effects on beneficial insects.

Epidinocarsis Lopezi: Feeds and reproduces on mealy bugs of cassava. It has the ability to establish itself in cassava fields

Encouraging Predators

In nature, pests are usually controlled by the pressure of insect predators and parasites which keep the populations of the harmful insects under control. Most of the insects in nature are either beneficial or at least harmless. There are many ways to encourage insect predators in one's garden.

1. **Create A Suitable Habitat For Insect Predators:** Flowering shrubs and trees throughout the garden will attract many beneficial insects, including parasitic wasps which require pollen and nectar for their growth and maturity. Plants belonging to Umbelliferae

family are particularly effective in attracting natural enemies of pests.

2. **Provide Alternate Hosts For Pests:** To ensure availability of food for the beneficial organisms, grow alternate host plants along fence lines and in between cultivated crops. The natural enemy populations on these alternate host plants will control pests attacking the cultivated crop.

3. **Create Nesting Sites For Frogs, Reptiles And Birds:** Logs of dead trees, irregularly shaped rocks with crevices and cavities and plenty of mulch can be a good nesting sites for snakes, lizards, frogs, rove beetles and carabid beetles, which feed on insects.

4. **Increase Humidity By Providing Water Holes:** Humidity is much needed for the survival of natural enemies. It serves as a source of drinking water for reptiles, birds and frogs. Many predatory insects live in, on and near water. Well-vegetated small dams, little water pools and swales scattered throughout the garden will create conditions for the build-up of natural enemies.

5. **Practice Mixed Cultivation:** Growing mixed crops and harvesting them in strips help maintain natural enemies and confuses pests. For fungal pathogens, the practice of mixed cropping is desirable as the root exudates of another crop can be toxic to the pathogen. Mixed cropping also encourages soil microbes which in turn, act as barriers to the fungal pathogen.

6. **Reduce Dust Build Up In Crop Plants:** Dust inhibits the functioning of natural enemies. Growing well-designed windbreaks and ground cover crops like centrosema and lablab bean will reduce dust. Use of overhead sprinklers will also help periodically in washing off the dust.

7. **Avoid Spraying Chemical Pesticides:** Chemical pesticides eliminate beneficial insects. If pest infestation reaches economic threshold levels and spraying cannot be avoided, use selective chemicals, such as:

a. Soil incorporated granular systemic insecticides for sucking insects;
b. Stomach poisons; avoid broad-spectrum contact poisons; and,
c. Insecticides with short-term residual action rather than persistent action.

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5. BOTANICAL ALTERNATIVES IN PLANT PROTECTION

Nature has provided a pest control system, which needs to be preserved. Diversity has an important role in building and maintaining an ecological balance. Some of the NPM practices that are based on observing and creating diversity are mixed or multi cropping techniques which include insect repelling plants, perennial trees and grasses; and preparation of bio-pesticides from different plant materials such as *Milea azadrichta, Vitex negundo, calotropis gigantean, Pongamea glabra* etc.

5.1 Methods of Preparation

Method – 1 **Ingredients:**

- Pods of Datura [*Datura sirumarium*] 1 kg
- Seeds of Arali [*Nerium oleander]* 1 kg
- Tobacco waste 1 kg
- Lime [*diluted calcium Carbonate]* 250 g
- Cow Urine 5 lit
- Mud pot (10 ltr capacity) 1 No.

Preparation Method:

- The pods of Datura to be finely powdered; the seeds of Arali pounded well. The Tobacco waste and lime to be added to the above mixture, add 5 lit of cow urine and put all in a mud pot.
- The mud pot is covered with a lid and buried inside the manure pit / soil for 7 days.

- Then the above mixture is filtered and diluted at the rate 1:10 **Ltrs of water** and sprayed for the control of all pests.

Method – 2 **Ingredients:**

• Rhizomes of (*Gloriosa superba*)	1 kg
• Pods of Datura	1 kg
• Leaves of Ekka (*Calotropis gigantea)*	1 kg
• Leaves of Adathoda *(Adathoda vasica*)	1 kg
• Tobacco waste	500 g
• Cow Urine	5 lit
• Mud pot (10 ltr capacity)	1 No.

Preparation method:

- The Rhizomes of *Gloriosa superba* to be finely chopped. The pods of Datura, the leaves of Ekka and the leaves of Adathoda to be nicely grounded and add the Tobacco waste to the above mixers. Add 5 lit of cow urine and transfer into a mud pot.
- The mud pot is covered with a lid and burried inside the manure pit / soil for 7 days.
- Then the above mixture is filtered and diluted at the rate 1:10 **lit of water** and sprayed for the control of all pests.

Method – 3 **Ingredients:**

• Leaves of Odukkam plant (*Cleistanthus collinus)*	1 kg
• Pods of Datura	1 kg
• Iiuppai cake *(Madhuca long ifolia)*	1 kg
• Seeds of Arali (*Nerium oleander)*	1 kg
• Tobacco waste	500 g
• Lime (Diluted calcium carbonate)	250 g
• Cow Urine	5 lit
• Mud pot (10 ltr capacity)	1 No.

Preparation method:

- The leaves of Odukkam plant, finely chopped the pods of Datura, and the seeds of Arali crushed; add Liuppai cake, tobacco waste and lime into a mud pot and add 5 lit of cow urine.
- The mud pot is covered with a lid and buried inside the manure pit / soil for 7 days.
- Then the above mixture is filtered and diluted at the rate 1:10 **Ltrs of water** and sprayed for the control of all pests.

Method – 4 **Ingredients**

• Ipomoea leaves	1 kg
• Neem seeds	1 kg
• Tobacco waste	500 g
• Lime [Diluted Calcium carbonate]	250 g
• Cow Urine	5 lit
• Mud pot (10 ltr capacity)	1 No.

Preparation method:

- Ipomea leaves chopped and neem seeds crushed. Add tobacco and lime to the above mixture and add 5 lit of cow urine into the mud pot.
- The mud pot is covered with a lid and buried inside the manure pit / soil for 7 days.
- Then the above mixture is filtered and diluted at the rate of 1:10 litres of water and sprayed for the control of all pests.

Method – 5 **Ingredients:**

• Etty Fruit *(Stychnos nuxvomica)*	2 kg

- Custard Apple (*Annona Squmosa)* 1 kg
- Green chilies 250 g
- Neem Seeds 1 kg
- Cow Urine 5 lit
- Mud pot (10 ltr capacity) 1 No.

Preparation method:

- The etty fruit chopped and neem seeds crushed. Add tobacco and lime to the above mixture and add 5 ltrs of cow urine into the mud pot.
- The mud pot is covered with a lid and buried inside the manure pit / soil for 7 days.
- Then the above mixture is filtered and diluted at the rate 1:10 **lit of water** and sprayed for the control of all pests.

Method – 6 **Ingredients:**

- Garlic cloves 250g
- Samanthi (Sevanthi) leaves (*Chrysanthemum coronerium)* 2 kg
- Black pepper 100g
- Tulasi leaves (*Ocimum tinctorium*) 1 kg
- Cow urine 5 lit

Preparation method:

- The garlic gloves and Chrysanthemum leaves chopped. Add black pepper crushed and tulasi leaves chopped to the above mixture and add 5 lit of cow urine into the mud pot.
- The mud pot is covered with a lid and buried inside the manure pit / soil for 7 days.

- Then the above mixture is filtered and diluted at the rate 1:10 **lit of water** and sprayed for the control of all pests in vegetable crops.

Method – 7 **Ingredients:**

• Ipomoea cornea leaves	10 kg
• Cow milk	1 lit
• Cow urine	5 lit

Preparation method:

- Leaves of Ipomoea is pounded well and soaked in cow urine. Boil it for 30 minutes
- Add cow milk.
- Dilute with water in the ratio 1:10 and spray for control of bacterial diseases.

Method – 8 **Ingredients:**

• *Prosopis* spp.	15 kg
• Cow dung	10 kg
• Cow urine	5 lit
• Water	60 lit

Preparation Method:

- *Prosopis* spp. pounded well and soaked in cow urine. To this add cow dung slurry. This mixture is left standing for 24 hours, then filtered, diluted with water and sprayed. It controls Tungro virus disease in Rice.

Botanical Multipurpose Insect Sprays

Onion Brew

This brew should contain roots, stems and leaves of as many aromatic herbs as possible; onion, garlic, horseradish, red pepper, mustard mints chop them and add a quarter or more of water and some liquid detergent. Pour a generous amount of the mixture over plants infested with insects. If the brew ferments, it is more effective in repelling insects.

Garlic and Marigold Mixture

Take 3-4 cloves of garlic, 2 handfuls of marigold leaves, 2-3 onions, 2-3 small peppers. Add water and bring mixture to a boil. Let cool. Dilute with 4-5 times quantity of water. Stir constantly. Spray as needed. Best used in 1-2 days.

Tabacco Leaves and Aromatic Herbs

Grind together tobacco leaves, hot peppers, garlic, onions and mint. The juice is mixed with an equal quantity of water and poured over or sprayed on infested plants.

Aromatic Herbs and Soap

Chop or grind one garlic one onion, one-tablespoon of hot pepper and mix with one-quart water. Let it stay for one hour; then add one-tablespoon of liquid soap detergent. Place the mixture in a tightly covered jar and store in a cool place for one week. This spray makes use of the repellant qualities of garlic, onion and hot pepper. The soap serves as sticker.

Soap and water spray

Mix 3 tablespoons of soap flakes and a gallon of water. Spray against insects.

Wood ash

Root maggots in radish, onions, cabbage and other brassicas can be controlled by spreading fresh (not hot) wood ash around the plant roots. Ashes are then covered lightly with soil. Snails, slugs and cutworms can be controlled by encircling plants with 3-4 inch – wide trench 1-2 inches deep. Fill this trench with fresh wood ash. Pests will avoid crossing this trench.

Flea beetles on tomatoes can be controlled by spraying a mixture of wood ash and water.

Cucumber beetles can like wise be controlled by spraying a mixture of equal quantities of wood ash and powered lime mixed with soapy water.

5.2 Common Herbs Employed In Pest Control

1. **Garlic *(Allium sativum*):** Chop the cloves finely, soak in 2 teaspoons of oil for one day, then mix with half a lit of soapy water and filter. Mix 1 part solution with 20 parts water, then spray

The target pests are Altenaria, Cercospora, Colletotrichum, Curvularia, Diplodia, Fusarium, Helminthosporium, Pestalotia.

The diseases controlled are fruit rot, early blight, purple blotch, leaf spot, frog eye leaf spot, anthracnose, smudge, leaf blight , fruit and stem rot, damping – off , stem and root rot , wilt, curly top.

2. **Acapulco *(Cassia alata*):** Extract the juice of *Cassia alata* leaves and spray at the rate of 1 cup juice / lit of water.

The target pests are Alternaria, Cercospora,

Colletotrichum, Diplodia, Fusarium, Helminthosporium, Pestalotia.

The diseases controlled are, fruit rot, early blight, purple blotch, and leaf spot, frog – eye leaf spot, anthracnose, smudge, fruit and stem rot, and damping – off, stem and root rot, wilt, curly top.

3. **Amaranth (*Amaranthus gracilis*):** Extract the juice from 1 kg of Amaranth leaves, then mix juice with 3 litres of water, and spray.

The target pests are Altenaria, Cercospora, Colletotrichum, Curvularia, Helminthosporium, Pestalotia.

The diseases controlled are, fruit rot, early blight, purple blotch, leaf spot, leaf mould, frog – eye leaf spot, anthracnose, smudge, leaf blight

4. **Red onion (*Allium cepa*):** Chop Allium cepa bulb finely, soak in two teaspoons of oil for a day. Then mix with half a lit of soapy water and filter. Mix one part solution with 20 parts water, and spray.

The target pests are: Cercospora, Colletotrichum, Curvularia, Fusarium, Helminthosporium, Pestalotia.

The diseases controlled are: Leaf mold, leaf spot, early blight, frog-eye leaf spot, anthracnose, fruit rot, smudge, fruit and stem rot, damping – off, root rot, early blight, wilt, curly top

5. **Drumstick (*Moringa oleifera*):** Extract the juice of 1 kg leaves of drum stick, then mix juice with 3 litres of water, and use as spray.

The target pests are: *Alternaria, Colletotrichum, Diplodia, Pestalona*.

The diseases controlled are fruit rot, early blight, purple blotch, leaf spot, anthracnose, fruit rot, smudge, fruit and stem rot.

6. **Kamantigi (*Impatiens balsamina*):** Extract the juice (1 Kg of *Impatiens balsamina*) leaves, then mix the juice with 3 litres of water, and use as spray.

The target pests are: *Altenaria, Cercospora, Helminhosporium.*
The diseases controlled are: Fruit rot, early blight, purple blotch, leaf spot leaf mould, early blight, and frog- eye leaf blight.

7. **Apiaceae (*Centella asiatica L.)*:** Extract the juice from 1 Kg of *Centella asiatica* with 3 litres of water, and use as spray.

The target pests are: Fusarium, Helminthosporium.
The diseases controlled are: Damping off, stem and root rot, early blight, wilt, curly top, leaf blight.

8. **Wild castor (*Jatropha multifida*):** Extract the juice of 1 Kg of *Jatropha* leaves, mix the juice with 3 lit of water, and use as spray.

   The target pests are: *Diplodia* and *Fusarium*.
   The diseases controlled are: Fruit and stem rot, damping off, stem and root rot, early blight. Wilt and curly top.

9. **Papaya (*Carica papaya*):** Pound and soak leaves of papaya in water and use infusion as spray.

   The target pests are: *Cercospora* and *Diplodia*.
   The diseases controlled are: Leaf mold, leaf spot, early blight, frog-eye leaf spot, fruit and stem rot.

10. **Touch me not (*Mimosa pudica*):** Pound, soak the whole plant in water overnight and use infusion as spray.

The target pests are: *Diplodia* and *Pestalotia*.
The diseases controlled are: Fruit and stem rot, leaf spot.

11. **Damong Maria (*Artemisia vulgaris*):** Extract the juice of *Artemisia vulgaris* leaves and use as spray at the rate of 2 to 5 table spoons juice per lit of water.

The target pest is: *Altenaria*.
The diseases controlled are: Fruit rot, early blight, purple blotch, and leaf spot.

12. **Ginger (*Zingiber officinale*):** Extract the 500 gm Ginger rhizome juice, add one lit of cow urine and 10 litres of water mix well and use as spray.

The target pest is: *Cerospora*
The diseases controlled are: Leaf mold, leaf spot, early blight, frog-eye leaf spot.

13. ***Gliricidia sepium*:** Extract the juice of *Gliricidia sepium* from 1 kg leaves, and then mix juice with 3 litres of water, and use as spray. Fresh stems with leaves can be placed between plants to deter insects.

The target pests are: *Cercospora* and insects
The diseases controlled are: Leaf mold, leaf spot, early blight, frog-eye leaf spot.

14. **Verbenaceae (*Vitex negundo*):** Extract juice of 1 kg of *Vitex negundo* leaves, then mix juice with 3 litres of water, and use as spray.

The target pest is: *Cercospora*.
The diseases controlled are: Leaf mold, leaf spot, early blight, frog-eye leaf spot.

15. **Asteraceae (*Artemisia vulgaris*):** Pound the *Artemisia vulgaris* leaves and extract juice and spray at the rate of 2 to 4 table spoons in 16 litres of water.
The target pest is: Corn borer

16. **Lantana (*Lantana camara*):** Pound the flowers and spread around stored grains.

The target pest is: Corn weevil.
Cut the branches sundry and burn. Apply the ashes to the leaves to control various beetles and leaf miners.

17. **Marigold (*Tagetes erecta*):** Extract the juice from marigold roots and spray at the rate of 2 to 4 tablespoons juice per litre of water.

The target pests are: Aphids and borers

18. **French Marigold (*Tagetes patula*):** Pound the roots of *Tagetes patula*, extract juice of 1 kg roots and mix with 1 litre water. Then spray the solution directly into the soil.

The target pests are: Green aphid, grain borer.

19. **Black Pepper (*Piper nigrum*):** Pulverize seeds of *Piper nigrum* with water and spray; powder and spread around stored grains.

The target pests are: Cotton stainer, diamond back moth, common

cutworms and weevils.

20. **Hot Pepper (*Capsicum frutescence*):** Pound the fruits of *Capsicum frutescence*, and extract juice and spray at the rate of 2 to 3 cups of juice with one litre of water.

The target pest is: Rice moth.

21. **Custard Apple (*Annona squamosa*):** Powder 1 kg custard apple seeds and disperse in 3 litre of water for seven days, then strain and use as spray.

The target pests are: Rice pests.
The diseases controlled are: Aphids, ants and other insects.

22. **Neem (*Azadirachta indica*):** Remove the neem seeds husks of 2 to 3 handfuls of mature seeds. Winnow or put in water to float away the husks. Grind seeds into fine particles. Soak Ground

seeds in 3 to 5 litres of water for at least 24 hours. Filter the solution, then use as spray.

The target pests are: Rice pests, diamond-back moth.

Botanical Formulations:

Chrysanthemum:

Grind the dried flowers. Mix with fine clay loam and water spray against a wide range of insects.

Six to seven tablespoons of dried and ground flower for one gallon of water.

***Nicotiana tabaccum* commonly known as Tobacco**

Boil the midribs and stem in water for a few minutes or soak for 3-4 days. Let it cool. This is an effective spray against numerous insect pests.

***Acorus calamus* L.Araceae, commonly known as Sweet Flag**

Powder the roots and add water. Use as an insecticide spray. Decoction of rhizome can also be used as a spray.

Mint, Coriander and other aromatic herbs

Plant these crops all around the garden plot. Their strong odour repels insects. They can also be used as spices and medicines. For every 100sq. meter bed, plant 8-10 marigolds in the border and intercrop20-25 garlic or onion bulbs.

Chapter 5.2
Pic 19

Tomato

Boil the stems and leaves of tomato in water. Cool it. Spray against caterpillars and black or green flies. This will also serve to deter future attack.

***Artemisia vulgaris* L. Asteraceae**

Cut the branches, dry and then burn near or below the plants. This will drive away insects.

***Melia azaderach* L. Meliaceae, commonly known as Persian Lilac**

Another popular south Asian tree whose leaves can be made into a decoction, sieved &then sprayed.

NOTE: To get effective herbal extracts, crush the leaves or seeds, soak in water overnight and extract the juice for good results.

5.3 Termites Control

1. Termites destroy the seedlings in nursery raised in dry-land conditions. To control these, neem leaves, sheep wool and human hairs are put; termites feeding on these materials will die due to rupture in their intestines.

2. Growing castor on the fields will control termites to some extent.

3. Putting neem cake inside a gunny bag and placing it in the irrigation channel controls termites.

4. Plant 'Piradai' (*Cissus quadrangularis*) vines around the field to protect against termites.

5. Before planting tree seedlings, dried leaves and trashes are burnt in the pits to protect the root zone of crops from termites.

6. Dusting wood ash in the pits before planting tree seedlings also helps to prevent termites.

7. Sprinkle 5% common salt solution to reduce termite attack on the trees.

8. After the harvest of tobacco leaves their stems and roots are ploughed in situ to control the termites.

9. Tobacco soaked water is poured on the ant mounds to control them

5.4 Rodent Control

1. Rats do not live in fields where sheep penning is being practiced (Stray cattle menace also can be checked by sheep penning as cattle do not feed on / graze the lands after sheep penning, as the sheep urine drives them away from grazing).

2. Putting fresh cow dung on both the fields and bunds reduces rat problem.

3. Put the branches of Thangarali (*Tecoma stands*) around the fields to control rats.

4. To control rats in paddy fields Channampoo (*Cycas cercinalis*) flowers are cut into pieces and placed in many places whose bad odour drives away the rats.

5. Planting closely Nochi (*Vitex negundo*) and *Calotropis gigantean* around the fields as a fence helps to control rat problem.

6. Pieces of Palmura (*Borassus flabellifer*) leaves are tied on the poles fixed on the field, the sound produced by the leaves scares away the rats (also for birds scaring).

7. To reduce the population, rat holes are disturbed and rats are held at each harvest.

8. Providing owl stands near the rat holes will help in reducing the rat damage.

9. To catch the rats a trap made up of wire loops on bamboo pegs is used.

10. Big round shaped earthen pots are buried on the field at ground level. Half of the pot is filled with mud slurry on which baiting material is put on a coconut shell. Attracted rats fall inside the pot and they cannot climb up and get killed.

11. Use of soaked rice as bait attracts more rats.

12. Smoking of rat burrows with paddy husk and dry chillies: Pungent smoke generated by paddy husk and chilies cause suffocation and kills rats. It is cost effective and eco-friendly measure for rat control.

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6. LIQUID MANNURES & PESTICIDES

Panchagavya is a combination of 5 products obtained from the cow which is used in traditional medicine extensively. These are cow dung, cow's urine, cow's milk, curd and ghee. This is also mentioned in Vrkshayurveda texts and it has been experimented by various organic farmers. It has a significant role in providing resistance to pests and disease and increasing the overall yield.

a. Panchagavya as a Liquid Mannure:

Ingredients:

- Cow dung - 5 kilo
- Water - 5 litres
- Cow milk - 2 litres
- Curd - 2 litres
- Clarified butter/ Ghee - 1 litre
- Sugarcane juice - 2 litres

(In place of sugarcane juice use 500gms of honey or 1 kg of jaggery or Palm sugar)

Mix these ingredients in a mud pot and stir them well. Allow this mixture under shade for fermentation for about 3 weeks. Then take out 2 litres of Panchagavya and dilute it with 100 litres of water and spray the crops by using a power sprayer in 1 acre plot. The above mixture is sufficient for spraying 4 acres at the rate of 2 rounds per crop. The diluted mixture has to be stirred thoroughly

for 20 minutes before spraying. This can be stored for another 1 month. It induces growth and enhances quick flowering. It gives resistance against pests and diseases.

First spray at 25 days after transplanting paddy and second spray 2 weeks after 1st spray. It has advanced paddy harvest by 10 days.

Similarly spraying 2 rounds of Panchagavya once before the flower initiation and another during pod/fruit setting phase resulting in quick flowering and thereby the productivity. In Jasmine it ensures continuous flowering; and in Moringa tree with synchronized early flowering, it doubled the yield of Moringa Pods. It can be used for groundnut turmeric and many other crops. Seed materials can be dipped for few minutes and wet their root zone before planting.

b. Panchagavya as a Pesticide:

Ingredients:

• Cow dung mixed with water	- 500 ml
• Cow's urine	- 300 ml
• Cow's milk	- 200 ml
• Curd	- 200 ml
• Ghee	- 100 ml
• Yellow plantain	- 2 nos.
• Coconut water	- 300 ml
TOTAL	**-** 1500 ml

Preparation:

All the products mentioned above should be put in a mud pot, mixed and kept open for 10 days. It should be mixed every day. It is ready for use in 10 days time.

JEEVAJALA – A Growth Regulator

Ingredients:

- Goat's meat - 1 kg
- Sesame - ¼ kg
- Blackgram - ¼ kg
- Cow's milk - 1 litre
- Mud pot (5 litres capacity) - 1 No.

The goat's meat should be washed properly and put in 5 liters of water and boiled till it reduces to half the quantity. After this the flesh should be removed and the extract alone should be filtered. Black gram and sesame should be properly powdered. The mixture of these powders should be mixed with the meat extract after it is cooled. After mixing this it should again be boiled. After boiling the mixture is cooled and then milk should be added. The mixture must be poured into the mud pot, and the mouth of the mud pot should be tied with a cloth. The pot should be buried under the ground or inside the compost pit. The extract should be mixed well atleast once a day.

After 10 days of the fermentation, the extract should be removed, properly filtered and stored in a pot.

This filtered extract can be applied near the roots or used as a spray. For application near the root zone, 3 litres of growth regulator is required. This should be applied near the irrigation channel so as to mix with the water.

500ml of extract should be mixed with 10 litres of water for use as a foliar spray. This is sprayed twice during the vegetative stage. By using this there is an increase in the number of grains per earhead and also a general increase in the yield. The weight of the grains also increases.

After irrigating the field in which the seedlings are transplanted, the growth regulator can also be applied using a band sprayer on the surface of the water.

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7. SEED STORAGE

Importance of Storage

The Cereals, pulses, oilseeds etc. are very important products for storage. A safe storage place must be provided for the grain produced until it is needed for consumption and multiplication purposes. Since grain production is seasonal, and consumption is continuous, safe storage must maintain grain quality and quantity. This means that grains have to be protected from weather, molds and other microorganisms, moisture, destructively huge temperatures, insects, rodents, birds, objectionable odours and contamination, and from unauthorized distribution.

Kinds of Storage Facilities:

1. **On The Ground:** Grain is piled on the ground unprotected only between harvest and the availability of transport equipment with which it can be moved to a safer place. Losses are small for short periods because a smooth–surface pile of grain sheds rain down its slopes quite well, permitting it to penetrate only an inch or two. But with time, depressions develop in the surface, allowing rain to soak downward and destroy columns of grain. The floor of the pile absorbs moisture from the ground, and surface water creeps under the edges of the pile. The grain is exposed to rodents, birds, insects and wind so that losses become severe within a few weeks.

Before the grain is threshed, the harvested crop is stacked near the threshing yard in such a way that any down pour of rain does not get an entry into the stacking, but runs down the stack by virtue of the slope provided without affecting the quality of grains. By this method the raw grain also attains good shape and shining colour that would be appealing to the user.

Many a times the farmers erect a storage bin made of paddy straw by twisting a bundle of the straw to a rope like structure and then laying it in circular fashion to get a bin like structure. Paddy grains after they are fairly dried are put into this structure again covered with paddy straw tightly in the shape of a cone, so that the grains are well stored inside the structure. Before putting

the grains, the ground surface also is well covered with the paddy straw.

Temporary crib for field storage: This structure of sticks and heavy twine is used for crops like corn and rough rice. The shifting agriculture practiced in this tropical lowland often results in fields being far from the farmstead. The corn will be transferred as needed to the house. This large box has been used for many years for storing beans and threshed corn. It is elevated on stones to facilitate inspection for signs of rodent activity.

2. **Temporary Corn Storage:** Field storage of corn is accomplished on platforms. The stack of un-pealed ears is covered by a cap of partially woven grasses.

3. **Underground:** Underground storage was probably the principal method used to accumulate surpluses in primitive societies, and it can still be found in our time. Its advantages are the grain's protection from seasonal and daily temperature fluctuations, inhibition of insects and molds by a tendency towards low oxygen and high carbon dioxide contents in the inter seed air,

and simple construction methods. Its principal drawback is the high cost of grain handling.

4. **Bagged:** Bags of grain may be piled under any convenient shelter away from weather and predators.

5. **Farm Bins:** Farm storage space is needed for three reasons; to hold the crop immediately after harvest, until it can be moved to better storage space or to market. Grain stored in bins maintains quality better in smaller than in larger lots. Farm storage tends to maintain the original condition of grain better than elevator storage, provided grain is not exposed to any moisture increase or to rodents birds or insects. The farmers have developed the oriental bins by using burnt clay which are in use by the farm families from time immemorial.

Seed Storage

Only well-dried seeds should be stored. Seeds with moisture in them become damp, moldy and vulnerable to insect attacks. For drying, lay the seeds under the sun on a mat and spread them thinly. Mix and turn the seeds 4 to 5 times in a day. Repeat the process for about 2 to 3 days. On a hot sunny day, the seeds spread on a mat in the morning should be heaped for some time and again spread frequently to avoid sun-burn and damage of the embryo.

After drying the seeds well, clean them to remove all stones, malformed, broken, undersized and diseased seeds, weed seeds, other crop seeds, chaff and other rubbish. These seeds must now be stored properly. To store seeds use containers that are airtight and moisture-proof. Earthen pots of burnt clay are used for the storage in traditional agricultural practices.

Storing seeds in a cool dry environment keeps them viable for longer. Seeds have a tendency to absorb moisture. To maintain dryness, the storage containers could be filled to a quarter capacity with either dry wood ash or dry charcoal. If the seeds are to be put directly into the earthen pot then cover the dry ash with a layer. In case the

container is opened frequently, change the wood ash or charcoal every time it is opened.

The viability and quality of seeds depend on how well they are protected from insects and pests. There are simple ways of protecting seeds from insects. Farmers have been using various indigenous methods of seed storage for ages. Generally the seeds to be stored are smeared with neem / castor oil which checks the pest attack.

Grains are usually stored in clay vessels or gunnysacks. These containers are coated with a paste of neem leaf or dry Neem cake powder. The floor and room in which the seeds are stored is plastered with cow dung to keep pests away. These are just a few very commonly used traditional seed storage practices

Storage Structures

1. Pits storage: Pits are usually excavated to be wide at the bottom and taper to a small opening at the top; more hygroscopic than the grain, tends to hold soil moisture away from grain mass.

2. Stone, brick, or mud warehouses have long been used for grain storage. The floor of the structure is generally covered with cow dung paste to avoid insect pests by its repellent action.

3. **For storing major grains like cereals and pulses,** mud and brick structures with double door system are constructed, one door being smaller than the other. The bigger door is seldom opened unless the entire quantity of stored grains are to be

shifted to market and the like. Small door is provided in such a way that only one man can enter the storage, take out the required quantity and close the same immediately without giving room for the larger quantity being affected by external factors.

4. **Corn ears tied and hanged on sticks or ropes:** Unhusked corn ears are hung with the tip downward to prevent moisture entry, a technique that is used almost throughout the world.

5. **Mud jar for threshed cereals and pulses:** This **un-burnt mud vessel** placed over stones contains threshed grains. The decorative design varies by zones within the country.

6. **Vegetable Seed Storage Method:** The vegetable seeds are normally stored by women folk for their kitchen garden requirements by securing the seeds of different vegetables into knots tied around them in a white cloth. While doing so the seeds are mixed with woodash / dried neem leaf powder. After this these are conveniently put into Bottleguard, sprinkled woodash on the top and closed the mouth of the bottleguard.

Safe Grain Storage Methods for Wheat, Pulses and Oilseeds

a. After harvesting of Rabi crops like wheat, pulses and oilseeds, they are cleaned and put in an open place for sun drying. After drying, seed grains are packed in jute bags. A store room of 20'x15' size is used for keeping 50 to 80 qtls of seed. Spread wheat husk on the floor upto 1-2 feet, after which all bags are kept at a distance of one foot away from all the walls of the room. After one layer, spread again wheat husk of 6" layer, followed by wheat bags as done earlier. This process is repeated to accommodate maximum produce till the room is filled, after

which the room is closed. The door has to be opened only when needed, which helps to protect the seed/grain from insect pests and moisture.

b. **Use of garlic for safe storage on cereals and pulses:** Take a container of one qtl. storage capacity. At the bottom of the container, about 200 gm of matured garlic are kept and then about 20 Kg of wheat poured into the container. Again a second layer of 200 gm of garlic and 20 kg of cereals poured into the container. It is repeated like this till the container is filled. This practice is also followed for safe storage of rice. But in case of rice, use turmeric instead of garlic. Ensure that the container is closed tightly. This is a low cost technology and can be easily practiced.

Chapter 7
Pic 11

c. The leaves, kernels and oil of neem (*Azadirachta indica*) have been found to be very effective against a wide variety of storage pests. Neem leaves are dried in shade and powdered. This powder is added to the bags or containers in which the grain is stored. Using neem oil is more efficient as the seeds have the maximum concentration of the active ingredients (*azadiragtim, salanin and malandriol*). The quantity of oil depends on the quantity of seeds used. Quantity of Neem oil should be one

percent by weight of seed. Grain stored for seed purpose can be treated with two percent by weight of seed (storing grains).

d. For safe storage of bean seeds, to one kilogram of bean seed add 2 teaspoons of vegetable oil. Mix the oil with 250 gms of seed and put it into a clean container. Add the remaining seeds and mix till all the seeds are coated with oil. When coated well with oil the seeds appear shiny. Generally this method is used for vegetable seeds.

e. Bamboo **grain storage** structure plastered with cow dung slurry covered with a layer of paddy straw and a layer of dried leaves of ***'neem'*** at the bottom to store paddy, reduces storage insect pests of paddy and prolongs storage life. Cow dung slurry acts as disinfectant while *neem* acts as an insect repellent.

The bamboo baskets are also used for **storing jaggery**. The inside surface is coated with woodash and red soil. However, the outer surface can be conveniently coated with cow dung and red earth slurry with little neem oil to drive away the insect pests.

f. Using bamboo bins for storage: Paint the bamboo bins with the solution prepared from neem cake. To the dry neem cake powder water is added and a thick paste of this is painted all over the grain bin. If one wishes to store it for more than 4 months, the process should be repeated every 4 months.

g. Treatment of gunny bags for storing grains: Prepare a 10% neem kernel solution. Once the solution is made, dip the gunny bag into this solution for 15 minutes. Dry the gunny bags under shade and this can be used for storing grains. The stored grain pests will be repelled by the action of neem. In case the gunny bags are new, they should be soaked for half an hour. For gunny bags with close meshes and small pores, thinner solution can be used. Make sure that the gunny bags are impregnated on all sides with this extract. If the seeds or grains are kept inside the house or in the godowns, there is no fluctuation in temperature and not much sunlight. As a result of this, longer, residual action of the neem product is obtained and the

repellent effect persists for 4 months. In store rooms, along with the cow dung that is used for cleaning the mud floor, neem cake or neem oil can be used straight away (in the same concentration as used for spraying purposes). The same could also be used for the mud walls. Neem cake solution or neem kernel extract could also be sprayed.

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8. LIVESTOCK MANAGEMENT

In India Agriculture means for the sustenance of the family and the local community together with the services of blacksmith, carpenter, washerman , tailor, cobbler, and livestock etc.

Man's agricultural life is incomplete without the role of domestic animals like cows and buffaloes, bullocks, sheep and goat, poultry, ducks and other birds, asses, horses¸ camels, etc., swine, rabbits and the like to fulfill his everyday needs like:

- Milk and milk products
- Protein-full foods from animals
- Very good manure to grow his crops
- Draught power for his agricultural activities
- Many utilitarian products like, blankets (kumbals-made of sheep wool) and several other items made from the skins of dead animals.

In the rural agriculture, the most commonly employed farm power apart from manual labour, invariably comes from **Cattle** which distinctly stand out from other farm animals. Efficient use of these animals in turn depends on their feeding, maintenance of their health and fitness and training them to adopt to different kinds of work has a definite say in successful agriculture.

Similar explanation hold good for milch animals and the animals that would provide us various other protein-full foods, which calls for appropriate management of these livestock to get the best out of them in different utilitarian directions. Ergo, it calls for a very good management efficiency on the part of the farmers in order to achieve the desired goal.

In this perspective, the Indian farmers over time, out of his fruitful journey along with his animals to establish a meaningful relationship with them in their efficient management, has come out with various indigenous findings which are really amazing and makes even a sophisticated modern technician raise his eyebrows on getting to know his unparallel efficiency in managing his livestock. Listed hereunder are very few of them to which many more can be added by Farmer-Scientists in the field:

It is strongly believed in Ancient Indian Agriculture that without **"*Gomuthram*" (Cow urine),** agriculture has no meaning at all. It is not a blind faith, but Indian farmer's well-knit experience that the depleted soil due to continuous cropping for his livelihood gets replenished by addition of cattle urine and dung in the proper manner.

1. Feeding green bamboo leaves for release of placenta

In course of giving birth to a calf, sometimes, a cow does not release placenta immediately. It causes many complications. Feeding 4-5 Kg of green leaves of bamboo in its raw form to the cow, it is found that placenta comes out just after half an hour of bamboo feeding.

Chapter 8
Pic 01

2. Control of intestinal worms in calves

Dried ginger 50 gm and tender leaves of guava (*Psodium guajava*) 500gm, are to be macerated together and made into balls and administered to 5 or 6 calves at a time. This will be very effective

for yellow colour diarrhea in the young calves caused due to intestinal worms. This can be repeated depending upon the severity of disease.

3. Tick/ Mites control in Cows:

One kg of *Albizia* leaves (*Albizia amara*) and half-kilo neem leaves (*Azadirachta indica*) leaves are to be grinded well. It should be mixed with 2 kg of tank silt or soil from ant hills and made into a slurry after pouring with adequate quantity of water. This slurry has to be smeared all over the body of the animal. Then the animal can

be allowed to stand in sunlight for few hours, followed by bathing the animal. This practice has to be repeated once after a week. This will increase the lustre of skin, and driving away the sucking pets from its body.

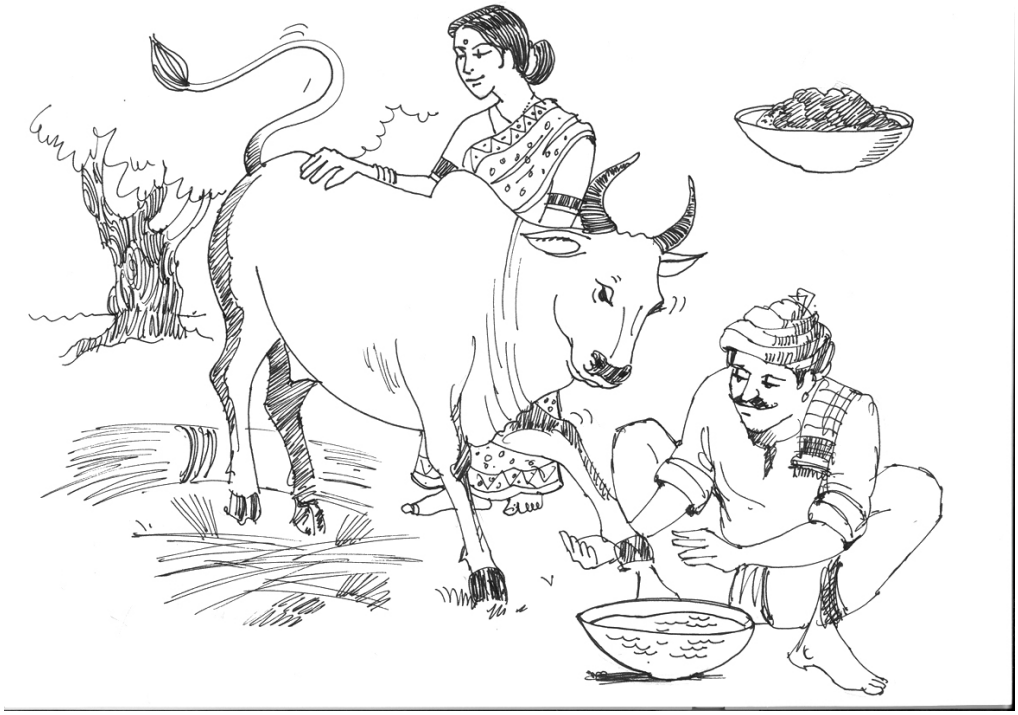
4. Refusal to feed / Fever / Giddiness / Cough In Cattle:

Take an earthen part and fill with Charcoal fuel upto its quarter portion. To this add a few barks of matured neem tree, seed husks of neem (10 gm), and tender leaves at 25 gm each of *Pongamia*, *Cardiospermum* and *Leucas aspera*. To facilitate fumigation apply a pinch of *Sambrani* (Incense powder). The animal is made to inhale these fumes till sweating is noticed in its nostril region. During this treatment the animal has to be fed with 250 gm of coriander leaves and 500 gm of rhizomes of radish twice a day.

5. Preventive herbal healing against Foot and Mouth disease:

a. Daily cleaning of foot and mouth portions of the animal with hot water (boiled with a pinch of common salt and bark of neem tree).

b. Administer leaf juice extract of Tulsi (*Ocimum sanctum*) for oral intake. About ½ kg of tulsi leaves residue may be used for smearing the foot and mouth portions of the cattle. This quantity is sufficient for 4 animals. This should be done once daily for a period of 3 days continuously.



6. Mastitis in cattle:

Handful of Henna leaves (*Lawsonia inermis*) and *Albizia* (*Albizia amare*) are grinded well and boiled. To this add lemon juice from one fruit; with a pinch of powdered camphor. Apply this over the udder and teats for 3 days.

As a preventive measure, 100-200 ml of lime water are to be administrated twice a week. Limewater can be prepared by putting 2 kg of lime stones (Calcium carbonate) in 5 liters of water. The supernatent layer of water at 100 to 200 ml has to be (free from sedimentation) mixed with drinking water and fed to the animal.

7. Infertility in Milch Animals:

a) Administer two succulent leaves of *Aloe vera* in empty stomach orally for the first three days. Subsequently feed with one kg of sprouted Bajra (*Pennisetum americanum*) grains, which has to continued for six days. On the seventh day the cow exhibits the symptoms of heat. Before taking the animal for natural crossing, administer 200 ml of neem oil orally.

b) The same result can be expected by feeding the animal with 5 kg of brinjal with 1 kg of curry leaves.

8. Urinary blockage

When animals suffer from kidney stones, it causes acute pain and inflammation of the urinary tract. This leads to blockage of the urinary passage. By feeding fruits of bitter apple (*Citrullus colocynthis*) along with regular feed for three days. This has to be administered twice a day (morning and evening), which clears the blockage.

9. Stomach Ache In Animals

If an animal suffers from stomach ache or gastric trouble or refuses to feed, then administer with 50 to 100 g of *Asafoetida* plus 250g of garlic and 100g of charcoal ground to a paste with water. This treatment relieves the animal from constipation.

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9. BIRDS SCARERS IN THE FIELDS

Brinjal Garden

Rice Field

Vegetable Garden

NAMES OF FOODSTUFFS IN INDIAN LANGUAGES

CEREAL GRAINS AND PRODUCTS

1. **Pearl Millet:** *Pennisetum typhoides*

   Bajra (**B**engali, **H**indi, **O**riya), **Bajri** (**G**ujarati, **M**arathi), **Sajje** (**K**annada), **Bajr'u** (**K**ashmiri), **Cambu** (**M**alayalam, **T**amil), **Sazzalu** (**T**elugu). **O**ther **n**ames: **Spiked millet, Pearl millet**

2. **Italian millet:** *Setaria italica*

   Syama dhan (**B**engali), **Ral Kang** (**G**ujarati), **Kangni** (**H**indi), **Thene** (**K**annada), **Shol** (**K**ashmiri), **Thina** (**M**alayalam), **Rala** (**M**arathi), **Kaon** (**P**unjabi), **Thenai** (**T**amil), **Korralu** (**T**elugu), **O**ther **n**ames: **Foxtail millet**, **Moha millet, Kakan kora**

3. **Sorghum:** *Sorghum bicolor*

   Juar (**B**engali, **G**ujarati, **H**indi), **Jola** (**K**annada), **Cholam** (**M**alayalam, **T**amil), **Jwari** (**M**arathi), **Janha** (**O**riya), **Jonnalu** (**T**elugu), **O**ther **n**ames: **Milo**, **Chari**

4. **Maize:** *Zea mays*

   Bhutta (**B**engali), **Makai** (**G**ujarati), **Maka** (**H**indi, **M**arathi, **O**riya), **Musikinu jola** (**K**annada), **Makaa'y** (**K**ashmiri), **Cholam** (**M**alayalam), **Makka Cholam** (**T**amil), **Mokka jonnalu** (**T**elugu)

5. **Finger Millet:** *Eleusine coracana*

   Madua (**B**engali, **H**indi), **Bhav** (**G**ujarati), **Ragi** (**K**annada) , **Moothari** (**M**alayalam), **Nachni** (**M**arathi), **Mandia** (**O**riya), **Kezhvaragu** (**T**amil), **Ragulu** (**T**elugu), **O**ther **n**ames: **Korakan**

6. **Rice, parboiled:** *Oryza sativa*

   Siddha chowl (**B**engali) **Ukadello chokha** (**G**ujarati), **Usna chawal** (**H**indi), **Kusubalakki** (**K**annada), **Puzhungal ari** (**M**alayalam), **Ukadla tandool** (**M**arathi), **Usuna chaula** (**O**riya), **Puzhungal arisi** (**T**amil), **Uppudu biyyam** (**T**elugu)

7. **Rice raw:** *Orya sativa*

Chowl (**B**engali), **Chokha** (**G**ujarati), **Chawal** (**H**indi), **Akki** (**K**annada), **Tomul** (**K**ashmiri), **Ari** (**M**alayalam), **Tandool** (**M**arathi), **Chaula** (**O**riya), **Arisi** (**T**amil), **Biyyam** (**T**elugu).

8. **Rice bran:** *Oryza sativa*

Goora (**B**engali), **Thavudu** (**M**alayalam, **T**amil, **T**elugu), **Konda** (**M**arathi)

9. **Rice flakes:** *Oryza sativa*

Chira (**B**engali), **Pohe** (**G**ujarati, **M**arathi), **Chewra** (**H**indi), **Avalakki** (**K**annada), **Aval** (**M**alayalam, **T**amil), **Chuda** (**O**riya), **Atukulu** (**T**elugu)

10. **Rice, puffed:** *Oryza sativa*

Mudi (**B**engali), **Murmura** (**G**ujarati, **H**indi, **M**arathi), **Pori** (**K**annada, **M**alayalam, **T**amil), **Mudhi** (**O**riya), **Murmuralu** (**T**elugu)

11. **Samai:** *Panicum miliare*

Kangni (**B**engali), **Mutki** (**H**indi), **Samai** (**K**annada, **T**amil), **Ganuhaar** (**K**ashmiri), **Chama** (**M**alayalam), **Sava** (**M**arathi), **Suan** (**O**riya), **Other names: Goudli**, **Gondola**

12. **Wheat:** *Triticum aestivum*

Gom (**B**engali), **Ghau** (**G**ujarati), **Gehun** (**H**indi), **Godhi** (**K**annada), **Ku'nu'kh** (**K**ashmiri), **Gothmbu** (**M**alayalam), **Gahu** (**M**arathi), **Gahama** (**O**riya), **Kamak** (**P**unjabi), **Godumai** (**T**amil), **Godhumalu** (**T**elugu)

13. **Wheat flour, whole:** *Triticum aestivum*

Atta (**B**engali, **H**indi, **O**riya), **Ato** (**G**ujarati), **Godhi hittu** (**K**annada), **Gothambu mavu** (**M**alayalam), **Kaneek** (**M**arathi), **Godumai mavu** (**T**amil), **Goduma pindi** (**T**elugu)

14. **Wheat flour, refined:** Triticum aestivum

Maida (**B**engali, **H**indi, **K**annada, **M**arathi, **O**riya), **Maida mavu** (**M**alayalam, **T**amil), **Maida pindi** (**T**elugu), **Other names:** American mavu

PULSES AND LEGUMES

15. **Bengalgram - whole:** Cicer arietinum

Chola (**B**engali), **Chana** (**G**ujarati, **H**indi), **Kadale** (**K**annada), **Chanu** (**K**ashmiri), **Kadala** (**M**alayalam), **Harbara** (**M**arathi), **Buta** (**O**riya), **Chole** (**P**unjabi), **Kothukadalai** (**T**amil), **Sanagalu** (**T**elugu), **O**ther **n**ames: **Chick pea, Garbanzo**

16. **Bengalgram dhal**: Cicer arietinum

Cholar dal (**B**engali), **Chane-ki-dal** (**H**indi), **Kadale bele** (**K**annada), **Chola dal** (**K**ashmiri), **Kadla parippu** (**M**alayalam), **Harbara dal** (**M**arathi), **Kadalai parappu** (**T**amil), **Samaga pappu** (**T**elugu)

17. **Bengal gram - roasted:** Cicer arietinum

Chola bhaja (**B**engali), **Phutana** (**G**ujarati, **M**arathi), **Bhuna Chana** (**H**indi), **Huri-kadale** (**K**annada), **Varutha kadala** (**M**alayalam), **Bhajabuta** (**O**riya), **Pottukadalai** (**T**amil), **Putnalupappu** (**T**elugu)

18. **Blackgram dhal:** *Phaseolus mungo Roxb*

Mashkalair dal (**B**engali), **Aalad** (**G**ujarati), **Urd dal** (**H**indi), **Uddina bele** (**K**annada), **Kaha** (**K**ashmiri), **Uzhunnu parippu** (**M**alayalam), **Uddachi dal** (**M**arathi), **Biri** (**O**riya), **Mah-di-dal** (**P**unjabi), **Ulutham paruppu** (**T**amil), **Minapa pappu** (**T**elugu)

19. **Cowpea:** *Vigna catjang*

Barbati (**B**engali), **Lobia** (**H**indi), **Alasande** (**K**annada), **Payar** (**M**alayalam), **Chavli** (**M**arathi), **Chani** (**O**riya), **Karamani** (**T**amil), **Bobbarlu** (**T**elugu)

20. **Fieldbean:** Dolichos lablab

Sim (**B**engali), **Valpapdi** (**G**ujarati, **M**arathi), **Val** (**H**indi),**Avare** (**K**annada), **Moang** (**K**ashmiri), **Avara** (**M**alayalam), **Baragudi** (**O**riya), **Mochai** (**T**amil), **Chikkudu** (**T**elugu), **O**ther **n**ames: **Kadumal**, **Hyacinth bean**

21. **Greengram - Whole:** Phaseolus aureus Roxb

Mug (**B**engali, **G**ujarati), **Mung** (**H**indi, **M**arathi), **Hesare kalu** (**K**annada), **Muang** (**K**ashmiri), **Cheru Pararu** (**M**alayalam), **Muga** (**O**riya), **Moongi** (**P**unjabi), **Pasipayir** (**T**amil), **Pesalu** (**T**elugu)

22. **Greengram dhal:** Phaseolus aureus Rox

Mug dal (**B**engali, **M**arathi), **Mung dal** (**H**indi, **M**arathi), **Hesare kalu** (**K**annada), **Kuang** (**K**ashmiri), **Cheru payaru** (**M**alayalam), **Muga** (**O**riya), **Moongi** (**P**unjabi), **Pasipayir** (**T**amil), **Pesalu** (**T**elugu)

23. **Horsegram:** Dolichos biflorus

Kulthi-kalai (**B**engali), **Kuleeth** (**G**ujarati, **M**arathi), **Kulthi** (**H**indi), **Hurule** (**K**annada), **Muthira** (**M**alayalam), **Kolatha** (**O**riya), **Kollu** (**T**amil), **Ulavalu** (**T**elugu)

24. **Lentil:** Lens esculenta

Masoor (**B**engali), **Masur dal** (**G**ujarati, **H**indi, **M**arathi), **Masur bele** (**K**annada), **Musur** (**K**ashmiri), **Masur parippu** (**M**alayalam), **Masura** (**O**riya), **Mysore paruppu** (**T**amil), **Misur pappu** (**T**elugu)

25. **Peas:** Pisum sativum

Katar (**B**engali, **H**indi), **Vatana** (**G**ujarati, **M**arathi), **Batani** (**K**annada, **T**elugu), Ka**r**a (**K**ashmiri), **Pattani** (**M**alayalam, **T**amil), **Matara** (**O**riya), **Kabli chole** (**P**unjabi)

26. **Redgram dhal:** Cajanus cajan

Arhar dal (**B**engali, **H**indi, **K**ashmiri), **Tuver** (**G**ujarati), **Thugare bele** (**K**annada), **Tuvara parippu** (**M**alayalam), **Tur dal** (**M**arathi), **Harada**

(**O**riya), **Tuvaram paruppu** (**T**amil), **Kandi pappu** (**T**elugu), **O**ther **n**ames**: Pigeon pea**

LEAFY VEGETABLES

27. **Agathi:** Sesbania grandiflora

Bak (**B**engali), **Agathio** (**G**ujarati), **Agasti** (**H**indi, **M**arathi, **O**riya), **Agase** (**K**annada), **Agathi** (**M**alayalam, **T**amil), **Avise** (**T**elugu), **O**ther **n**ames: **Basna**

28. **Amaranth spined:** Amaranthus spinosus

Kanta-notya (**B**engali), **Kantalo dabho** (**G**ujarati), **Kantewali chaulai** (**H**indi), **Mulla dantu** (**K**annada), **Mullancheru-cheera** (**M**alayalam), **Kante-math** (**M**arathi), **Kanta nentia saga** (**O**riya), **Mullu keerai** (**T**amil), **Mullu thotakoora** (**T**elugu), **Other names:** Gendari sag

29. **Amaranth, tender**: Amaranthus gangeticus

Notya (**B**engali), **Chaulai sag** (**H**indi), **Dantu** (**K**annada), **Cheera** (**M**alayalam), **Math** (**M**arathi), **Thandukeerai** (**T**amil), **Thotakoora** (**T**elugu), **O**ther **n**ames: **Gogta sag**

30. **Ambat chukka**: Rumex vesicarius

Chuka palang (**B**engali), **Chuka** (**H**indi), **O'bej** (**K**ashmiri), **Ambat chukka** (**M**arathi), **Chukka keerai** (**T**amil), **Chukka koora** (**T**elugu) **O**ther **n**ames: **Khatti palak**

31. **Araikeerai**: Amaranthus tristis

Araikeerai (**T**amil)

32. **Bottle gourd leaves**: Lagenaria vulgari

Lau sag (**B**engali), **Lauki-ka-sag** (**H**indi), **Sorakay yele** (**K**annada), **Cheranga ilagal** (**M**alayalam), **Ghia da sag** (**P**unjabi), **Surai ilaigal** (**T**amil), **Anapa akulu** (**T**elugu), **O**ther **n**ames: **Calabash cucumber leaves**

33. **Cabbage:** Brassica oleracea var.capitata

Bandha kopee (**B**engali, **O**riya), **Kobi** (**G**ujarati, **M**arathi), **Band gobee** (**H**indi, **K**ashmiri), **Kosu** (**K**annada), **Mutta gose** (**M**alayalam), **Muttaikose** (**T**amil), **Gos koora** (**T**elugu), **O**ther **n**ames: **Pat gobee**

34. **Cauliflower greens**: Brassica oleracea var, botryt

Phool-kopi sag (**B**engali), **Phool gobee sag** (**H**indi, **M**arathi), **Hukosina yele** (**K**annada)

35. **Coriander leaves**: Coriandrum sativum

Dhane sag (**B**engali), **Kothmer** (**G**ujarati), **Hara dhania** (**H**indi), **Kothambari Soppu** (**K**annada), **Daaniwal** (**K**ashmiri), **Kothamalli** (**M**alayalam, **T**amil), **Kothimbir** (**M**arathi), **Dhania** (**O**riya), **Kothimiri** (**T**elugu)

36. **Cowpea leaves:** Vigna cathjang

Payar ilagal (**M**alayalam), **Chavli pan** (**M**arathi), **O**ther **n**ame: **Rawandi sag**

37. **Drumstick leaves**: Moringa oleifera

Sajna sag (**B**engali, **O**riya), **Saragavo** (**G**ujarati), **Saijan Patta** (**H**indi), **Nugge yele** (**K**annada), **Muringa ela** (**M**alayalam), **Shevaga pan** (**M**arathi), **Murungai** (**T**amil), **Mulaga akulu** (**T**elugu), **O**ther **n**ames**: House radish leaves, Suha najna**

38. **Fenugreek leaves**: Trigonella foenumgraecum

Methi sag (**B**engali, **H**indi, **O**riya), **Methi** (**G**ujarati, **K**ashmiri, **M**arathi), **Menthina soppu** (**K**annada), **Uluva ila** (**M**alayalam), **Venthiya keerai** (**T**amil), **Menthkoora** (**T**elugu)

39. **Gogu**: Hibiscus cannabinus

Mestapat (**B**engali), **Ambadi** (**G**ujarati, **M**arathi), **Pitwa** (**H**indi), **Pundi** (**K**annada), **Nalite saga** (**O**riya), **Pulichai keerai** (**T**amil), **Gongura** (**T**elugu)

40. **Mustard Leaves**: Brassica campestris var. sarason

Sorisa sag (**B**engali), **Sarson-ka-sag** (**H**indi), **Sasuve yele** (**K**annada), **Kaduguila** (**M**alayalam), **Mohari-chi pan** (**M**arathi), **Sarson-da-sag** (**P**anjabi), **Kaduguilai** (**T**amil), **Ava akulu** (**T**elugu), **O**ther **N**ames: **Sharisha**

41. **Neem Leaves**: Azadirachta inidca

Neem pata (**B**engali), **Limdo limba** (**G**ujarati), **Neem-ke-patte** (**H**indi), **Bevu** (**K**annada), **Arya veppila** (**M**alayalam), **Kadulimb** (**M**arathi), **Nima patra** (**O**riya), **Nim** (**P**anjabi), **Veppilai** (**T**amil), **Vepa akulu** (**T**elugu).

42. **Tamarind leaves**: Tamarindus indicus

ROOTS AND TUBERS

43. **Ash gourd:** Benincasa hispida

Chalkumra (**B**engali), **Petha** (**H**indi, **P**anjab), **Budagumbala** (**K**annada), **Mashaa'ly al** (**K**ashmiri), **Kumbalanga** (**M**alayalam), **Kohala** (**M**arathi), **Panikakharu** (**O**riya), **Poosini kai** (**T**amil), **Boodida gummadi** (**T**elugu)

44. **Bitter gourd**: Momordica charantia

Karela (**B**engali, **G**ujarati, **H**indi, **K**ashmiri, **P**unjabi), **Hagal kai** (**K**annada), **Kaippakka** (**M**alayalam), **Karle** (**M**arathi), **Kalara** (**O**riya), **Pavakkai** (**T**amil), **Kakara kayi** (**T**elugu)

45. **Bottle gourd:** Lagenaria vulgaris

Lau (**B**engali, **O**riya), **Dudhi** (**G**ujarati), **Lowki** (**H**indi), **Sorekai** (**K**annada), **Zeeth** (**K**ashmiri), **Charanga** (**M**alayalam), **Pandharabhopla** (**M**arathi), **Ghia** (**P**unjabi), **Surai kai** (**T**amil), **Anapakaya** (**T**elugu)
Other **n**ames: **Calabash cucumber**, **Kaddu**.

46. **Brinjal**: Solanum melongena

Begun (**B**engali), **Ringna** (**G**ujarati), **Baingan** (**H**indi), **Badane** (**K**annada), **Waangum** (**K**ashmiri), **Vazhuthininga** (**M**alayalam), **Vange** (**M**arathi), **Baigan** (**O**riya), **Bataun** (**P**unjabi), **Kathiri** (**T**amil), **Vankaya** (**T**elugu)
Other **n**ame: **Egg plant**

47. **Broad beans**: Vicia faba

Makhan sim (**B**engali), **Fafda papdi** (**G**ujarati), **Bakla** (**H**indi), **Chapparadavare** (**K**annada), **Avarakka** (**M**alayalam), **Simba** (**O**riya), **Avarai** (**T**amil), **Pedda chikkudu** (**T**elugu)

48. **Cho-cho-marrow**: Sechium edule

Seeme badane (**K**annada), **Phuti Kakudi** (**O**riya), **Seemai Kathirikai** (**T**amil), **Seema vankayi** (**T**elugu)

49. **Cluster beans**: Cyamopsis tetragonoloba

Jhar sim (**B**engali), **Govar**(**G**ujarati), **Guar-ki-phalli** (**H**indi), **Gori kayi** (**K**annada), **Kothavara** (**M**alayalam, **T**amil), **Govari** (**M**arathi), **Guanra chhuin** (**O**riya), **Guara-di-phalli** (**P**unjabi), **Goruchikkudu** (**T**elugu)

50. **Colocasia stem**: Colocasia antiquorum

Kochu danta (**B**engali), **Arwi-ki-dandi** (**H**indi), **Kesu dantu** (**K**annada), **Chembin thandu** (**M**alayalam), **Alu-che-deth** (**M**arathi), **Sarunada** (**O**riya), **Seppanthandu** (**T**amil), **Chama kadda** (**T**elugu).

51. **Cucumber**: Cucumis sativus

Sasha (**B**engali)**, Kakdi** (**G**ujarati)**, Khira** (**H**indi)**, Souche kayi** (**K**annada)**, Laa'r** (**K**ashmiri)**, Vellarikka** (**M**alayalam)**, Kakadi** (**M**arathi) **Kakudi** (**O**riya)**, Tar** (**P**unjabi)**, Kakkarikkari** (**T**amil)**, Dosa kayi** (**T**elugu)

52. **Drumstick**: Moringa oleifera

Sajna danta (**B**engali)**, Saragavo** (**G**ujarati)**, Sajjan-ki-phalli** (**H**indi)**, Nuggekayi** (**K**annada)**, Muringakkai** (**M**alayalam**, T**amil)**, Shevaga sheng** (**M**arathi)**, Sajana chhuin** (**O**riya)**, Mulagu kada** (**T**elugu)**.**
Other **n**ame**: Horse radish**

53. **Drumstick flowers**: Moringa oleifera

54. **French beans**: Phaseolus vulgaris

Fansi (**G**ujarati)**, Bakla** (**H**indi)**, Huruli kayi** (**K**annada)**, Fraa'sh bean** (**K**ashmiri)**, Pharas bee** (**M**arathi)**, Fras bean** (**P**unjabi)

55. **Jack, tender**: Artocarpus heterophyllus

Aanchar (**B**engali)**, Kawla phanas** (**G**ujarati)**, Kathal** (**H**indi)**, Halasu** (**K**annada)**, Idichakka** (**M**alayalam)**, Phanas** (**M**arathi)**, Panasa katha** (**O**riya)**, Pila pinju** (**T**amil)**, Panasa** (**T**elugu)

56. **Ladies fingers**: Abelmoschus esculentus

Dherasa (**B**engali)**, Bhunda** (**G**ujarati)**, Bhindi** (**H**indi**, P**unjabi)**, Bende** (**K**annada)**, Bindu** (**K**ashmiri)**, Vendakkai** (**T**amil, **M**alayalam)**, Bhendi** (**M**arathi**, O**riya)**, Benda kayi** (**T**elugu)**, O**ther **n**ame: **Okra**

57. **Onion stalks**: Allium cepa

Piyaz kali (**B**engali)**, Dunglinu dakkadi** (**G**ujarati)**, Pyaz** (**H**indi)**, Eerulli soppu** (**K**annada)**, Ulli thandu** (**M**alayalam)**, Pati** (**M**arathi)**, Piaja sandha** (**O**riya)**, Vengaya thandu** (**T**amil)**, Ulli kadalu** (**T**elugu)

58. **Papaya, green**: Carica papaya

Pempe (**Kancha**) (**B**engali)**, Papayi** (**G**ujarati)**, Papita** (**H**indi)**, Papaya** (**M**arathi)**, Parangi** (**K**annada)**, Omakaya** (**M**alayalam)**, Katcha pepita** (**P**unjabi)**, Pappali kai** (**T**amil)**, Boppayi kayi** (**T**elugu)

59. **Plantain flower**: Musa sapientum

Mocha (**B**engali)**, Kel phool** (**G**ujarati**, M**arathi)**, Kele-ka-phool** (**H**indi)**, Bale motho** (**K**annada)**, Vazhapoo** (**M**alayalam**, T**amil)**, Kadali bhanda** (**O**riya)**, Kele-da-phool** (**P**unjabi)**, Arati puvvu** (**T**elugu)

60. **Plantain, green**: Musa sapientum

Kela (**Kanch**) (**B**engali)**, Kela** (**G**ujarati)**, Kela** (**hara**) (**H**indi**, P**unjabi)**, Bale kayi** (**K**annada)**, Vazhakkai** (**M**alayalam**, T**amil)**, Kele** (**M**arathi)**, Bantala kadali** (**O**riya)**, Arati kayi** (**T**elugu)

61. **Plantain stem**: Musa sapientum

Thor (**B**engali)**, Kelanu thed** (**G**ujarati)**, Kele-ka-tana** (**H**indi)**, Dindu** (**K**annada)**, Unnipindi** (**M**alayalam)**, Kelicha khunt** (**M**arathi)**, Kadali manja** (**O**riya)**, Vazhaithandu** (**T**amil)**, Arati doota** (**T**elugu)

62. **Pumpkin**: Cucurbita maxima

Kumra (**B**engali)**, Kohlu** (**G**ujarati)**, Kaddu** (**H**indi)**, Kumbala** (**K**annada)**, Paa'rimal** (**K**ashmiri)**, Mathan** (**M**alayalam)**, Lal bhopla** (**M**arathi)**, Kakharu** (**O**riya)**, Sitaphal** (**P**unjabi)**, Purangikkai** (**T**amil)**, Gummadi kayi** (**T**elugu)

63. **Ridge gourd**: Luffa acutangula

Jhinga (**B**engali)**, Turia** (**G**ujarati)**, Torai** (**H**indi)**, Heeraikai** (**K**annada)**, Turrel** (**K**ashmiri)**, Peechinga** (**M**alayalam)**, Dodka** (**M**arathi)**, Janchi** (**O**riya)**, Kali tori** (**P**unjabi)**, Pirkkankai** (**T**amil)**, Beera kayi** (**T**elugu)

NUTS & OILSEEDS

64. **Almond:** Prunus amygdalus

Badam (**B**engali, **G**ujarati, **H**indi, **K**annada, **K**ashmiri, **M**arathi, **O**rissa, **P**anjabi, **T**amil, **T**elugu)

65. **Cashew Nut** : Anacardium Occidentale

Hijli badam (**B**engali)**, Kaju** (**G**ujarati, **H**indi, **K**ashmiri, **M**arathi, **O**rissa), **Kaju** (**P**anjabi), **Geru beeja** (**K**annada), **Kasu andi** (**M**alayalam), **Lanka ambumanji** (**O**rissa), **Mundiri paruppu** (**T**amil), **Jeedi pappu** (**T**elugu)

66. **Coconut**: Cocos nucifera

Narkel (**B**engali)**, Nariyal** (**G**ujarati, **H**indi), **Thengini Kai** (**K**annada), **Narjeel** (**K**ashmiri), **Thenga** (**M**alayalam, **T**amil), **Naral** (**M**arathi), **Nadia** (**O**riya), **Gola** (**P**unjabi), **Kobbari** (**T**elugu).

67. **Gingelly seeds**: Sesamum indicum

Til (**B**engali**, H**indi**, M**arathi**, P**unjabi)**, Taj** (**G**ujarati)**, Acchsilu** (**K**annada)**, Ellu** (**M**alayalam**, T**amil**,**)**, Rasi** (**O**riya)**, Nuvvulu** (**T**elugu)
Other **n**ame**: Sesame seeds**

68. **Groundnut**: Arachis hypogaea

China badam (**B**engali, **O**riya), **Bhoising** (**G**ujarati), **Moong phalli** (**H**indi, **K**ashmiri, **P**anjabi), **Kadale kayi** (**K**annada), **Nilakkadalai** (**M**alayalam, **T**amil), **Bhui mug** (**M**arathi), **Verusanaga** (**T**elugu).

69. **Mustard seeds**: Brassica nigra

Sorse (**B**engali)**, Rai** (**G**ujarati**, H**indi**, P**unjabi)**, Sasuve** (**K**annada)**, Aasur** (**K**ashmiri)**, Kadugu** (**M**alayalam**, T**amil)**, Mohori** (**M**arathi)**, Sorisa** (**O**riya)**, Avalu** (**T**elugu)

70. **Sunflower seeds**: Helianthus annuus

Suraj mukhi (**B**engali, **P**unjabi), **Surya mukhi** (**H**indi, **M**arathi), **Surya kanthi** (**M**alayalam, **T**amil), **Podduthirugudu puvvu ginzalu** (**T**elugu).

CONDIMENTS AND SPICES

71. **Asafoetida**: Ferula foetida

Hing (**B**engali**, G**ujarati**, H**indi**, M**arathi**, P**unjabi)**, Hingu** (**K**annada**, O**riya)**, Yangu** (**K**ashmiri)**, Perungayam** (**M**alayalam**, T**amil)**, Inguva** (**T**elugu)

72. **Chilies**: Capsicum annuum

Lanka (**B**engali, **O**rissa)**, marcha** (**G**ujarati)**, Mirch** (**H**indi)**, Menasina kayi** (**K**annada), **Marach wangun** (**K**ashmirie), **Mirchi** (**M**arathi)**, Mulaku** (**M**alayalam), **Mirchan** (**P**unjabi)**, Milagai** (**T**amil), **Mirapa kayi** (**T**elugu).

73. **Cloves**: Syzygium aromaticum

Labanga (**B**engali, **O**rissa), **Lavang** (**G**ujarati, **H**indi, **M**arathi), **Lavanga** (**K**annada), **Ruang** (**K**ashmiri), **Krambu** (**M**alayalam, **T**amil), **Long** (**P**anjabi), **Lavangalu** (**T**elugu).

74. **Coriander**: Coriandrum sativum

Dhaniya (**B**engali, **G**ujarati, **H**indi **O**rissa, **P**anjabi), **Kothambari** (**K**annada), **Daaniwal** (**K**ashmirie), **Kothambalari** (**M**alayalam), **Dhane** (**M**arathi), **Kothamalli vidai** (**T**amil) **Dhaniyalu** (**T**elugu).

75. **Cumin seeds**: Cuminum cyminum

Jira (**B**engali, **H**indi, **M**arathi, **O**riya, **P**unjabi), **Jiru** (**G**ujarati), **Jeerage** (**K**annada), **Zyur** (**K**ashmiri), **Jeerakam** (**M**alayalam, **T**amil), **Jeelakarra** (**T**elugu).

76. **Fenugreek seeds**: Trigonella foenum – graecum

Methi (**B**engali**, G**ujarati**, H**indi**, M**arathi**, O**riya), **Menthe** (**K**annada), **Meeth** (**K**ashmiri), **Uluva** (**M**alayalam), **Meth** (**P**unjabi), **Venthayam** (**T**amil), **Menthulu** (**T**elugu)

77. **Garlic**: Allium sativum

Rashun (**B**engali), **Lasan** (**G**ujarati**,** **P**unjabi), **Lehsan** (**H**indi), **Bellulli** (**K**annada), **Ruhan** (**K**ashmiri), **Vellulli** (**M**alayalam**,** **T**elugu), **Lasoon** (**M**arathi), **Rasuna** (**O**riya), **Ullipoondu** (**T**amil)

78. **Ginger, fresh**: Zinziber officinale

Ada (**B**engali, **O**riya), **Adu** (**G**ujarati), **Adrak** (**H**indi, **P**anjab), **Shunti** (**K**annada), **Inji** (**M**alayalam, **T**amil), **Ale** (**M**arathi), **Allam** (**T**elugu)

79. **Lime peel**: Citrus medica var. acida

Lebur Khosa (**B**engali), **Limbuni chal** (**G**ujarati), **Neebu ka chilka** (**H**indi), **Nimbe sippai** (**K**annada), **Cherunaranga tholu** (**M**alayalam), **Limbsal** (**M**arathi), **Lembri chopa** (**O**riya), **Elumicham thol** (**T**amil), **Nimma thokku** (**T**elugu)

80. **Mace**: Myristica fragrans

Jayitri (**B**engali, **O**riya), **Jaypatri** (**G**ujarati, **M**arathi), **Javithri** (**H**indi), **Jalwatur** (**K**ashmiri), **Jathipatri** (**M**alayalam, **T**amil), **Japathri** (**T**elugu)

81. **Nutmeg**: Myristica fragrans

Jaiphal (**B**engali, **G**ujarati, **M**arathi, **O**riya), **Jaji kayi** (**K**annada, **T**elugu), **Zaaphal** (**K**ashmiri), **Jathikkai** (**M**alayalam, **T**amil)

82. **Pepper**: Piper nigrum

Golmarich (**B**engali, **O**riya), **Mari** (**G**ujarati), **Kalimirch** (**H**indi, **P**anjabi), **Kari menasu** (**K**annada), **Marutus** (**K**ashimir), **Kurumulaku** (**M**alayalam), **Mire** (**M**arathi), **Milagu** (**T**amil), **Miriyalu** (**T**elugu).

83. **Tamarind pulp**: Tamarindus indica

Tetul (**B**engali), **Amli** (**G**ujarati), **Imli** (**H**indi, **P**unjabi), **Hunise hannu** (**K**annada), **Tamber** (**K**ashmiri), **Puli** (**M**alayalam, **T**amil), **Chinch** (**M**arathi), **Tentuli** (**O**riya) **Chintha pandu** (**T**elugu)

84. **Turmeric**: Curcuma domestica

Holud (**B**engali), **Haldhar** (**G**ujarati), **Haldi** (**H**indi, **P**unjabi), **Arashina** (**K**annada), **Lader** (**K**ashmiri), **Manjal** (**M**alayalam, **T**amil), **Halad** (**M**arathi), **Haladi** (**O**riya), **Pasupu** (**T**elugu)

FRUITS

85. **Amla**: Emblica Officinalis

Amlaki (**B**engali), **Amla** (**G**ujarati, **H**indi), **Nellikai** (**K**annada, **M**alayalam, **T**amil), **Anvla** (**O**riya), **Usirikayi** (**T**elugu)
Other **n**ame: **Indian gooseberry**

86. **Apple**: Malus sylvestris

Safarjan (**G**ujarati), **Sev** (**H**indi, **O**riya), **Sebu** (**K**annada), **Tsoonth** (**K**ashmiri), **Safar Chad** (**M**arathi). **O**ther **N**ame: **Tarel.**

87. **Bael fruit**: Aegle marmelos

Bel (**B**engali**, H**indi**, M**arathi), **Bil** (**G**ujarati), **Bilwa pazham** (**T**amil), **Maredu pandu** (**T**elugu)

88. **Banana, ripe**: Musa paradisiaca

Kala (paka) (**B**engali), **Kela** (**G**ujarati, **H**indi, **K**ashmiri), **Bale hannu** (**K**annada), **Vazha pazham** (**M**alayalam, **T**amil), **Kele** (**M**arathi), **Champa kadali** (**O**riya), **Kella** (**P**unjabi), **Arati pandu** (**T**elugu)

89. **Cashew fruit**: Anacardium occidentale

Hijli badam (**B**engali)**, Kaju phal** (**G**ujarati**, H**indi**, M**arathi**, P**unjabi), **Geru hannu** (**K**annada), **Kasu manga** (**M**alayalam), **Lanka amba** (**O**riya), **Mundiri pazham** (**T**amil), **Jeedi pandu** (**T**elugu)

90. **Figs**: Ficus carica

Dumoor (**B**engali), **Anjeer** (**G**ujarati**, H**indi**, K**ashmiri**, M**arathi**, P**unjabi)**, Anjura** (**K**annada), **Atti pazham** (**M**alayalam**, T**amil), **Dimiri** (**O**riya), **Athi pallu** (**T**elugu), **O**ther **n**ame: **Gullar**

91. **Grape**: Vitis vinifera

Angoor (**B**engali, **H**indi, **P**anjabi, **O**riya), **Draksha** (**G**ujarati, **K**annada, **M**arathi, **T**amil, **T**elugu), **Da'ch** (**K**ashmiri), **Mundiringa** (**M**alayalam)

92. **Guava, Country**: Psidium guajava

Payra (deshi) (**B**engali), **FJam phal** (**G**ujarati), **Amrud** (**H**indi, **P**unjabi), **Seebe** (**K**annada), **Perakka** (nattu) (**M**alayalam), **Peru** (**M**arathi), **Pijuli** (deshi) (**O**riya), **Koya pazham** (**T**amil), **Jama pandu** (**T**elugu)

93. **Jack fruit**: Artocarpus heterorphyllus

Kanthal (**B**engali), **Phanas** (**G**ujarati**,** **M**arathi), **Kathal** (**H**indi**,** **P**unjabi), **Halasu** (**K**annada), **Chakka** (**M**alayalam), **Panasa** (**O**riya**,** **T**elugu), **Pala pazham** (**T**amil)

94. **Lemon**: Citrus limon

Pati lebu (**B**engali), **Motu limbu** (**G**ujarati), **Bara nimbu** (**H**indi), **Nyomb** (**K**ashmiri)

95. **Lime**: Citrus aurantifolia

Lebu (**B**engali), **Kadgi limbu** (**G**ujarati), **Neembu** (**H**indi), **Nimbe** (**K**annada), **Nyomb** (**K**ashmiri), **Cherunaranga** (**M**alayalam), **Musumbe** (**M**arathi), **Gangakulia lebu** (**O**riya), **Nimbha** (**P**unjabi), **Elumichai** (**T**amil), **Nimma pandu** (**T**elugu)

96. **Lemon, Sweet** : Citrus Limetta

Mitha lebu (**B**engali), **Mitha limbui** (**G**ujarati) **, Mitha meebu** (**H**indi), **Gaja nimbe** (**K**annada)**, Kolinchi Pazham** (**T**amil**l**), **Gaja nimma pandu** (**T**elugu).

97. **Mango, ripe:** Mangifera indica

Aam (paka), (**B**engali, **H**indi), **Keri** (**G**ujarati), **Mavina hannu** (**K**annada), **Amb** (**K**ashmiri, **P**anjabi), **Mam pazham** (**M**alayalam, **T**amil), **Amba** (piklela), (**M**arathi), **Amba** (pachila) (**O**riya), **Mamidi pandu** (**T**elugu).

98. **Melon, water**: Citrullus vulgaris

Tarmuj (**B**engali), **Tarbuj** (**G**ujarati**, H**indi), **Kallangadi** (**K**annada), **He'nd wend** (**K**ashmiri), **Thannir mathan** (**M**alayalam)**, Kalingad** (**M**arathi)**, Tarvuja** (**O**riya)**, Tarbuja** (**P**unjabi)**, Darbusini** (**T**amil)**, Puchakayi** (**T**elugu)

99. **Neem fruit**: Malia azadirachta

Neem phal (**B**engali)**, Veppam pazham** (**M**alayalam**, T**amil)**, Vapa pandu** (**T**elugu)

100. **Orange**: Citrus aurantium

Kamala lebu (Bengali)**, Santra (G**ujarati, **P**anjabi)**, Narangi (H**indi)**, Kithilai (K**annada)**, Sangtar (K**ashmiri)**, Madhura naranga (M**arathi)**, Kamala (O**riya)**, Kichili Pazham (T**amil)**, Kamala pandu (T**elugu)**.**

101. **Palmyra fruit**: Borassus flabellifer

Tal shash (**B**engali)**, Tar** (**G**ujarati)**, Tar** (**H**indi)**, Thati mangu** (**K**annada)**, Panam mungu** (**M**alayalam)**, Shindi shirani** (**M**arathi) **Tala** (**O**riya)**, Panai mungu** (**T**amil)**, Thati Pandu** (**T**elugu)**.**

102. **Papaya, ripe**: Carica papaya

Pepe (Paka) (**B**engali)**, Papaya** (**G**ujarati)**, Papita** (**H**indi**, P**unjabi)**, Pharangi** (**K**annada)**, Omakai** (**M**alayalam)**, Popai** (**M**arathi)**, Amrut bhanda** (pachila) (**O**riya)**, Pappali** (**T**amil)**, Boppayi pandu** (**T**elugu)

103. **Pine apple**: Ananas comosus

Anarash (**B**engali)**, Ananas** (**G**ujarati**, H**indi**, K**annada**, M**arathi, **P**anjabi), **Kayitha chakka** (**M**alayalam)**, Supuri Anasianas** (**Orrissa**)**, Anasi pazham** (**T**amil)**, Anasa pandu** (**T**elugu)**.**

104. **Pomegranate**: Punica granatum

Dalim (**B**engali)**, Dalamb** (**G**ujarati)**, Anar** (**H**indi**, P**unjabi)**, Dalimbari** (**K**annada)**, Daa'n** (**K**ashmiri)**, Mathalampazham** (**M**alayalam**, T**amil)**, Dalimb** (**M**arathi)**, Dalimb** (**O**riya)**, Danimma pandu** (**T**elugu)

105. **Raisins:** Vitis vinifera

Kash (**B**engali, **G**ujarati, **H**indi)**, Kishmish** (**O**riya, **P**anjabi, **T**elugu)**, Drakshi** (**K**annada)**, Mundiringa** (unakku) (**M**alayalam)**, Manuka** (**M**arathi)**, Drakshai** (**T**amil)**.**

106. **Tomato, ripe**: Lycopersicon esculentum

Ruwangum (**K**ashmiri)**, Takkali pazham** (**M**alayalam**,** **T**amil)**, Tametokai** (**T**elugu)**.**

107. **Wood apple**: Limonia acidissima

Kathbel (**B**engali)**, Kothu** (**G**ujarati)**, Kaith** (**H**indi)**, Bele** (**K**annada)**, Vilampazham** (**M**alayalam**,** **T**amil)**, Kavath** (**M**arathi)**, Kaitha** (**O**riya)**, Velega pandu** (**T**elugu), **O**ther **n**ame: **Kapith**

108. **Zizyphus**: Zizyphus jujuba

Bor (**G**ujarati**,** **M**arathi)**, Ber** (**H**indi)**, Yelachi** (**K**annada)**, Bre'y** (**K**ashmiri)**, Elanthapazham** (**M**alayalam**,** **T**amil)**, Barakoli** (**O**riya)**, Regu pandu** (**T**elugu), **O**ther **n**ames: **Jujube, Indian, plum**

FATS AND EDIBLE OILS

109. **Butter:**

Makhan (**B**engali, **H**indi, **P**anjabi)**, Benne** (**K**annada)**, Thany** (**K**ashmiri)**, Venna** (**M**alalayalam, **T**elugu)**, Loni** (**M**arathi)**, Vennai** (**T**amil)**.**

110. **Ghee:**

Ghee (**B**engali, **H**indi, **P**anjabi), **Thuppa** (**K**annada), **Ney** (**M**alayalam, **T**amil), **Thup** (**M**arathi), **Neyyi** (**T**elugu).

MISCELLANEOUS FOODS

111. <u>Amaranth Seeds</u> Amaranthus sp

Cheera vithu (**M**alayalam)**, Keerai vidai** (**T**amil)**, Thotakoora ginjalu** (**T**elugu)**.**

112. <u>Groundnut cake</u> Arachis hypogaea

Badamer khol (**B**engali), **Chinia badam-ka-khali** (**H**indi), **Kadalai punnakku** (**M**alayalam, **T**amil), **Pend** (**M**arathi), **Verusanaga pindi** (**T**elugu).

113. <u>Honey</u>

Mou (**B**engali), **Shaid** (**H**indi), **Jen thuppa** (**K**annada), **Maanch** (**K**ashmiri), **Ten** (**M**alayalam, **T**amil), **Madh** (**M**arathi), **Thene** (**T**elugu).

114. <u>Jaggery</u>

Gud (**B**engali, **H**indi **P**anjabi), **Gol** (**G**ujarati), **Bella** (**K**annada), **Gor** (**K**ashmiri), **Vellam** (**M**alayalam, **T**amil), **Gul** (**M**arathi), **Guda** (**O**riya), **Bellum** (**T**elugu).

115. <u>Mango seed kernel</u> Mangifera indica

Am-ka-guthli-ka-atta (**H**indi), **Manga andi parippu** (**M**alayalam), **Am-di-guttak** (**P**unjabi), **Mamidi jeedi** (**T**elugu).

116. <u>Poppy Seeds</u>: Papaver somniferum

Posto (**B**engali)**, Post dana** (**H**indi)**, Khaskhas** (**M**arathi)**,**
Khasakhasa (**T**amil)**, Gasagasalu** (**T**elugu)**.**

117. <u>Pumpkin Seeks</u>: Cucurbita maxima

Kumdar dana (**B**engali), **Mathan vithugal** (**M**alayalam), **Sitaphal-di-bee** (**P**anjabi), **Gummadi ginjalu** (**T**elugu).

118. <u>Sago</u>

Saboo (**B**engali), **Sabu dana** (**G**ujarati, **M**arathi), **Sago** (**H**indi, **M**alayalam), **Sabba akki** (**K**annada), **Saboo dana** (**K**ashmiri), **Sagu dana** (**O**riya), **Javvarisi** (**T**amil), **Saggu biyyam** (**T**elugu).

119. <u>Sugarcane Juice</u>

Ikkhu raush (**B**engali), **Sherdina ras** (**G**ujarati), **Ganne-ka-ras** (**H**indi), **Kabbina halu** (**K**annada), **Karumbin neeru** (**M**alayalam), **Usacha rasa** (**M**arathi), **Akhju dorua** (**O**riya), **Ganne-da-ras** (**P**unjabi), **Karuppan charu** (**T**amil)**, Cheraku rasam** (**T**elugu)**.**

120. <u>Tamarind seed kernel</u>: Tamarindus indicus

Imli-ka-biya-ka-gudda (**H**indi), **Pulin kuru** (**M**alayalam), **Puliyamn kottai** (**T**amil), **Chinta ginjalu** (**T**elugu).

121. <u>Toddy</u>

Tari (**B**engali), **Tarail** (**H**indi), **Henda** (**K**annada), **Kallu** (**M**alayalam, **T**amil, **T**elugu), **Tadi** (**M**arathi, **O**riya).

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