



SPICES BASED PEST CONTROL FOR THE MOUNTAIN AREAS



Supported under: National Mission on Himalayan Studies Project,
Ministry of Environment, Forest and Climate Change (MOEF&CC), Govt. of India





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Purpose of the booklet

With modern agriculture practices frequently becoming unsustainable causing harm to local environment and leaving crops more vulnerable to insect and pest attacks, it is pertinent for the farming community of the mountain regions to be aware of inputs disguised as pest controllers.

The farmers are troubled by the incidence of insects infesting the standing crop, as well as the attack of insects, fungi (fungus) and rodents (mice) on the stored produce. It is, thus, required to not only stay alert and identify with respect to incoming pest attacks and conditions that facilitate it but, also, to be able to introduce measures to protect the crops from infection. This can be done with the help of locally available bio-resources that are not only cost effective but, also doesn't harm the local ecosystem.

This booklet is an attempt to strengthen the farming communities of the mountain region of the Himalayas so that they do not have to depend on external sources to protect their crops. With the use of this booklet, farmers can practice **LEISA** (**L**ow **E**xternal **I**nput **S**ustainable **A**griculture) model of farming by preparing the required bio-pest controllers at household level by tapping the local and on-farm resources.

With the help of the illustrations, farmers can:

- Identify the pests that are attacking their crops of Cereals, Pulses, Oilseeds, Spices and Vegetables.
- Know the name, dose and time of application of Biological Pest-Controllers to remove specific pest from their crop(s).
- Learn the easy method of making Biological Pest Controllers using naturally available resources that are usually found in a rural setting and in homes.
- Get information on measures to protect their stored Grains, Pulses and Seeds from insects, fungus and rodents with the help of natural and easily available resources. (Eg: Turmeric, Ginger, Onion, Peach Leaves, Walnut Leaves etc.)


A word of caution- to remain organic and chemical free, it is important to be sure of the source of the material used to prepare the organic pest controllers to prevent any unintended contamination.

Botanical Pest Controllers

The only way to save the agro-ecosystem

Plants on the Earth evolved more than 400 million years ago and have developed protective mechanisms such as repellent and even pesticidal effects during the course of evolution to protect themselves from pest attacks. The oldest known pest control methods are ash, dust and plant extracts which have even been mentioned in ancient scriptures. The botanical insect controllers were once considered superstition by agriculture scientists but later when tested with scientific methods, proved to be effective. When chemical pesticides were invented in the 1940s, some people thought that the botanical based pest controllers would disappear forever because of the readily visible benefits of the novel agro-chemicals that were initially adopted by the entire farming class. But in the current trends, environmental pollution, chemical poison residues in food and fodder as well as problems like pest resistance are re-gaining the attention of agrarian communities and encouraging preference for botanical pest controllers.

In any environmental system, every organism is related to the other through the food chain and bio-chemical cycles. Therefore, as a result of the destruction of a single organism, other species are also adversely affected. This is known as the '*ripple effect*'. There is no doubt that pest control is both necessary and desirable but it can become a serious environmental issue when left entirely to agro-chemical companies. Some of the most deadly and appalling effects of agro-chemicals are decreasing population of animals and birds, destruction of soil micro-organisms and chemical residue magnification in food chains. These are lethal to both human and its environmental health.







So far, more than 250,000 plant species have been researched for botanical pest control by our scientists. This means that the future prospects are countless. In fact many plants such as *Neem*, *Garlic* etc. have already shown excellent results as bio-pest controllers. There is a plethora of such botanical diversity whose products have already struck the market as successful pest repellents/ controllers. It is expected that within 10-15 years, the share of these organic products in the pesticide market will increase by 25% and they will not be limited to gardens only but will, also, be widely adopted in urban and agricultural uses. There is no doubt that botanical insect controllers will pave the path as an alternative to chemical pest controllers and the only way to avoid poisoning of agro-environment.

Many of the plant based pest controllers can be easily prepared by the farmers from local and home resources at low or negligible cost. This booklet is a contribution to the effort to empower farmers with knowledge which is useful, cost saving and environment friendly.





MAJOR PESTS OF CEREALS





Paddy (Rice)

Major Pest and Prime Time of Transition	Identification	Botanical pest controllers and Spraying time
Yellow Stem Borer (July-September)		<ul style="list-style-type: none"> • Spray neem seed kernel extracts • Garlic-Chilli extracts SPRAYING: Start spraying after one month of sowing.
Brown Plant Hopper (June-July)		<ul style="list-style-type: none"> • Spray neem seed kernel extracts • Garlic-Chilli extracts Citrus spray SPRAYING: Sprinkle in nursery and start spraying on crop after one month of sowing.
Gundhi Bug / Earhead Bug (August-September)		<ul style="list-style-type: none"> • Garlic-Chilli extracts • Citrus spray SPRAYING: Start spraying when paddy earrings start to form
Grasshopper (Full Duration of crop)		<ul style="list-style-type: none"> • Garlic-Chilli extracts • Neem Cake (Soil Use) SPRAYING: Keep spraying for 2 months after sowing.

Wheat

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Army Worm (December-February)</p>		<ul style="list-style-type: none"> • Neem seed kernel extract • Garlic-Chilli extracts • Citrus spray <p>SPRAYING: Start spraying when the wheat earrings begin to form</p>
<p>Wheat Aphid (October-December)</p>		<ul style="list-style-type: none"> • Tomato leaf spray. • liquid soap spray • Garlic-Chilli extracts <p>SPRAYING: Start spraying after one month of sowing.</p>
<p>Termite (Full Duration of Crop)</p>		<ul style="list-style-type: none"> • Neem Cake (Soil Use) <p>SPRAYING: Mix neemcake with soil while preparing the land before planting the crop</p>
<p>Root Grub (Full Duration of Crop)</p>		<ul style="list-style-type: none"> • Neem Cake (Soil Use) <p>SOIL PREPARATION: Mix neem cake with soil while preparing the land before planting the crop</p>

Finger Millet (Mandua)/ Barnyard Millet (Jhangora)



Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
Stem Borer (May-July)		<ul style="list-style-type: none">• Neem seed kernel extract• Garlic-Chilli extracts <p>SPRAYING: Start spraying after one month of sowing.</p>
Root Aphid (Full Duration of Crop)		<ul style="list-style-type: none">• Tomato Leaf Spray• Garlic-Chilli extracts <p>SPRAYING: Spraying at the bottom of the plant after one month of sowing.</p>




MAJOR PESTS OF VEGETABLES





Tomato

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
Tomato Fruit Borer (June-August)		<ul style="list-style-type: none"> • Spray neem seed kernel extracts • Garlic-Chilli extracts <p>SPRAYING: Start spraying the plant with flowers</p>
Fruit Fly (July-September)		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chilli) • Tomato Leaf Spray • Tobacco spray <p>SPRAYING: Start spraying the plant with flowers</p>



Chilli / Capsicum

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
Aphid (June-August)		<ul style="list-style-type: none"> • Citrus spray • Garlic-Chilli extract. <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>




Brinjal/Eggplant

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Shoot and Fruit Borer (June-August)</p>		<ul style="list-style-type: none"> • Neem seed kernel extract • Neem-Garlic extracts • Tobacco spray <p>SPRAYING: Start spraying the plant with flowers</p>
<p>Hadda beetle (Full duration of crop)</p>		<ul style="list-style-type: none"> • Neem Cake (Soil Use) • Garlic-Chilli extract. <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>

Okra




Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Fruit Borer (June-August)</p>		<ul style="list-style-type: none"> • Spray neem seed kernel extracts • Neem-Garlic extracts • Tobacco spray <p>SPRAYING: Start spraying the plant with flowers</p>
<p>White Fly (June-August)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chilli) • Neem-Garlic extracts • Tomato Leaf Spray <p>SPRAYING: Start spraying after one month of sowing.</p>

Potato

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Potato Tuber Moth (February – April / During Storage)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic Onion-Chilli) • Neem-Garlic extracts <p>SPRAYING: Start spraying the lower part of the plant with the beginning of potato production.</p>
<p>Root Knot Nematode (Full Duration of Crop)</p>		<ul style="list-style-type: none"> • Neem Cake (Soil Application) <p>SOIL PREPARATION: Mix neem cake with soil while preparing the land before planting the crop</p>
<p>Cut worm (June-August)</p>		<ul style="list-style-type: none"> • Tobacco spray • Citrus spray • Neem seed kernel extract <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>






Cauliflower / Cabbage



Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Diamond Back Moth (Full Duration of Crop)</p>		<ul style="list-style-type: none"> • Neem seed kernel extract • Neem-Garlic extracts • Garlic-Chilli extracts <p>SPRAYING: Start spraying as soon as the cabbage leaves begin to turn.</p>
<p>Aphid (June-August)</p>		<ul style="list-style-type: none"> • Garlic-Chilli extracts • Liquid soap spray • All in one spray (Garlic-Onion-Chilli) <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>
<p>Cabbage Butterfly (July- August)</p>		<ul style="list-style-type: none"> • Citrus spray • Neem-Garlic extracts <p>SPRAYING: Start spraying on soft stalks one month after sowing.</p>





Pea

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Pea Aphid (November-January)</p>		<ul style="list-style-type: none"> • Garlic-Chilli extracts • Tomato Leaf Spray • Tobacco spray • Liquid soap spray <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>
<p>Pea Pod Borer (December-February)</p>		<ul style="list-style-type: none"> • Citrus spray • Neem seed kernel extract • Neem-Garlic extracts <p>SPRAYING: Start spraying the plant with flowers</p>
<p>Leaf Miner (October-December)</p>		<ul style="list-style-type: none"> • Garlic-Chilli extracts • Tomato Leaf Spray • All in one spray (Garlic-Onion-Chilli) <p>SPRAYING: Start spraying on leaves two to three weeks after sowing.</p>

Onion / Garlic




Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Onion Thrips (November-January)</p>		<ul style="list-style-type: none"> • Tobacco spray • All in one spray (garlic-onion-chilli) <p>SPRAYING: Start spraying on leaves two to three weeks after sowing.</p>
<p>Onion Bulb Maggots (December-February)</p>		<ul style="list-style-type: none"> • Neem-Garlic extracts • Neem Cake (Soil Application) <p>SOIL PREPARATION: Mix neem cake with soil while preparing the land before planting the crop</p>

Spinach / Fenugreek

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Aphids (November-January)</p>		<ul style="list-style-type: none"> • Liquid soap spray • Neem-Garlic extracts • Garlic-Chilli extracts <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>
<p>Caterpillar (November-January)</p>		<ul style="list-style-type: none"> • Tomato Leaf Spray • Citrus spray <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>


MAJOR PESTS OF PULSES



Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Pod Borer (While Making Pods)</p>		<ul style="list-style-type: none"> • Neem seed kernel extract • All in one spray (Garlic-Onion-Chilli) <p>SPRAYING: Start spraying with flowers.</p>
<p>Tur Bug (May-July)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chili extract) <p>SPRAYING: Start spraying on leaves after 1-2 months of sowing.</p>
<p>Pod Fly (While Filling The Pod)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chili extract) • Citrus spray <p>SPRAYING: Start spraying with flowers.</p>



Soybean/Black Soybean (Bhatt)

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
Soybean Stem Fly (June - August)		<ul style="list-style-type: none">• All in one spray (Garlic-Onion-Chili extract)• Neem seed kernel extract <p>SPRAYING: Start spraying on soft stalks one month after sowing.</p>







MAJOR PESTS OF OILSEEDS






Mustard

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Mustard Aphid (November-January)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chili extract) • Liquid soap - oil spray <p>SPRAYING: Start spraying on leaves after one month of sowing.</p>
<p>Mustard Saw Fly (December-February)</p>		<ul style="list-style-type: none"> • All in one spray (garlic-onion-chili extract) <p>SPRAYING: Start spraying on soft stalks one month after sowing.</p>

MAJOR PESTS OF SPICES





Turmeric & Ginger

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Stem Borer (April - June)</p>		<ul style="list-style-type: none"> • Spray neem seed kernel extracts • Garlic-Chilli extracts <p>SPRAYING: Spray once in a month.</p>
<p>Rhizome Scale Insects (April - July)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chilli) • Tobacco spray <p>SPRAYING: Spray once in a month.</p>
<p>Thrips (Jan - March)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chilli) • Tobacco spray <p>SPRAYING: Spray once in a month.</p>

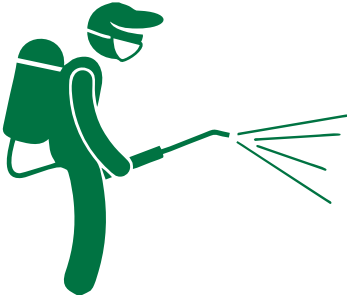


Coriander

Major pest and Prime time of transition	Identification	Botanical pest controllers and Spraying time
<p>Indigo Caterpillar/ Cutworm (Nov - Jan)</p>		<ul style="list-style-type: none"> • Neem seed kernel extract • Neem-Garlic extracts • Tobacco spray <p>SPRAYING: Start spraying 3-4 weeks after sowing.</p>
<p>Aphids (Nov - March)</p>		<ul style="list-style-type: none"> • All in one spray (Garlic-Onion-Chili extract) • Liquid soap - oil spray <p>SPRAYING: Start spraying 20-25 days after sowing of seeds.</p>

Note: It is important for the farmer to be aware about the source of off-farm inputs (those not being grown in the farmland) such as Garlic, Chilly etc. as bio-pest controllers to avoid contamination from unwanted chemicals.





Botanical Pest Controllers Preparation and Use

1. Garlic - Chilli Extracts:

Utility: Sucking pests (Aphids, Thrips, White Flies, Fair Bugs), leaf feeding Caterpillars, prevention of egg laying by bacteria.

Method of preparation:

- Make a paste of 4-5 dried chillies and 1-2 whole bulbs of Garlic with 1 cup of water.
- Mix and boil with 1 litre of water.
- Sieve the mixture after it cools down.
- Add 5-10 drops of liquid soap.

Usage: Mix 250 ml of prepared mixture with 1 litre of water and spray 1.5 litre / nali at 15 days interval.

2. Garlic-onion-chilli extracts (all in one spray):

Utility: Prevention of sucking pests (Aphids, Thrips, White Flies, unhygienic insects), Cutworms and leaf cutters.

Method of preparation:

- Take 1 Garlic bulb + 1 Onion.
- Boil in 1 litre of water.
- Mix 1-2 teaspoons Chilli powder and leave it in the pot overnight.
- Sieve the next day after cooling down.
- Add one litre of water and sprinkle in 2 nali.

Usage: @ 2 litre / nali, at an interval of 20 days; Spray directly on the stem, upper and lower surface of leaves.

3. Neem seed kernel extract

Utility: Prevention of egg laying by leaf feeding caterpillars, stem borers and leaf hoppers.

Method of preparation:

- Take dried neem seeds, remove the outer layer of seeds.
- Grind 1 kg of clean neem kernel and make it equal to the size of a grain.
- Soak it in about 10 litre of water.
- Add 10 ml liquid soap / vegetable oil and shake the mixture.
- Keep the mixture overnight and filter and store it the next day.
- Add water to the residue and repeat extraction 2-3 times.

Usage: Prepare 5% spray (5 ml of the mixture with 1 litre of water), apply @ 2-3 litre / nali at an interval of 20 days; Use in the evening on the leaves of the plant. Its effect lasts for 7-10 days.

4. Neem-Garlic extracts:

Utility: Prevention of egg-laying by leaf-feeding Caterpillars, stem Borers & sucking pests.

Method of preparation:

To make 5 litre spray

- Take 1 kg neem leaves (roughly chopped) + 3-4 garlic bulbs (roughly chopped).
- Boil for about 1 hour (until the leaves turn light).
- Let it cool overnight, filter and store.

Usage: @ 1.5 litre / nali at 15 days interval; Use as a spray directly on your vegetable plants to avoid pests laying eggs.

5. Neem Cake:

Utility: Prevention of soil insects like Termites, Root Borers, Beetles, White Grubs.

Method of preparation:

- After preparing neem seed kernel extract and Neem-Garlic extract collect the remains of Neem leaves and seed kernels.
- Add wet soil and mix the mixture into the cake form with the help of hands.
- Store after being sun-dried.

Usage: @ 25 kg / nali; apply directly to soil at the time of field preparation, or mix with compost.

6. Tobacco Spray:

Utility: Prevention of leaf miners, Aphids, Caterpillars, fruit flies. Avoid the use of this spray in Tomatoes, Brinjal, Chillies, Datura and Petunia.

Method of preparation:

- Collect one ¼ cup of Tobacco leaves.
- Tie in a cloth packet and soak in 1 litre of water overnight.

Usage: 1 litre / nali at intervals of 10–15 days; Spray directly on foilage.

Note : Tobacco Spray is not allowed in organic agriculture pest controls.

7. Liquid Soap - Oil Spray:

Utility: Prevention of Aphids and Mites.

Method of preparation:

Mix one cup (250 ml) vegetable oil with quarter cup of liquid soap and shake it well.

Usage: Mix 1 tbspc of it with four cups of water. Use @ 1.5 litre / nali at an interval of 20 days.

8. Citrus Spray:

Utility: Prevention of soft body pests (Aphids, Thrips & young Caterpillars).

Method of preparation:

- Grate the peel with 2-3 lemons and put it in 500 ml of boiling water. Let the mixture stand overnight.
- Filter and store.

Usage: @ 1.5 litre / nali at 15 days interval.

9. Tomato Leaf Spray:

Utility: Prevention of Leaf miners, Aphids, Caterpillars and fruit flies.

Method of preparation:

- Thickly chop 20-30 Tomato leaves.
- Boil in 1 litre of water.
- Sieve the next day after cooling down Usage: Add one litre of water to the liquid and spray as desired. Use @ 2 litre / nali at an interval of 15 days.





SOME IMPORTANT POINTS DURING USAGE OF BOTANICAL PEST-CONTROLLERS

- Most botanical pest controllers prevent insects from attacking the plant more than actually killing them. Therefore, their application should start from the early life of the plant.
- Even the sprays in higher amount than optimum dosage causes no damage to the crop.
- Usually these should be sprayed after every 15-20 days.
- Botanical pest controllers do not have any adverse effect on the production of crop or its yield potential.
- At the time of spraying, soil fertility can also be increased by incorporating some amounts of cow urine in the spray.
- These insecticides are basically organic in nature, so they do not harm the beneficial insects like bees.
- Their organic nature helps to promote the growth of species of microorganisms living in the soil.
- While making these, you can also use the leaves of many other locally available flora that has pest controlling toxins in it (such as Bichhu grass, marigold, papaya etc.)
- Some organic pest controllers such as chilli and garlic also protect trees from many birds.

PEST CONTROL

in storage / stored seeds and grains

Proper storage of seed is important for its ability to grow and conserve vitality. Depending on the seed, species and storage conditions, seeds can be stored up to several years. One can collect and store seeds even without expensive storage facilities. Proper seed collection and storage is the key to ensuring viable seeds in the future. For long life of seeds and grains in storage, they should be stored in a cool, dry and clean place. Generally the following 3 major problems in storage of seeds / grains are:

1. Insects
2. Fungus
3. Rodents

Infection of these can be easily avoided with the help of some home remedies and techniques.

Material	Method	Target Crop
Solar Drying	The grains are dried in the sun for a long time before storing.	All Seeds and Grains
Ash	The seeds are filled to 3/4th level of earthen pots and the upper 1/4 area is filled with ash from wood or cow dung.	Pulses
Soil-Cow Dung Paste	Storage bins made of bamboo are plastered with mud and cow dung which prevents insect attack from outside.	Pulses
Common Salt	About 200 grams of salt is added manually to 1 kg of lentils, pulses are stored for a period of 6-8 months.	Gram, Urad, Moong, Soyabean
Turmeric Powder	1 kg of grains and seeds are mixed with 50 grams of turmeric powder before placing them in containers or bags of jute. This treatment provides protection for 6-8 months and is equally safe for consumption.	Cereals

Material	Method	Target crop
Garlic Bubl	Garlic bulbs are kept in layers in a storage bin filled with seeds. The garlic bulb acts as a repellent for many insects.	Pulses, Paddy and Maize
Salt and Chili Powder	250 grams of salt and 250 grams of dry chilli powder mixed with 20 kg of seeds are filled in a plastic bag or bin.	Pulses
Neem and Dry Chillies	Dried neem leaves and dried chillies are stored in a bag containing seeds.	Pulses and Cereals
Camphor	2 grams of camphor is kept in a 5 kg grain bag which can be kept for 3 months. After 3 months the grain is dried again and fresh camphor is placed in the bag.	Cereals
Seed of Tulsi	The seeds are mixed with dried tulsi seeds and leaves.	Cereals
Ginger (Rhizome)	Ginger is dried and made into powder and 30 grams of it is mixed with 1 kg of pulses.	Pulses
Matchsticks	It is the oldest method commonly used for storing food grains by women in households. Match boxes are placed in layers. Typically 12-15 matches are placed in the middle, bottom and top of the container and tightly close the lid of the container.	All Seeds and Grains
Lime Powder	Grains are mixed evenly with lime (calcium carbonate) powder and stored them in jute bags in a dry place. Usually 10-15 grams of lime is used for 1 kg of grain.	Cereals

Material	Method	Target crop
Leaves of Lantana	1 kg of dried leaves are mixed with 100 kg of dried paddy and kept in a closed Storage bins.	Pulses, paddy and maize
Leaves of walnut and peach	Mix 50 grams of dried walnuts and peach leaves with 1 kg of cereal grains and store in a closed container. Grains can be safely stored for up to 1 year using walnut leaves.	Cereals
Leaves of Papaya	30-40 grams of dried leaves are mixed with 1 kg of cereal and placed in a closed box.	Cereals

Control of fungi in stored seeds and grains:

Moisture in the atmosphere is the main cause of mould growth in seeds/grains. That is why its problem increases especially in the rainy season.

- Use storage containers that do not contain dust, dirt and old crop grass.
- Store the seeds or grains in direct sunlight for 2-3 days before storing them in a store or in a solar dryer for best results.
- Keep the deposited seed cans or sacks in a place without moisture.

CONTROL OF RODENTS

in stored seeds and grains:

- When rodents appear in the storehouse, immediately use the rat catching traps.
- Onion bulbs: To control rats, place 10-15 onion bulbs inside a 100 kg storage container.
- Mix 100 grams of dried leaves of papaya with 50 kg of grains and store it in sacks or containers.

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