Manual for Skill Development of Farmers for Production of IPM inputs in IPM Seva Kendra

Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
Directorate of Plant Protection Quarantine and Storage
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Manual for Skill Development of Farmers for Production of IPM inputs in IPM Seva Kendra
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Introduction

Integrated Pest Management (IPM) is an eco-friendly approach aims at keeping pest population at below economic threshold levels by employing all available alternate pest control methods and techniques such as cultural, mechanical and biological with emphasis on use of bio-pesticides and pesticides of plant-origin. The use of chemical pesticide is also advised as a measure of last resort when pest population in the crop crosses economic threshold levels (ETL). IPM helps in maximizing crop protection with minimum input costs, minimizing pollution in soil, water and air reducing occupational health hazards, conserving ecological equilibrium and reducing pesticide residue loads in food.

Though Integrated Pest Management has been accepted by agriculture extension workers, farmers and researchers and proved its worth role in management of pests, the availability of IPM inputs like bio-control agents, light traps, rodent traps, pheromone traps, sticky traps, Nuclear Polyhedrosis Virus (NPV), bird percher, seed treatment drums, Neem/Melia seed kernel extract, cow dung ash etc. are the major constraints in implementation of IPM programme in India. The main reason for this is the non availability of local entrepreneurs for the production of these IPM inputs. To ensure the availability of above IPM inputs, the entrepreneurship development is needed among the farmers who can produce and sale or distributes these IPM inputs to the farmers of their vicinity.

In view of this, it is proposed to train the farmers in production technology of these IPM inputs so they may open “IPM Seva Kendra” in their villages to make these inputs available as and when required by their fellow farmers. To develop skill of farmers for production of IPM Inputs in IPM Seva Kendra, the production methodology for some of the IPM inputs is simplified and described herein in the form of manual for benefit of the farmer entrepreneurs.
1. **Yellow sticky traps**

*Pest attracted:* White flies, aphids, leaf miners  
*Crops:* Cotton, mustard, vegetable and flowers

**Methodology 1:**

**Materials required:**
- Ply wood board or hard board or card board (1.5 ft X 1.0 ft size)  
- Yellow colour oil paint  
- Glue or white grease  
- Bamboo poles  
- Wire or rope

**Procedure for making yellow sticky trap:**

Take new or used sheet of plywood board or hard board or card board. Paint it with Yellow colour oil paint. Allow it for drying. Apply grease or glue on the painted board. Erect these traps above crop canopy with the help of bamboo poles.

**Methodology 2:**

**Materials required:**
- Used empty oil tin (1 or 2 litre size)  
- Yellow colour oil paint  
- Glue or white grease  
- Bamboo poles  
- Wire or rope

**Procedure for making yellow sticky trap:**

Take new or used empty 1 or 2 litres oil tin. Paint it with yellow colour oil paint. Apply grease or glue around the tin. Erect these traps above crop canopy with the help of bamboo poles.

**Cleaning of traps:**

Clean the tin or plywood or hardwood traps by dipping into the hot water for couple of minutes to soften the sticky coating. Discard dead insects by using brush or duster. Dry the traps completely and recoat with similar glue for reinstallation. Cardbord traps should be discarded after use.

**Benefits:**

Highly effective, non-toxic and easy to use.

**No. of traps per acre:** 6-8
2. Blue sticky traps

Pest attracted: Thrips

Crops: Cotton, paddy, vegetables and flowers

Methodology 1:

Materials required:
- Plywood board or hard board or card board (1.5 ft X 1.0 ft)
- Blue colour oil paint
- Glue or white grease
- Bamboo poles
- Wire or rope

Procedure for making yellow sticky trap:
Take new or used sheet of plywood board or hard board or card board. Paint it with blue colour oil paint. Allow it for drying. Apply grease or glue on the painted board. Erect traps above crop canopy with the help of bamboo poles.

Methodology 2:

Materials required:
- Used empty oil tin (1 or 2 litre size)
- Blue colour oil paint
- Glue or white grease
- Bamboo poles
- Wire or rope

Procedure for making blue sticky trap:
Take used empty 1 or 2 litres oil tin. Paint it with blue colour oil paint. Apply grease or glue around the tin. Erect traps above crop canopy with the help of bamboo poles.

Cleaning of traps:
Clean the tin or plywood or hardwood traps by dipping into the hot water for couple of minutes to soften the sticky coating. Discard dead insects by using brush or duster. Dry the traps completely and recoat with similar glue for reinstallation. Cardboard traps should be discarded after use.

Benefits:
Highly effective, non-toxic and easy to use.

No. of traps per acre: 10-15
3. White sticky traps

**Pests attracted:** Flea beetles, plant bugs

**Crops:** Vegetable and fruits

**Methodology 1:**

**Materials required:**
- Ply wood board or hard board or card board (1.5 ft X 1.0 ft)
- White colour oil paint
- Glue or white grease
- Bamboo poles
- Wire or rope

**Procedure for making yellow sticky trap:**

Take new or used sheet of plywood board or hard board or card board. Paint it with white colour oil paint. Allow it for drying. Apply grease or glue on the painted board. Erect these traps above crop canopy with the help of bamboo poles.

**Methodology 2:**

**Materials required:**
- Used empty oil tin (1 or 2 litre size)
- White colour oil paint
- Glue or white grease
- Bamboo poles
- Wire or rope

**Procedure for making blue sticky trap:**

Take used empty 1 or 2 litres oil tin. Paint it with white colour oil paint. Apply grease or glue around the tin. Erect traps above crop canopy with the help of bamboo poles.

**Cleaning of traps:**

Clean the tin or plywood or hardwood traps by dipping into the hot water for couple of minutes to soften the sticky coating. Discard dead insects by using brush or duster. Dry the traps completely and recoat with similar glue for reinstallation. Cardbord traps should be discarded after use.

**Benefits:**

Highly effective, non-toxic and easy to use.

**No. of traps per acre:** 6-8
4. **Pit fall traps**

**Pest attracted:** Larvae of Army worm, cut worm, white grub and invertebrates

**Crops:** Ground nut, sugarcane, fruit crops, banana, coffee etc.

**Materials required:**
- 500 ml plastic jar or flower pots
- 6 inches iron rod for scooping soil
- Detergent
- Water

**Methodology:**
Dig the soil to make a pit equal to the size of jar. Place plastic jar inside the pit adjusting the mouth of jar to ground level. Fill the jar with water up to two third. Add small quantity of detergent into the jar.

**Cleaning of traps:**
Remove jar from pit and refill after cleaning

**Benefits:**
Simple, cheap and cost effective, do not kill the animals (except inadvertently) collect large numbers of animals and safe for the operator

5. **Ant traps**

**Pests attracted:** Ants

**Materials required**
- Plastic pan or aluminum pan of 1 ft. square
- Glue/sticky material

**Methodology:**
Make a hole in pan (plastic or aluminum) about one foot length and six inches width. Push pan into the sloping downwards. Coat the bottom of the pan with sticky materials. Check the pans regularly to make sure that the baits are sticky enough to trap the ants.

**Benefits:**
Barriers prevent ants from attacking the sown seeds and seedlings that are grown in free standing seedbeds
6. **Delta Sticky traps**

**Pest attracted:** Flying insects

It is a triangular trap, made of plastic or water proof card. Insects that attracted, depending upon the pheromone lures, fly into the trap and stick to the surface coated with a special type of non-drying glue.

**Materials required**

- Wax coated cardboard (shape to be made as per image)
- Small piece of wire for suspension
- Pheromone lure
- Non-drying Glue
- Insect brush

**Methodology:**

Take a hard waterproof cardboard sheet of 18 x 9 inches. Make folding marks to make delta shape and staple the loose ends. Paste glue material in the inner side of trap. Hang the bait/lure from the holes from the top. Use wire/rope for hanging the trap close to the plant canopy. Change the lures once in 15-20 days.

7. **White board traps for snails**

**Materials required**

- Wooden boards
- white paint, brush
- bucket
- detergent
- Attractant like potato, cabbage

**Methodology:**

Take white surface wooden boards (30 cm x 30 cm size). Place them along the plant rows. At daytime, snails take shelter underneath the cooler places. Check the traps before sunset and collect the snails. Put these traps in a bucket of soapy water or kill them.
8. **Rat glue trap**

Rat glue traps are non-poisonous sticky glue spread over card boards and place them where rats make their route frequently. When rat passes over trap it gets stuck over glue trap. The rat will subsequently die from dehydration. Bait may also be placed on the cardboard to attract them.

**Materials required:**
- Card board
- Glue
- Coloured papers

**Methodology:**
Cut card board in size of 30X30 cms. Cover the trap with colour papers on all the sides leaving one side. Fix brown sheet on card board. Spread glue on card board sheet.

9. **Rat cage trap**

**Materials required:**
- Rat cage

**Methodology:**
A rat cage trap is a metal cage box-shaped device that is designed primarily to catch rats without killing them. Food bait (not poisoned) is put in the cage trap. When an animal enters the cage and moves toward the bait, the mechanism triggers and closes door over the entry point. Rat is caught alive and without injury. The rat can be released in far from field in forest area.
10. Fruit fly traps using methyl eugenol

**Pest attracted:** Fruit flies

**Materials required:**
- Plastic bottle/jar 1 litre
- Latex gloves
- Galvanized utility wire

**Methodology:**
Make 10 to 12 holes into an old 1 liter plastic bottle or 3 holes on each side of 1 liter ice cream container, to allow flies to enter. Heat a small piece of metal to make the holes easily. Put a wire from the cover to suspend the bait. Secure the pheromone dispenser aligns with the entrance holes inside the trap. Make a rectangular opening into the lower part of the container for removing the flies caught. Half-fill the trap with soapy water. Put bait in the pheromone dispenser or suspend the pheromone capsule from the lid using string or wire. Close the container. Attach the trap to a bamboo or wooden stake or hang on branch of a tree. Place traps for different pests at least 3 meters apart. If traps are used for monitoring the pests, 2-3 traps are enough for 1 ha field.

**Reminders while using pheromone traps:**
Buy the pheromone that lures the pest you want to control. Always label the trap. The name of the species you are trapping, the date the bait was placed, and the name of the bait if you are using several. Change bait according to manufacturer's recommendation. Dispose properly the bait wrappers. The tiny amount of pheromone left near the traps will compete with your bait. Wash your hands between handling baits. Minute traces of other chemicals can render the baits completely ineffective. Always remove all captured adults during each visit. Discard them away from the field. Put live ones into a bucket with soap solution to drown.

**No. of traps per acre:**
- Cue Lure: Melon Fly - Use 2-3 traps/acre
- Methyl Eugenol: Oriental Fruit Fly - Use 3-5 traps/acre
- Trimedlure: mediterranean fruit fly - Use 3-5 traps/acre
11. Fruit fly traps using ripe banana, apple or mango peel

Pest attracted: Fruit flies

Materials required:
- Plastic jar 1 litre
- Ripe banana or apple or mango
- jaggery/Sugar solution
- Wires/ropes for hanging the trap

Methodology:
Cut fruit peels into small pieces and mix with sugar and water. Make circular holes randomly on the plastic jar. Place sugary water inside the container. Hang the bait/lure from the lid with the help of a wire/rope. Use wire/rope for hanging the trap close to the plant canopy. Change the lures once in 15-20 days. Flush out the trapped insects periodically.

No. of traps per acre: 4-5

12. Pheromone traps

Sex pheromones (Septa) are insect specific produced artificially in laboratories and used seperately.

Pest attracted: American boll worm, spotted boll worm, pink boll worm, dimond back moth, white grubs.

Material Required:
- Rubber septa (Pheromone lures), traps and pouches
- Polythene bags/ sheets
- Small piece of wire for suspending the lures
- Knife for opening the bottom
- Insect brush and scissor

Methodology:
Cut the polythene sheets into required size (2ft. length X 4 inch wide) and make polythene arm. Close the bottom end of the arm with rubber band to prevent the escaping of trapped insects and to flush out them. Wrap and fit the other end of polythene arm with wider end of the funnel with the help of rubber band/wire. Keep the lid of funnel one inch above mouth of the funnel.
Make a small hole to place septa/lure. Fix the trap containing lure in the field with the help of bamboo sticks keeping the lure nearly one foot above the crop canopy.

**Field application:**

Lures containing sex pheromones are placed into insect trap and erected in the field at a recommended spacing. The lure will release the sex pheromone at a constant rate over a period of 2-4 weeks. Male moths are attracted and while attempting for mating, fall into a container having pesticide. Thus the female moths in the field are deprived of successful mates and fail to reproduce or lay viable eggs.

**Caution while using pheromone traps**

- Always label the trap with detailed information of the species to be trapped and the date of fixing the lure
- Change lure once in 15-20 days
- Dispose properly the lure wrappers/covers
- Wash hands before/after handling baits
- Remove all captured adults during each visit. Put live ones into a bucket with soap solution to drown

**13. Light Traps**

**Pest attracted:** Armyworm, bugs, cutworm, flies, gnats, bollwprm, leafhoppers, planthoppers, stem borers

**Materials required:**

- Plastic buckets 5-10 lts.
- Metal light shade (2 nos.)
- Fluorescent light with holder
- Electrical wires
- Coated metal rods (4 nos.)
- Tin sheets
- String/ flexible wire
- Nut bolts & Screws
- Rubber plug for drainage hole
- Soap water or Kerosinized water
Methodology:
Take a bucket and make 4 holes at the top rim and one larger hole at the bottom rim. Adjust small sized light shade on the bucket in inverse direction. Fix four rods with screws/nuts with the bucket for holding up the large sized light shade. Fix the light source as shown in the figure. Hang the light trap on the large sized light shade. Drainage hole on the bucket should be kept closed by the rubber plug while filling it with soap water/kerosinized water. Collect/drain out trapped insects periodically.

Procedure for installation:
- Install the light trap near or within the field where you want to trap the flying insects
- Secure the poles firmly on the ground
- Mount the lamp or the bulb on the frame, five meters from the ground
- When using electric bulb, make sure that the bulb and wiring are not in contact with water to avoid electrocution
- Place the shallow basin with soapy water or the jute sack underneath the light
- Put the light trap from early evening 6:00 PM to 10:00 PM
- Collect the trapped insects daily and dispose them properly

No. of traps per acre: 2

Materials required for light trap
14. Bird percher

Bird perchers are resting places for predatory birds to rest and to look for preys; such as insect pests of cotton, peanuts, and cowpeas. Predatory birds prefer to look for prey in field crops where they have places to rest.

Materials required:

- Bamboo poles or wooden poles, nails, rope, grease

Methodology:

Use hollow bamboo or wooden poles for making the bird perches. Make a window slit near to upper node of the bamboo. Collect egg mass from the fields and put inside slit least part of the leaf. Provide resting place for the birds on the bamboo pole. Apply grease around the slit so that the birds sitting can predate upon the emerged larvae. Once the birds are on the field, they prey on cotton bollworms and other insects.

No. of traps per acre: 5
15. Mass production of *Corcyra cephalonica* (Laboratory host for *Trichogramma* spp.)

**Materials required:**

- Sterilized sorghum
- *Corcyra* rearing boxes/trays/jars made up of plastic or wood with lid provided with wire mesh for aeration
- *Corcyra* egg laying cage
- Black cloth
- Mosquito net
- Table
- Racks for placing *Corcyra* cages
- Honey
- Glycerin
- Tubes for collecting *Corcyra* moth
- Measuring cylinder
- Plastic tubs for egg laying purpose
- Brush
- Roasted ground nut powder - 100 grams
- Yeast - 5 grams
- Wettable sulphur - 5 grams
- Streptomycin sulphate - 0.05 gms

**Preparation of egg laying cage of *Corcyra cephalonica***

Take a plastic bucket with lid. Cut the lid in circular shape leaving space for providing /fixing wire mesh for egg laying purpose in the (circular wire mesh). Make a hole on the centre of bottom of the plastic bucket to pour the collected adults in the bucket. Keep bucket inverted in the plastic tub for egg laying purposes.
Steps for production of *Corcyra cephalonica*:

- Sterilize the rearing boxes (if wooden) in hot air oven for 100 degrees centigrade for 30 minutes
- If plastic trays are used, wash them before use
- Dry broken grains of jowar in sunlight properly
- Pour sterilized grain - 2.5 kg/box/tray
- Add 100 grams of roasted ground nut powder, 5 grams of yeast, 5 grams of wettable sulphur, 0.05 gms of streptomycin sulphate in each box or tray
- Mix well all ingredients
- Sprinkle 1 cubic centimeter of *Corcyra eggs*/box/tray on the top of mixture (culture medium)
- Cover the box with lid, label the date of inoculation
- Keep these boxes in racks protected by ant pans
- Favourable temperature for rearing is 28+/−2 degree centigrade and Relative humidity, 75% +/− 5%
- The moth starts emerging on 40th day
- Bring the boxes ready for moth emergence and collect moths inside the net by glass tubes
- Transfer the moths to egg laying chamber
- Provide cotton soaked 20% honey+ vitamin E solution as adult food in the egg laying chamber
- Collect the eggs daily
- Pour the eggs in a paper by tilting slightly downward so eggs come down side where as dust particles remain in upper side
- Clean the eggs further by passing through different size sieves to 10, 15 and 40 meshes
- Discard the moth after 4 days
- Utilize the *Corcyra eggs* for *Trichogramma* production (or) host culture or store them in refrigerator at 10 degree centigrade for 7 days, if required.

**Materials required:**

- *Corcyra* eggs
- Nucleus culture of *Trichogramma*
- Polythene bags
- Rubber bands
- Scissors
- Gum
- Brush
- Tea strainer
- *Tricho* cards
- 50% honey solution
- Stapler
- Refrigerator
- UV lamp

**Methodology:**

Clean fresh *Corcyra* eggs by passing through 15, 30 and 45 mesh sieves. Prepare “Trichocard” by cutting card board sheet to the size of 10 x10 cm which can accommodate 1 cc of eggs. Apply gum on the card and sprinkle the cleaned eggs uniformly. Remove the excess eggs from the cards by using brush. Allow the card for shade drying for 30 minutes. Treat the eggs under UV lamp for 30 minutes. Take polythene bag, insert UV treated “Trichocard” and nucleus card at the ratio of 6:1 (6 *Corcyra* egg cards: 1 *Trichogramma* nucleus card) and provide 50% honey vitamin E in a soaked cotton swab. Remove the Tricho cards after 2 days *Corcyra* eggs changes black colour on 3rd day indicates the parasitization of eggs. Release the parasitized egg cards immediately in the fields (or) store them in refrigerator at 10 degree centigrade up to 21 days. Place/tie/staple parasitized cards on leaf sheath of plant.
17. Mass production of *Beauveria bassiana* (white muscardine fungus)

**Materials required:**
- Sorghum
- Water
- Chalk powder
- Autoclave

**Methodology:**
Soak 1 Kg of Sorghum in water for 48 hours. Replace water after 24 hrs, after 48 hrs. rinse water completely. Separate equally in 10-15 flasks and plug with hard cotton cushion and wrap with double aluminum foil. Sterilize for 40 minutes with 21 psi. Inoculate the each flask containing jowar with 2-3 drop of nucleus culture after cooling. *Beauveria* culture will grow fully after 20-25 days. Mix 2 Kg of chalk powder in *Beauveria* culture and dry in shade.

**Dose:** 1 gram/liter of water or 1 Kg/1000 liter of water/ha (Repeat application after 10-20 days interval)

18. Mass production of *Metarhizium anisopliae* (green muscardine fungus)

**Pest managed:** Rhinoceros beetle, *Oryctes rhinoceros*

A. On coconut water

**Material Required:**
- Coconut water
- Flat glass bottles
- Cotton plug
- Pressure cooker
- Injection syringe
- Bunsen burner
- Laminar flow chamber
- Mixer grinder
**Methodology:**

Take glass bottles containing 40 ml of coconut water. Plug these bottles with cotton plug and sterilize in autoclave for 20 minutes at 15 psi. The bottles are inoculated with 1 ml suspension containing spores of the fungus with the help of a sterile injection syringe. Sterilize the bottles with the help of burner. Spores are inoculated in bottles with the help of syringe in a laminar flow chamber. Keep inoculated bottles till the surface of medium is fully covered by the olive green sporulated fungus. Whole culture is grinded thoroughly in mixer. Keep culture in cool and dry place in packets.

**B. In Carrot broth**

**Material Required:**
- Carrots
- Conical flask (250 ml)
- Distilled water
- Autoclave
- Laminar flow chamber

**Methodology:**

Wash thoroughly cut pieces of carrots put in conical flask. Add 15 ml of distilled water in conical flask. Conical flasks are plugged with cotton and autoclaved for 20 min at 15 psi and allow for cooling. Inoculate mother culture in slant loopful quantities of *M. anisopliae* spores in flasks. The flasks are incubated at room temperature. Spores will be ready in 15 days.
19. Mass production of Nuclear Polyhedrosis Virus (NPV):

**Material Required:**

- Agar-agar : 12.75g
- Gram floor (Besan) : 105g
- Methyl Para Hydroxyl Benzoate : 2g
- Yeast powder : 10g
- Ascorbic acid : 3.5g
- Sorbic acid : 1g
- Streptomycin : 0.25g
- Multi vitamin : 2 capsule
- Vitamin-E (400 mg) : 1 capsule
- Distilled water : 390 ml
- Centrifugal machine
- Glass vials
- Muscin cloth

**Methodology:**

Nuclear Polyhedrosis Virus (NPV) is host specific for *Spodoptera litura* and *Helicoverpa armigera*. NPV is a stomach poison. NPV is effective when it is ingested by the larvae. The mass production of NPV of *H. armigera* and *S. litura* is same except *H. armigera* is reared in individual vial to avoid cannibalism. The NPV of these pests can be produced by using both natural as well as artificial diet contaminated with the respective NPV. The third instar larvae of these pests either collected from field or reared in the laboratory are allowed to feed the contaminated diet. Keep larvae hungry for 24 hours before inoculation of virus. Larvae get infected with virus within 3-4 days and hang themself upside down in tubes. These infected larvae are collected in a beaker containing water for 3-4 days for putrification. The putrifled larvae are crushed with the help of mixer cum grinder by adding some water. This solution is filtered with the help of muslin cloth and add more water, if required. The filtered extract solution is centrifuged (30,000 RPM) to separate the polyhedral of NPV from the solution. The polyhedral is separated from the water and is ready to use.
20. Mass production of *Trichoderma*:

**Materials Required:**

- Rice/Wheat/ Sorghum/ Maize
- Mother Culture (may be procured from CIPMCs or State biocontrol laboratory)
- 8" x 12 " plastic bag
- Cotton
- Rubber band
- Plastic pipe of 1 ½ inch length and 1 ½ cm – 2 cm diameter having both side open (or even a bamboo of same size and diameter, can be used removing the internodes)
- Pressure cooker of 5 Lts. or above
- Stone/wood
- Heating system (gas/electric heater)
- Fresh Water
- Candle
- Spoon

**Methodology:**

Take 200g of Rice/Wheat/Jower/Maize in the poly pack and add 200 ml of fresh water in the pack (if grains contain dust then wash it twice before adding fresh water). Place the plastic pipe/Bamboo in the middle of the plastic pack (opening end) in such a way that level of the pipe and plastic remain equal. Tie it with the help of rubber band. Plug the opening end of the pipe tightly with the help of the cotton. Cover the cotton plug with a paper using rubber band. Place the thick paper inside the pressure cooker surrounding the cooker wall. Place the stone/wood in the cooker and add water into the cooker just below the stone/wood. Place the plastic pack inside the cooker and put it on heating system. Wait until 3 times gas release from the cooker (3 whistles). Remove the packet from the cooker until totally cool down.
Inoculation method:
Place a candle at the corner of the room and wait for 3-4 min. Wash hand and the spoon with Dettol. Open the paper cover from the plastic pack. Take mother culture (Talc based) by using opposite end of the spoon and pour it in to the plastic pack, removing cotton plug in front of candle. Plug it again and keep the plastic pack in room temperature for 10-12 days. The entire grain based medium will turn green due to sporulation of Trichoderma

Precautions:
- Do not open the cotton plug until use.
- Keep it in a cold place (refrigerator preferably after sporulation)
- Avoid direct sunlight until use

21. Spider Multiplication
Spiders: Neoscona spp (Orb web spider)

List of Neoscona spp

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<td><em>Neoscona mukerjei</em> (Tikader)</td>
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<tr>
<td><em>Neoscona nautical</em> (Koch)</td>
<td>Orb web spider</td>
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![Neoscona sp](image1.jpg)

![Neoscona mukerjei](image2.jpg)
**Material required:** Live culture, dry plant materials, Plastic / glass jars, Muslin cloth

- Spider egg mass of *Neoscona* (Female usually remain adjacent to egg mass till it hatches. Selection of egg mass will be made which is under parental care or gravid female of *Neoscona* species. However, it is better to rear the gravid female)
- Small jars 500 ml/waste mineral bottle (both side open) covered with cotton cloth
- Food (live moth, house fly, hoppers, nymphal instar of grasshopper or *Corcyra* moth)
- Scissor and camel hair brush
- Dry plant materials

**Methodology:**

**Rearing of spider (Neoscona spp.)**

![Egg mass](image1.png) ![Spiderlings](image2.png) ![Adult Spider](image3.png)

**Life cycle of *Neoscona* sp.:**

Egg mass or gravid *Neoscona* female reared in jar for hatching and/or for egg lying. The spiderlings emerge after hatching are very soft and do not require food for first day. 2nd day onwards till the 3rd instars they usually feed on the prey. For feeding living *Corcyra* moth by making it wingless, 3-small hoppers (nymph) or 3-housefly (adult or maggots) or small soft bodied insect pests (sedentary) of different crops can be given to spiderlings. After 3rd instars a few male and female may be collected from the batch for nucleus culture for further rearing and the remaining may be released. It is better if the spiderlings at the 3rd instars are released in the field. From the nucleus culture one male and one female are kept in a jar for mating.

**Precautions:**

- The early instars of spiderlings are very soft so the prey to be provided to match the need
- Release of spider is best at 3rd instars stage (15-20 days after hatching)
- Release is to be made near the dense canopy & preferably in the morning or afternoon
- There is some cannibalism in the late instars if the food is not enough or a large number of Individuals are allowed to remain in the small jars
23. Botanicals

A. Neem Seed Kernel Extract

Pest Controlled: Beetle larvae, butterfly and moth caterpillars, stalk borers, true bugs, plant and leaf-hoppers, adult beetles, thrips, fruit flies, scale insects, mealy bugs etc.

Material required:
For preparation of 100 liters of 5% NSKE solution, following material are required

- Neem seed kernels (well dried) – 5 kg
- Water (reasonably good quality) – 100 litres
- Detergent -200 gms
- Muslin cloth for filtering

Methodology:
Take required quantity of Neem seed kernel (5 kg). Grind the kernels gently to powder it. Soak it overnight in 10 liter of water. Next morning stir with wooden stick till solution becomes milky white. Filter through double layer of muslin cloth and make the volume to 100 liter. Add 1% detergent (Make a paste of the detergent and then mix it in the spray solution). Mix the spray solution well and use.

Precautions:
- Collect the Neem fruits during bearing season and air-dry them under shade
- Do not use the seeds over eight months of age. The seeds stored over and above this age lose their activity and hence not fit for NSKE preparation
- Always use freshly prepared neem seed kernel extract (NSKE)
- Spray the extract after 3.30 pm to get effective results
Spray solution preparation:

- Neem Kernel extracts (500 to 2000 ml) is required per tank (10 liters capacity). 3-5 kg of neem kernel is required for an acre. Remove the outer seed coat and use only the kernel. If the seeds are fresh, 3 kg of kernel is sufficient. If the seeds are old, 5 kg are required.
- Pound the kernel gently and tie it loosely with a cotton cloth. Soak this overnight in a vessel containing 10 litre of water. After this, it is filtered.
- On filtering, 6-7 litre of extract can be obtained. 500-1000 ml of this extract should be diluted with 9 ½ or 9 litres of water. Before spraying khadi soap solution @ 10 ml/litre should be added to help the extract stick well to the leaf surface. This concentration of the extract can be increased or decreased depending on the intensity of pest attack.

B. *Pongamia* leaves

a) *Pongamia* leaf extract:

Pests controlled: Sucking insect pests and Leaf eating caterpillars

Materials required:
- 1 kg of leaves
- 5 ml of soap
- Grinder
- Water
- Stick/rod

Methodology:

Soak shredded leaves overnight in water (Enough to cover the leaves)
Next day, grind the filtrate material. Dilute the extract with 5 liters of water. Add soap and stir thoroughly. Spray on plants early in the morning or late in the afternoon.
b) *Pongamia* Seed extract:

**Pests controlled:** Aphid, Armyworm, Brown plant hopper, Citrus leaf miner, Corn stem borer, Green leafhopper, Potato tuber moth, Rice caseworm, Whitefly

**Materials required:**
- 50 grams of Pongamia seed powder
- 1 liter of water
- Few drops of soap
- Mortar and pestle
- Muslin cloth
- Jar 1 lt. Capacity
- Strainer/ Sieve
- Stick/rod
- Plastic bucket

**Methodology:**
De-pulp the seeds. Crush them gently so that oil should not be lost. Put the crushed material in the muslin cloth and soak overnight in water. Squeeze the cloth containing soaked material. Filter it and add soap. Stir well and spray on plant.

**Dosage:** 5 kg *Pongamia* seed powder is required for 100 liters of extract which can be used for 0.4 ha area.

C. *Lantana* leaf extract

**Pest controlled:** White flies, leaf miner, termites, stored insects, nematodes, fungi, bacteria and virus

**Materials required:**
- Lantana leaves
- Detergent/ soap solution
- Scissor/knife
- Water
- Filter
- Stick/rod
- Plastic bucket
Methodology:
Take 1 kg Lantana leaves. Cut into small pieces and grind it. Add 250 ml of water and stir well. Filter the material by adding another 250 ml of water. Add detergent few drops and stir well. Then dissolve in 10 liters of water and spray on plants.

D. *Calotropis* leaf extract

Pest controlled: *Spodoptera litura* (Anti feedant activity)

**Materials required:**
- *Calotropis* leaves
- 1 liter of water
- Few drops of soap
- Muslin cloth
- Jar 1 lt.
- Strainer/ Sieve
- Plastic bucket

**Methodology:**
Crush 1 kg of leaves in motar-pestle, make paste. Add one liter of water and filter. Make final solution in 10 lts. of water before spraying.

22. Plant ash, sand, Saw dust, egg shell powder Mixture

Pest controlled: Snails

**Materials required:**
- Plant ash
- Saw dusts
- sand or crushed eggshells

**Methodology:**
Take equql ratio (1:1) of plant ash; saw dusts, sand or eggshells. Sprinkle enough ash, sand, or crushed eggshells at the base of the plants. The snails are sensitive to harsh objects which prevent them from crawling into the plants. Keep these substances dry more effectiveness because snails are problematic only when the soil is moist.