

INSECT-PEST MANAGEMENT IN NATURAL FARMING

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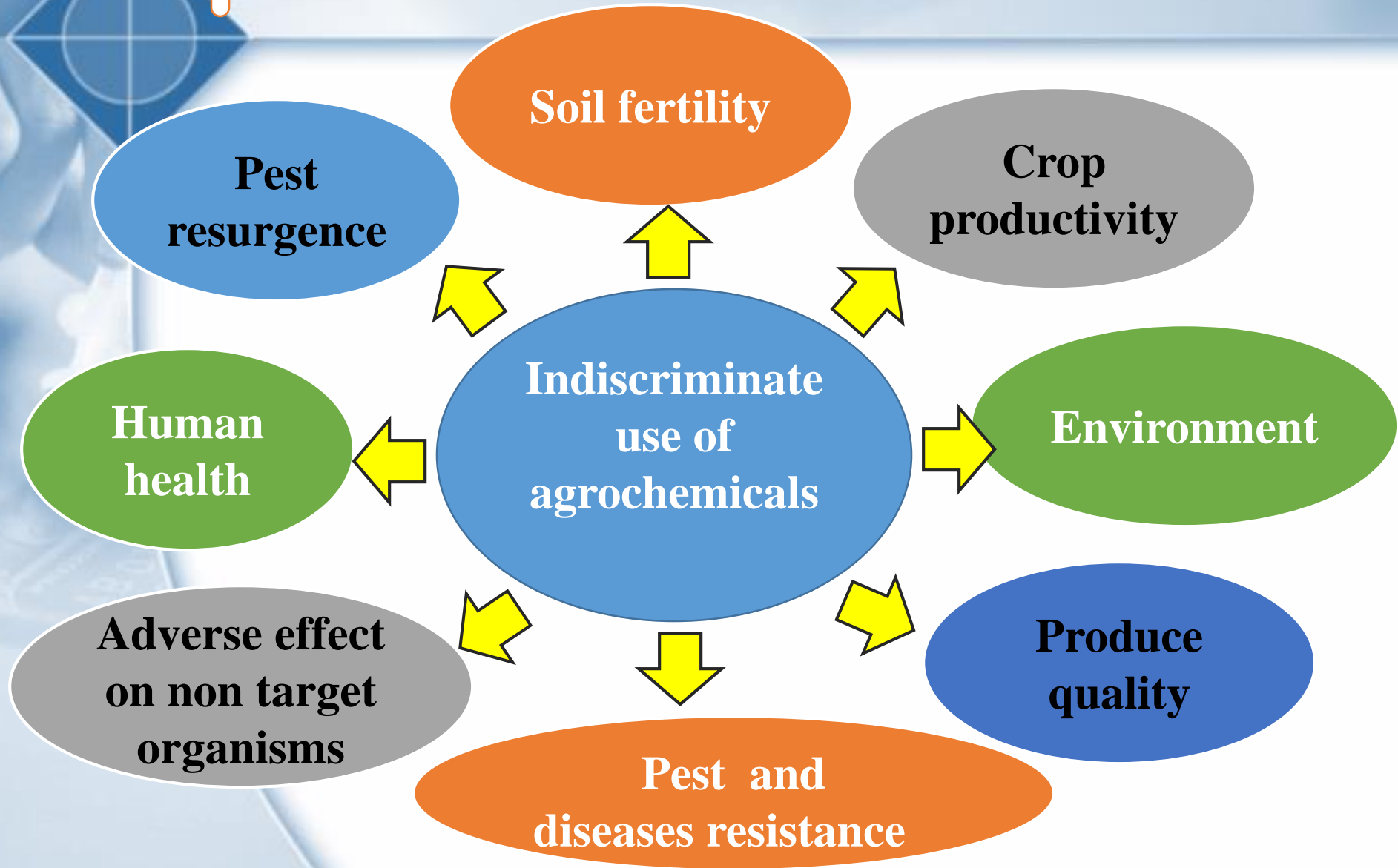
WHY THERE IS A NEED OF NATURAL FARMING ?

- ➔ Stagnation in crop productivity
- ➔ **Input intensive: High production cost**
- ➔ Degradation of natural resources: land, ground water, biodiversity and environment
- ➔ **Climate change and associated challenge**
- ➔ Farmers distress
- ➔ **Indiscriminate use of agrochemicals**

Do we need new direction ?



TODAY'S SCENARIO



WHAT IS NATURAL FARMING?

- Natural Farming can be defined as “chemical- free and livestock based farming”. Soundly grounded in agro-ecology, it is a diversified farming system that integrates crops, trees and livestock, allowing the optimum use of functional biodiversity.
- Natural Farming holds the promise of enhancing farmers’ income while delivering many other benefits, such as restoration of soil fertility and environmental health, and mitigating and/or reducing greenhouse gas emissions.
- Natural Farming builds on natural or ecological processes that exist in or around farms.



KEY PRINCIPLES OF NATURAL FARMING

- ➡ **Enhanced biomass recycling**
- ➡ **Strengthened 'immune system' through enhanced functional biodiversity**
- ➡ **Improving soil health by managing organic matter and soil biological activity**
- ➡ **Minimized loss of energy, water and nutrients**
- ➡ **Diversification of genetic resources**
- ➡ **Enhanced beneficial biological interaction**

AIMS AND OBJECTIVES OF NATURAL FARMING

- Preserve natural **flora and fauna**
- Restore **soil health and fertility** and soil's biological life
- Maintain diversity in crop production
- Efficient utilization of land and natural resources (light, air, water)
- Promote natural **beneficial insects**, animals and microbes in soil for nutrient recycling and biological control of pests and diseases
- Use of natural / local resource-based inputs
- **Reduce input cost** of agricultural production
- **Improve income** of farmers



Different methods of crop protection in Natural farming

Cultural Method



- Crop rotation
- Use of Insect-Pest resistant varieties
- Mixed cropping
- Inter cropping
- trap crop

Mechanical Method



- Collection and destruction of different life stages of insect-pest
- Bagging of fruit with polythene
- Installation of pheromone trap
- Yellow sticky trap
- Blue sticky trap

Physical Method



- Heat of sunlight
- Atmospheric factors
- Light trap

Biological Method



- Beneficial insect (predators and parasites)
- Microorganisms (fungi, bacteria, virus, protozoa, worms)
- Conservation of birds

Botanicals



- *Neemastra*
- *Brahmastra*
- *Agniastra*
- *Dashparni Ark*
- Tobacco decoction

Animal originated products



- Sour butter milk

1. Cultural Method

- ❑ Pest population can be reduced by partial modification of farming system. This system includes following various methods.



Deep summer ploughing



Crop rotation



Transplantin/sowing of crops at the right time



Timely irrigation



Selection of resistant varities



Mixed cropping/intercropping



Sowing of trap crop



Collection and destruction of infested fruits

2. Mechanical method

❖ This method involves reducing pest populations or damage by hand or hand-operated devices.

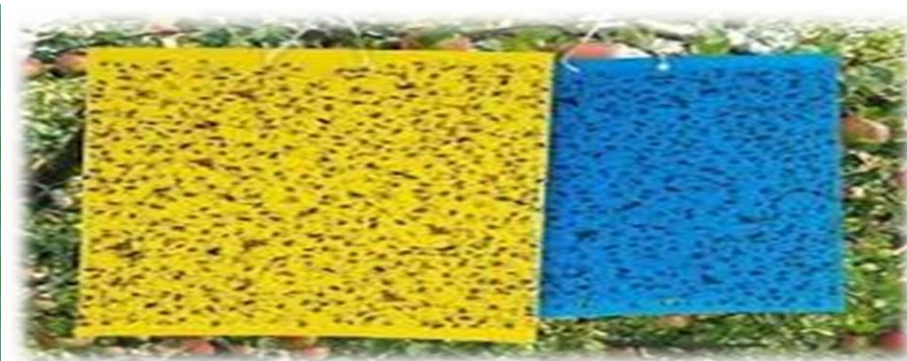
- Bagging of ripening fruits of citrus reduces the damage of citrus fruit sucking moth.
- The upward movement of the nymphs of mealy bugs on the mango trees can be checked by banding the tree trunks with 400 gauze polythene sheet or band (30 cm wide) round the trunk during the months of November and December.



- Entry of rats on to the trunk can be prevented by fixing mechanical barriers up to 2m height from ground level using 40cm sized G.I. sheets in coconut.
- Collect and destroy the adult beetles of white grub by Jarring and shaking of host plants with the help of a hooked bamboo pole during night after monsoon rain for 4 to 5 nights.



- By **digging** one-and-a-half feet wide and two feet **deep trenches** around the field and filling them with water, **swarms of caterpillars, armyworms** and **locusts** can be managed.
- Collection and destruction of **egg masses**, gregarious first and second instar **larvae** and full grown larvae of **armyworms**.
- For the management of **mango stem borer**, Insert the **iron spike** into the hole of tree trunk to kill the larvae, which is quite effective when infestation is low.
- **Sieving and Winnowing** are often used to combat insect pests of stored grains.
- Installation of **yellow sticky trap** for the control of **aphid** and **whitefly**. while, **blue sticky trap** is used for the control of **thrips**.



Yellow sticky trap (Aphid and whitefly) and

Blue sticky trap (thrips) 11

❑ **Pheromone traps are used for three main functions.**

1. Survey of pests 2. Mass extermination of pests 3. Disruption in mating activity of pest

Pest	Pheromone	Rate
Brinjal shoot and fruit borer	Luci Lure	40 per hectare
Melon fruit fly	Cue Lure	10-12 per Hector
Fruit fly	Methyl eugenol	10-12 per hectare 4-5 feet above the ground
Pigeon pea pod borer	Hali Lure	10-12 per hectare 1.5 feet above ground
Gram pod borer	Hali Lure	8-10 per hectare
Tomato leaf eating caterpillar	Spodo Lure	40 per hectare
Fall armyworm	Spodo Lure	50 per hectare
Pink bollworm	Pactino Lure	20 per hectare



3. Physical method

- ❑ In this method Physical forces such as temperature, sound or radiation are used to reduce pest populations or damage.



1 light trap/ha (for attracting adult moths)

- ❑ **Seed treatment by heat of sunlight**

✓ **Pink cotton bollworm** As it remains dormant in the seeds, **drying the seeds** in the sun before sowing destroys them.

4. Biological Method

❑ This method of crop protection uses natural enemies of pests such as parasites, predators, beneficial microorganisms (bacteria, viruses, fungi, worms) and birds.



Chrysoperla carnea



Lady Bird Beetle



Cryptolaemus montrouzieri



Mantid



Mynah



Spiders



Trichogramma Spp.



Cotesia Spp.



Virus Infested caterpillars



Green fungus



Bt Infested caterpillars



White fungus

Table 1: Recommended doses of bio-control agent

Pest	Bio-control agent	Rate of application
Pod borer, Leaf-eating caterpillar, Fall armyworm	Adult <i>Trichogramma</i> wasps	1 to 1.5 lakh/ha 5 times in a week
	Green lace wing bug	10 thousand/hectare
	<i>Bacillus thuringiensis</i> (Bacteria)	40 grams in 10 liters of water at the initiation of pest and the remaining two sprays at 15 days interval (1 to 1.5 kg/ha)
	Nuclear Polyhedrosis Viruses (NPV)	250 LE/ha. Spray in the morning or evening on early instar larvae.
White grub	<i>Metarhizium anisoplea</i> (green fungus)	Apply 25 grams of powder per 1 kg of seed
Sucking pest	<i>Beauveria bassiana</i> 2 x 10⁸ CFU/g (1% w.p.) (white fungus)	40 grams per 10 liters of water at the initiation of pest and the remaining 2 sprays at 15 days interval
	<i>Lecanicillium lacani</i> 2 × 10⁸ CFU/g (1% w.p.)	40 grams per 10 liters of water at the initiation of pest and the remaining 2 sprays at 15 days interval

5. Botanicals

✓ Antifeedant

✓ Attractant

✓ Repellent

✓ Growth inhibitor



Use of Neem as an insecticide



☐ Repellent as well as antifeedent

- **Neem seeds** and other parts of neem are repellent and antifeedant. The insecticidal properties **of neem seed are attributed to the azadirachtin, nimbin, salenin and meliantriol present in it.**
- Spraying neem-based insecticide causes **death of the pest due to starvation as it loses the ability to discern its food.**
- **Neem seed and its derivatives are** used as antifeedant, stimulant, protectant, nematicide and nitrogen regulator.

☐ Ovulation inhibitor

- ✓ Female moths avoids eggs laying on crops sprayed with neem-based insecticide. Due to this property, pests can be prevented from entering the field and female lay very few eggs.

☐ Growth inhibitor

- ✓ **Azadirachtin** and other substances present in neem seeds and leaves inhibit the growth of the pest. So, **the pest cannot reaches to their adult stage** and the population is reduced.

Procedure to make Neem seed kernel extract 5%

- ❖ Take 5kg of Neem seed kernel
- ❖ Grind the kernels gently to powder it
- ❖ Soak it overnight in 10 liter of water
- ❖ Stir with wooden plank in the morning 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

Neem seed kernel extract 5%



Neem leaf Extract 10%

- To make 10 liters liquid mixture, collect 1 kg of fresh neem leaves and crush it using mortar pestle.
- Take out these crushed material into fine muslin cloth and dip it into 2-3 liters of water for 3 to 4 hours. Thereafter, gently squeeze the cloth 5 to 6 times to educe leaf extract out in water
- Add additional water to this solution to make total volume of 10 liters and spray it as soon as possible
- If 100 liters of liquid mixture is to be made, 10 kg of neem leaves will be required



Table 2: Recommended doses

pest

dose

Pod borers, leaf-eating caterpillars,
Fall armyworms, Spotted
bollworms, diamond back moth,
sugarcane borers, locusts, sucking
insect-pest,

Neem-based insecticide 10 ml. (5 EC) to 60 ml. (0.03 EC) in 10 liters of water

Neem seed kernal extract 5% (500g per 10 liters of water)

Neem oil 50 ml. per 10 liters of water

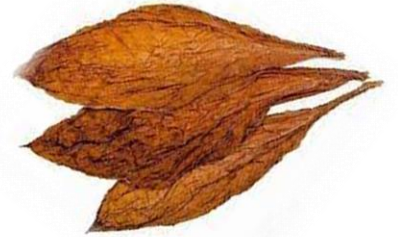


Tobacco decoction preparation

Botanical insecticides can be made from tobacco in two ways.

1. Tobacco decoction – Hot Water Method :

- ✓ Collect **1 kg of tobacco** leaf powder/ dust and sock in **10 liters** of water overnight.
- ✓ Next day morning, boil it at **60 to 70 degree C temperature** of about one hour.
- ✓ While boiling, maintain 10 liters quantity by adding water.
- ✓ The stock solution becomes dark coffee colour.
- ✓ Filter it with a muslin cloth and add **200 g soap powder** or any washing detergent powder.
- ✓ In this stock solution, add more 4-5 times additional water and this quantity is ready for spray
- ✓ Tobacco decoction– cold water Method: Follow the same method as described above but **do not boil at any stage.**



Target Pests: Small bodied insects like aphids, whiteflies, thrips, mite, mealy bugs and early instar larvae of leaf eating caterpillars like tobacco leaf-eating caterpillars, leaf folders, hairy caterpillar etc.

Preparation of *Neemastra*

Materials/ Ingredients



5 liters of
cow urine



1 kg desi
cow dung



10 kg of
neem
leaves



100 liters
of water

❑ How to make:

- ✓ Take 100 liter of water into a drum and add 5 liter of cow urine. Then add 1 kg of local cow dung. Next, add 10 kg of fine paste of neem leaves or 10 kg neem seed pulp.
- ✓ Then stir it clockwise with a long stick and cover it with a gunny bag. Keep it in shade as it should not be exposed to either sunlight or rainfall. Stir the solution every morning and evening in clockwise direction.
- ✓ After 48 hours, it is ready for use. It may be stored for use up to 6 months. It should not be diluted with water.
- ✓ Filter the prepared solution with a muslin cloth and apply directly on the crop through foliar spray.

Target Pests: All the sucking pests, jassids, aphids, white fly and small caterpillars are controlled by *Neemastra*.

Preparation of *Agnistra*

Materials/ Ingredients



20 liters of
cow urine



500 grams
of chillies



5 kg of
neem
leaves



250 grams
of garlic

❑ How to make:

- ✓ Add 20 litre cow urine to a container. Then add 5 kg neem leaves paste, 500 gram tobacco powder, 500 gram green chilli paste, 250 gram garlic paste.
- ✓ Stir the solution in clockwise direction and cover it with a lid and allow it for boiling till we get foam.
- ✓ Remove from fire and keep the vessel under shade, away from direct sunlight for cooling up to 48 hours During this fermentation period stir the components twice a day.
- ✓ After 48 hours, filter with a thin muslin cloth and store it. It can be stored for 3 months.

✓ How to use:

- 6-8 liters of *Agnistra* should be taken and diluted in 200 liters of water for spraying. The following ratio are to be followed based on the severity of pest attack.

Target Pests: For management of stem borers, fruit borers, bollworms of cotton and all major pests and caterpillars.

Preparation of *Brahmastra*



Custard apple



Neem leaves



Castor



Dhatura



Karanj



❑ How to make:

- ✓ Take 20 liter of cow urine in a vessel and add 2 kg of fine paste of neem leaves, 2 kg of paste prepared from leaves of karanj, 2 kg paste of custard apple leaves, 2 kg paste of castor leaves, and 2 kg paste of datura leaves into it.
- ✓ Boil it on a small flame, till one or two foams (overflow level). Stir in clockwise direction, then cover the vessel with a lid and keep on boiling it.
- ✓ After formation of second foam, stop boiling and allow it to cool for 48 hours so that the alkaloids present in the leaves are released into the urine.
- ✓ After 48 hours, filter solution using a muslin cloth and store it. It is better to store in pots (earthen pots) or plastic drums under shade. The solution may be stored for use up to 6 months.

✓ How to use:

- 6-8 liter of *Brahmastra* diluted in 200 liter of water can be used as the foliar spray on the standing crop.

Target Pests: It controls all sucking pests and hidden caterpillars that are present in pods and fruits.

Preparation of *Dashparni Ark*

- ❖ Take 200 liters of water in a drum, add 20 liters of cow urine and 2 kg of cow dung. Mix it well and cover with the gunny bag and keep aside for 2 hours.
- ❖ Add 500 gram of turmeric powder, 200 gram of ginger paste, 10 grams of Asafoetida into the mixture. Stir it well in the clockwise direction; cover with gunny bag and keep overnight.
- ❖ Next morning, add 1 kg of tobacco powder, 2 kg of hot green chilli paste and 500 gram of garlic paste and stir it well with wooden stick in the clockwise direction, cover with gunny bag and leave for 24 hours under shade.
- ❖ Next morning, add paste of any 10 types of leaves* (from the list given on next slide) to the mixture.
- ❖ Stir thoroughly and cover with the gunny bag. Keep it for 30-40 days for fermentation so that the alkaloids present in the leaves will get dissolve in the mixture. Stir twice a day
- ❖ Filter this after 40 days with a muslin cloth and use it.
- ❖ **Application:** The prepared *Dashaparni ark* of 6-8 litres should be diluted in 200 liters of water for spraying.

Dashaparni ark acts as substitute for *Neemastra*, *Bramhastra*, and *Agniastra*. It is used to control all types of pests and used depending on the level of infestation.

Different types of leaves used in the preparation of *Dashaparni Ark*

- **Neem** leaves -3 kg
- Leaves of **Bitter Gourd** (*Momordica charantia*) -2 kg
- Leaves of **Guava** (*Psidium guava*) -2 kg
- **Mango** leaves (*Mangifera indica*) -2 kg
- **Castor** leaves (*Ricinus communis*) -2 kg
- **Datura** leaves (*Datura metel*) -2 kg
- Leaves of **Drumstick** (*Moringa oleifera*) -2 kg
- Leaves of **Pomegranate** (*Punica granatum*) -2 kg
- Leaves of **Coffee** (*Coffea arabica*) -2 kg
- Leaves of **Mahua** (*Maduca indica*) -2 kg
- Leaves of **Hibiscus rosa** -2 kg
- Leaves of **Lantana camara** -2 kg
- Leaves of **Casia tora** -2 kg



Buttermilk- natural way to keep pest away

- ❖ Sour buttermilk works both as an insecticide and fungicide
- ❖ The older the buttermilk is, the more beneficial it is for the crops
- ❖ It is very beneficial for the control of stem borer caterpillar, twig caterpillar, and other juice sucking pests
- ❖ The fresh buttermilk should not be used as it is not effective in prevention of pests
- ❖ For the caterpillar control, 1 year old buttermilk can be used
- ❖ For spraying purpose, buttermilk must be 15 days old
- ❖ The dosage of 3-4 liter in 130-150 liter water for per acre land should be use
- ❖ It reduces the infestation of hairy caterpillars and aphids in cowpea
- ❖ Also effective against the whitefly in mung bean and cowpea

There are few points we need to consider for more effective control of these pests by spraying buttermilk

- ❖ While storing buttermilk put a copper wire in the buttermilk, store it in a jar and try to keep it in a dark and warm place.
- ❖ Store minimum for 15 days and maximum one year.
- ❖ Spray it in a dry weather, better to check the forecast, day of spraying should not be followed by a rainy day
- ❖ Spray in the evening time, so that it should not get evaporated quickly.
- ❖ For high infestation of any pests- Mix 1 liter of cow urine with 1 liter of sour buttermilk and 8 liters of water.



Benefits of Pest Management by Natural farming

Farming costs are reduced by stopping the use of chemicals

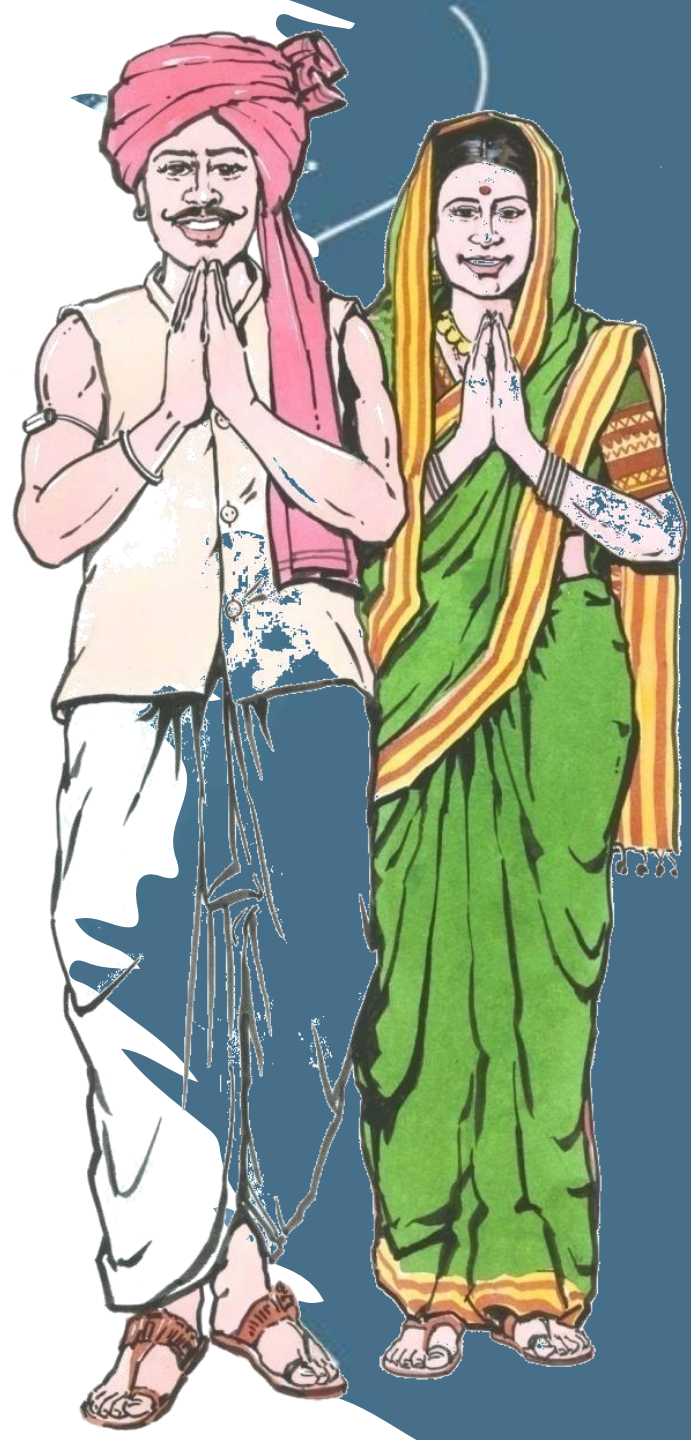
The number of beneficial insects like parasitoids-predators and pollinators are increases

Toxic chemical residues are not found on farm produce

The natural balance of life in the environment is maintained

Pollution of land, air and water remains under control





THANK YOU