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Natural farming: An eco-friendly approach for sustainable agriculture

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Agricultural practices have a major impact on the environment. climate change, deforestation, genetic engineering, irrigation problems, pollutants, soil degradation and waste are some of the concerns that are connected with agriculture. Excessive use of chemical fertilizers such as urea, nitrate, phosphorous along with many other pesticides have affected air, water, and soil quality. Natural farming in India is an ideal solution to reducing all these hazards. This sustainable way of farming is also known as 'Do-nothing farming' or 'No-tillage farming'. In natural farming, the farmer is considered only a facilitator and the real work is done by nature itself. There are no good or bad organisms; all are vital for a balanced ecosystem. Natural farming, a type of farming which involves elimination of chemical fertilizers and agro-chemicals (pesticides), sustaining agriculture with eco-friendly processes, and restoring soil fertility and organic matter. 'Natural farming' means farming with Nature and without chemicals. Genetically engineered crops are herbicide-tolerant and their excessive use has created herbicide-resistant 'super weeds'. Non-target plants, birds, fish and other wildlife have also been killed because of pesticide application. Soil degradation has affected the microbial community of the soil, altering the nutrient cycle, pest control and chemical transformation properties of soil. Natural farming have been widely practiced in Indian agriculture from ancient time. In India, natural farming is often referred to as 'Rishi Kheti', which is based on ancient Vedic principles of farming like the use of animal waste and herbal juices for controlling pests and promoting plant growth. Natural farming is a traditional farming method that is considered to be agro-ecology based diversified farming system which integrates crops, trees and livestock with functional biodiversity. Natural farming is promoted as Bharatiya Prakritik Krishi Paddhati (BPKP) under centrally sponsored scheme- Paramparagat Krishi Vikas Yojana

(PKVY). Bhartiya Prakratik Krishi Paddhati (BPKP) is aimed at promoting traditional indigenous practices which excludes all synthetic chemical inputs and is largely based on on-farm biomass recycling with major stress on biomass mulching, use of on-farm cow dung-urine formulations; time to time working for soil aeration.

Keywords: Natural farming, Sustainable Agriculture, Climate change, Cost-benefit analysis,

Green revolution leads to...



Concept of natural farming:

- Natural farming an approach towards sustainability in agriculture.
- Farming without external input, which involves elimination of chemical fertilizers and agro-chemicals (pesticides).
- Producing quality, nutritious, healthy and poison- free food.
- Farming up to 30 acres with one indigenous cow.
- Package of practices for multi cropping towards higher return.
- Reducing external labour requirement.
- Farming with resource conservation towards minimum electricity and water consumption.
- Farming in tune with nature, eco-friendly and without chemicals.
- Saving the farmers from suiciding themselves and up- lifting their economy.

Vision of natural farming:

- This model eliminates the cost of chemical fertilizers, agro-chemicals (pesticides) and seeds.

- He believes in a method of cultivation which make use of already existing nutrients in soil such as phosphorus, potassium, zinc and calcium available in absorbable form to the plants.
- In this farming nothing has to be purchased from the market. All things required for the growth of the plants are available in root zone.
- Almost 98 to 98.50 % nutrients are taken from air, water and solar energy. Remaining 1.5 % nutrients taken from the soil are also available free of cost as it is taken from the prosperous soil which enriched with these nutrients.

Principles of natural farming:



Preparation of Jeevamrut: In a plastic drum of 250 litres capacity. Add 10 kg indigenous cow dung. 10 litres of indigenous cow urine, 2 kg of jaggary, 2 kg of pulse flour (besan, chickpea flour) and 1 kg of live forest soil under tree cover in 200 litres of water mixed thoroughly. Ferment for 5 to 7 days. Stir the solution regularly for 5-10 minutes for twice a day (Morning and evening) with wooden stick. Jeevamrut is ready for application at 9th day and it can be applied up to 12th day from preparation in one acre with irrigation water. Jeevamrut is either sprayed/ sprinkled on the crop field or added to the irrigation tank in regular interval of 15 days until the soil is enriched

Jeevamrut is to be provided once in a fortnight or at least once in a month. Promote biological activity thereby breaks the nutrients available in the soil by increasing soil microbes. When we apply Jeevamrut to the soil, we add nearly 500-crore micro-organisms to the soil. These micro-organisms convert the non-available form of nutrients - nitrogen, phosphate, potash, iron, sulphur, calcium, etc - into available forms. Once you apply Jivamrut to the soil, the earthworms start their work and they can bring the nutrients from 15 feet deeper in the soil to the upper surface and make them available to the roots. Soil is saturated with all the nutrients, but these are in the non-available form to the roots of the plants. Beneficial micro-organisms in Jeevamrut

convert the nutrients in non-available form into dissolved form, when it is inoculated to the soil.



Major nutrient composition of Jeevamrut:

Sample	Total nitrogen (%)	Total phosphorus (%)	Total potassium (%)	Total calcium (%)	Total magnesium (%)	Total sulphur (%)
Cow dung	1.064	0.55	0.13	0.03	0.067	0.19
Cow urine	0.084	0.125	0.72	0.04	0.045	0.015
Pulse flour	0.96	0.04	0.19	0.092	0.067	0.082
Jaggery	0.14	0.24	0.18	0.032	0.048	0.073
Compost	0.092	0.195	0.15	0.046	0.003	0.14
Jeevamrut	0.168	0.365	0.85	0.02	0.048	0.045

Source: Pathak and Ram (2013)

Micro nutrient composition of Jeevamrut:

Sample	Total iron (mg kg ⁻¹)	Total manganese (mg kg ⁻¹)	Total zinc (mg kg ⁻¹)	Total copper (mg kg ⁻¹)	Total born (mg kg ⁻¹)
Cow dung	786.90	26.90	37.10	48.00	171.00
Cow urine	61.30	1.50	12.30	20.00	163.00
Pulse flour	20.14	19.30	57.20	12.40	163.00
Jaggery	61.60	2.20	21.40	11.00	147.00
Compost	1452.00	572.10	1102.10	56.50	297.00
Jeevamrut	1334.00	77.00	255.00	39.00	155.00

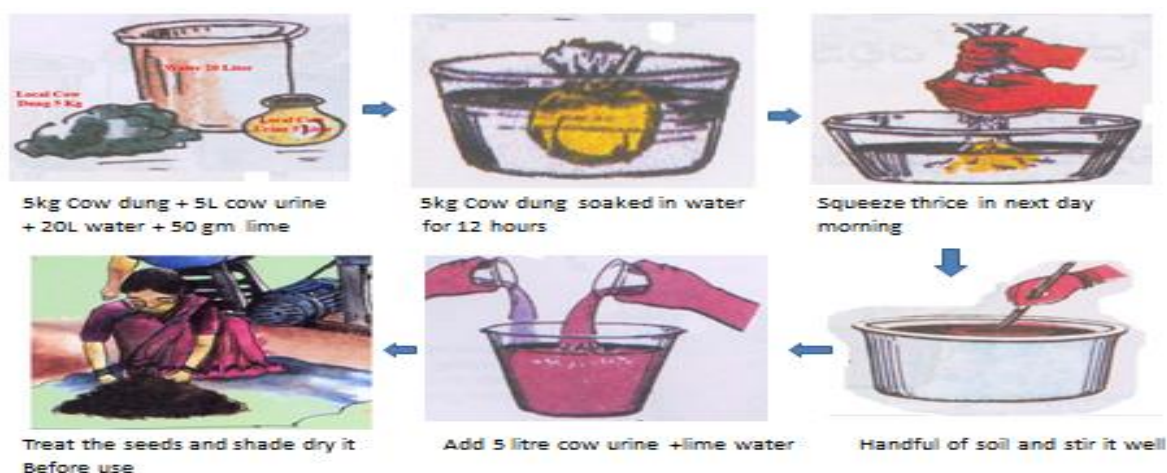
Source: Pathak and Ram (2013)

Preparation of Ghanjeevamrut: 100 kg indigenous cow dung (air dried for 4-5 days), 1 kg jiggery, 1 kg of pulse flour (besan, chickpea flour), 3 liters of indigenous cow urine, and 250g of live forest soil under tree cover, mix all these things.

Spread this manure in the shade for 48-50 hours and cover it with jute sack. After adding all the materials, this can be prepared like cake and stored. After 10 days of its preparation, this can be used @250kg/ha. This compost can be used for 6 months.

Preparation of Beejamrut: Take 5 kg of indigenous cow dung (preferably fresh or not more than 3 days old) in a cloth and bound it by tape and hang this in the 20 liters of water for 12 hours. Take 50 gm lime in 1 liter water and let it stable for 12 hours. Now stir and squeeze this sealed cloth of cow dung in water 3 times to accumulate all extract material of cow dung in that water. Add of live forest soil under tree cover in the solution and stir it well. Add 5 liters of indigenous cow urine in the solution and add lime water and stir it well. Beejamrut is used for treating seeds and also effective in young roots protection. The fungus, soil-borne, and seed-borne diseases commonly affect plant growth. Beejamrut has similar ingredients as organic fertilizer jeevamrut- Take 10 liters of water, 3 kg of indigenous cow dung, 3 liters of local cow urine, and 30-gram lime and handful soil of the farm.

Farmers have been treating their seeds by local cow urine, cow dung and little soil from the bund of the farm or land of the farm since time immemorial (mentioned even in our *vedas as well as other ancient literature*). This was the traditional method and also a totally scientific method. It acts as a catalytic agent to promote biological activity thereby breaks the nutrients available in the soil by increasing soil microbes. Hence under Natural farming the seeds are treated with the formulation made from cow urine, cow dung and other locally available material which is equally effective in checking seed borne diseases and increase germination percent of seeds.



Major nutrient composition of Beejamrut

Sample	Total nitrogen (%)	Total phosphorus (%)	Total potassium (%)	Total calcium (%)	Total magnesium (%)	Total sulphur (%)
Cow dung	1.064	0.55	0.13	0.03	0.067	0.19
Cow urine	0.084	0.125	0.72	0.04	0.045	0.015
Lime-water	0.14	0.23	0.33	0.04	0.064	0.030
Compost	0.09	0.195	0.15	0.046	0.003	0.14
Beejamrut	0.14	0.24	0.8	0.02	0.048	0.011

Source: Patil and choudhary (2013)

Micro nutrient composition of Beejamrut

Sample	Total iron (mg kg ⁻¹)	Total manganese (mg kg ⁻¹)	Total zinc (mg kg ⁻¹)	Total copper (mg kg ⁻¹)	Total born (mg kg ⁻¹)
Cow dung	786.90	26.90	37.10	48.00	171.00
Cow urine	61.30	1.50	12.30	20.00	163.00
Lime-water	884.20	25.40	22.20	3.30	144.00
Compost	1452.00	572.10	1102.10	56.50	297.00
Beejamrut	460.00	3.00	127.00	41.00	138.00

Source: Gore and Sreenivasa (2013)

Preparation of Sanjeevak : In a plastic drum of 500 litres capacity. Add 100 kg indigenous cow dung, 100 litres of indigenous cow urine, 500 gm of jaggary in 300 litres of water mixed thoroughly. Fermented for 10 days. Dilute with 20 times water. Application of Sanjeevak is either sprinkled/ sprayed as soil in one acre or along with irrigation water.

Preparation of Amrutpani : Take 10 kg indigenous cow dung and 500 gm honey and mix thoroughly to form a creamy paste. Add 250 gm of cow desi ghee and mixed thoroughly at high speed. Dilute with 200 litres water and sprinkled/ sprayed as soil in one acre or along with irrigation water. Apply second dose after 30 days in between the row of plants or through irrigation water.

Preparation of Panchgavya : Take 5 kg of fresh indigenous cow dung, 3 litres indigenous cow urine, 2 litres cow milk, 2 litres curd, 1 kg cow butter oil mixed thoroughly. Ferment for 7 days. Stir the solution regularly for 5-10 minutes for twice a day (Morning and evening) with wooden stick. Dilute 3 litres of Panchgavya in 100 litres water and sprinkled/ sprayed as soil in one acre or along with irrigation water. 20 litres Panchgavya is needed per acre for soil application along with irrigation water.

Preparation of Enriched Panchgavya (Dashgavya): Take ingredients 5 kg indigenous cow dung, 3 litres indigenous cow urine, 2 litres cow milk, 2 kg curd, 1 kg cow desi ghee, 3 litres sugarcane juice, 3 litres tender coconut water, 12 fruits paste of banana and 2 litres toddy or grape juice. Mix indigenous cow dung and ghee in a container and ferment for 3 days with intermittent stirring. Add rest of the ingredients on the 4th day and ferment for 15 days. Stir the solution regularly for 5-10 minutes for twice a day (Morning and evening) with wooden stick. The formulation will be ready in 18 days. Sugarcane juice can be replaced with 500 jaggery in 3 litres water. In case of non-availability of toddy or grape juice 100gm yeast powder mixed with 100 gm jaggery and 2 litres of warm water can also be used. For foliar spray 3-4 litres Panchgavya is diluted with 100 litres water. For soil application 50 litres Panchgavya is sufficient for one ha. It can also be used for seed treatment.

Preparation of Botanical Pesticides : Many plants are known to have pesticidal properties and the extract of such plants or its refined forms can be used in the management of pests. Among various plants identified for the purpose, neem has been found to be most effective.

Preparation of Neem Extract : Take 3 to 7 kg of Neem seed and pound it gently. The powder obtained will be taken in muslin cloth and tied to get a pouch. Which is allowed to soak in 50 to 80 litres of water for overnight. The pouch is thoroughly squeezed for four to five times to get the extract into water. 50 to 100 gm of detergent is added to the extract to get milky white NSE. Practices should be adopted to ensure the access and efficacy of the extract.

Neem extracts are very effective against grasshoppers, leaf hoppers, leaf minor, plant hoppers, aphids, cotton jassids, and moth caterpillars. Application of neem extracts for the management of sucking and borer insect pests of pulse, oilseed and vegetables crop.

Neem oil @ 2.0% with 1% detergent found most effective against pod borers complex in chickpea, moong, cowpea and okra, shoot and fruit borer of brinjal.

Neem seed kernel extract (NSKE) @ 5% with 1% detergent found most effective against stem borer in rice and management of diamond back moth.

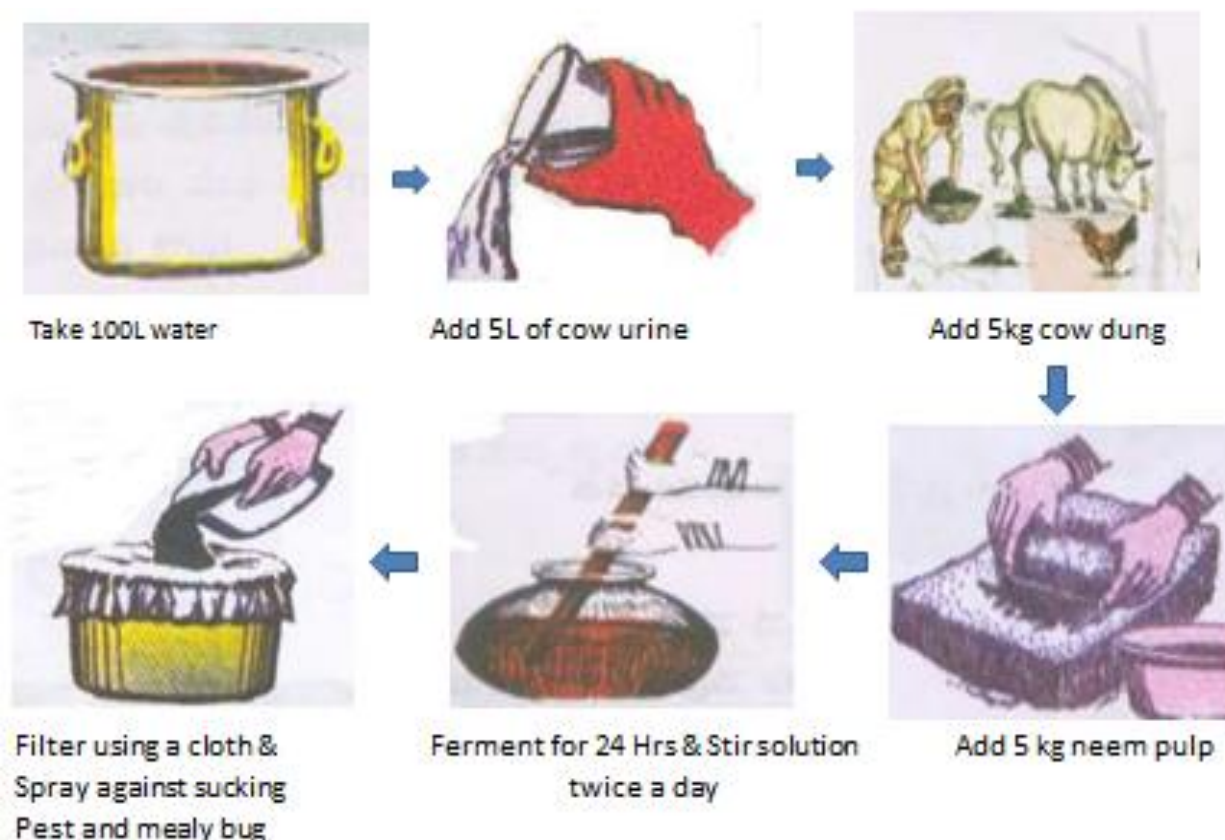
Karanj oil @ 2.0% with 1% detergent found most effective against pod borer complex in chickpea, moong, cowpea and okra shoot and fruit borer.

Neem are also very effective against beetle larvae, butterfly, aphids and white flies, mealy bug, scale insects, adult bugs, diamond back moth, fruit maggots, spider mites, moth and caterpillars such as Mexican bean beetle and Colorado potato beetle. Neem has been found to be effective in the management of approximately 200 insects, pests and nematodes. Oil based formulation at the concentrations of 300 ppm. Neem based EC formulation at the concentrations of 10000 ppm (1%) for the control of shoot and fruit borer of brinjal. It is sufficient 1-1.5 liter for spraying in one hectare in the vegetable crops.

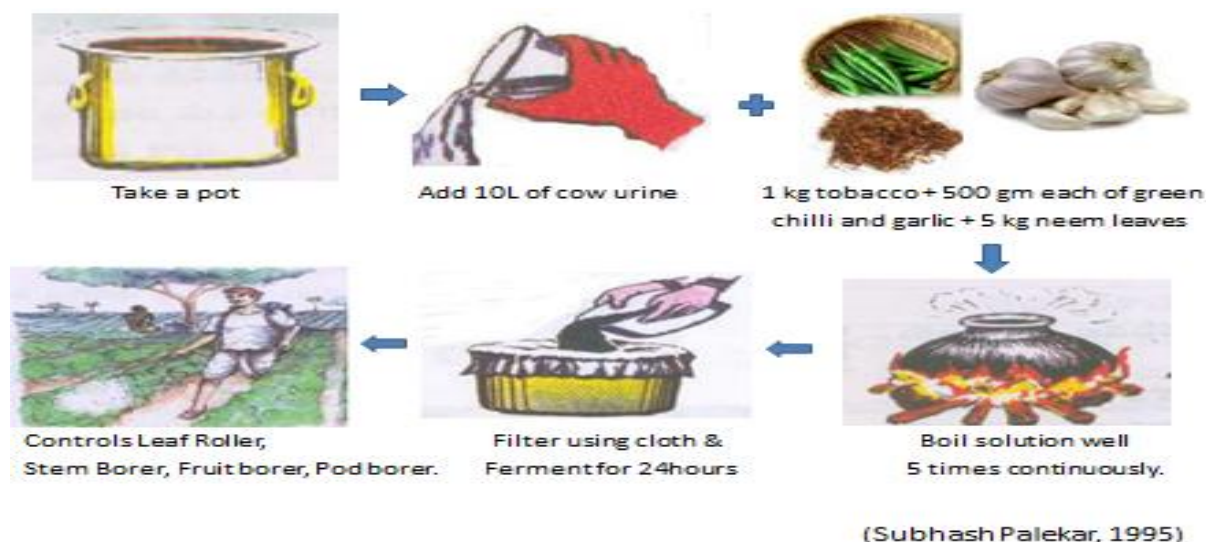
Preparation of Neemastra : Take 5 kg of fresh neem leaves or 5 kg of neem seed kernels (3-8 month old). Crush the materials to make fine/ small pieces. Mix the

crushed leaves/ kernels in 100 litres of water in a plastic drum. Mix 5 litres indigenous cow urine , 1kg indigenous cow dung, 500 gm turmeric powder, 500 gm ginger paste and 10 gm asafoetida (hing) powder. Mix the content thoroughly with the help of a wooden stick for 2-3 minutes. Cover the mouth of drum with a fine cotton cloth and incubate for 48 hours, stir the content thrice a day for 2-3 minutes. After 48 hours, filter the content with a fine mesh or cloth and spray on one acre crop.

Neemashtra are easy to prepare in the farm with in 2 to 4 days. Fresh neemashtra is sprayed on crops to control insects pests like aphid, jassid, mealybug, thrips, whiteflies, small caterpillars and other sucking pests. For spraying, one hectare of crop, 250 litres of solution is required.



Preparation of Agniashtra : Take 500 gm of green chilli, 250 gm garlic, 250 gm tobacco powder and 5 kg of fresh neem leaves . Crush all the materials to make a fine paste. Add crushed materials in 20 litres of indigenous cow urine and mix thoroughly. Boil the content with intermittent stirring with wooden stick for about 20 minutes. Cool content for about 48 hours. Filter the content with fine cotton cloth. Take 5-6 liters of agniashtra (filtrate) is sufficient for spraying, one hectare of crop after dilution in 250 litres of water. Agniashtra is used to manage stem borer, fruit borers and other different types of caterpillars of the crop.



Preparation of Brahmasutra : Take 3 kg of fresh neem leaves and 2 kg of karanj (*Pongamia pinnata*) leaves, 2 kg of custard apple leaves and 2 kg of dhatura leaves crush them to fine pieces. Mix all the above crushed leaves in 10 litres of indigenous cow urine. Boil the mixture for about 20-25 minutes. Cool the mixture for 48 hours. Filter the content with fine cotton cloth. Take 5-6 litres of brahmasutra is sufficient for spraying in one hectare of crop after dilution in 250 liters of water. Brahmasutra is used to manage large size borers and caterpillars of the crops.

Preparation of Dashparni Extract : Take 5 kg of neem leaves and 2 kg leaves from each of any ten plants species mentioned in table. Take 10 liters of indigenous cow urine, 10 kg indigenous cow dung, 500 gm turmeric powder, 500 gm garlic paste, 500 gm ginger paste, 1 kg tobacco leaf powder, 1 kg chilli paste. Crush the leaves in to fine pieces. Mixed thoroughly all above ingredients in 200 litres water drum in shade. Stir the mixture (solution) regularly thrice a day with the help of a wooden stick and ferment the content for 30-40 days. Filter the content with fine cotton cloth. Store the filtrate in containers and it can be used for 6 months. Dashparni extract is very useful to manage all kind of insects-pests of crops and orchards. Take 5-6 liters of filtrate is sufficient for spraying in one hectare of crop after dilution in 250 liters of water.

Leaves of following plants species are required for preparation of dashparni extract :

S.No.	Name of plant species
1.	Neem (<i>Azadirachta indica</i>)
2.	Mango (<i>Mangifera indica</i>)
3.	Custard apple (<i>Annona reticulate</i>)
4.	Karanj (<i>Pongamia pinnata</i>)
5.	Castor (<i>Ricinus communis</i>)
6.	Dhatura (<i>Datura spp</i>)

7.	Beal (<i>Aegle marmelos</i>)
8.	Aak/Akora (<i>Calotropis spp</i>)
9.	Ber (<i>Zyzyphus mauritia</i>)
10.	Papaya (<i>Carica papaya</i>)
11.	Guava (<i>Psidium guojava</i>)
12.	Gurhal (<i>Hibiscus rosa-sinensis</i>)
13.	Turmeric (<i>Curcuma longa</i>)
14.	Karela (Bitter gourd) (<i>Momordica charantia</i>)
15.	Marigold (<i>Tagetes spp</i>)
16.	Giloya/Amrita (<i>Tinospora cordifolia</i>)

Preparation of Chilli-Garlic Extract : Take 500 gram each of chilli and garlic bulb and make their paste. Take 5 kg of neem leaves and 1kg of beshram (*Ipomoea carnea*) leaves crush them to fine pieces. Mix all above crushed leaves in 10 litres of indigenous cow urine. Boil the mixture till the volume becomes half. Cool the mixture for 24 hours. Filter the content with fine cotton cloth. Fill the filtrate in bottles.

Chilli-garlic extract to manage different kind of caterpillars i.e. leaf rollers, stem, pod and fruit borers. Take 5-6 liters of filtrate is sufficient for spraying in one hectare of crop after dilution in 250 liters of water. Chilli-garlic extract @ 9 Kg/ha (8:1) most effective against gall midge, GLH and thrips of rice and white fly, thrips, semilooper and tobacco caterpillar of soybean, also shoot and fruit borer of brinjal along with pod borer of tomato.

Preparation of Mixed leaf Extract : Take 3 kg of neem leaves, 2 kg of custard apple leaves, 2 kg pomegranate leaves, 2 kg papaya leaves and 2 kg guava leaves. Mix all above crushed leaves in 10 litres of indigenous cow urine. Boil the mixture till the volume becomes half. Cool the mixture for 24 hours. Filter the content with fine cotton cloth. Fill the filtrate in bottles.

Mixed leaf extract is useful to manage sucking pests and different kind of pod/fruit borers. Take 5-6 liters of filtrate is sufficient for spraying in one hectare of crop after dilution in 250 liters of water.

PREPARATION OF OTHER EXTRACT

Neem-Cow urine extract: Crush 5.0 kg neem leaves in water, add 5.0 lit cow urine and 2.0 kg cow dung, ferment for 24 hrs with intermittent stirring, filter squeeze the extract and dilute to 100 lit, use as foliar spray over one acre. Useful against sucking pests and mealy bugs.

Cow urine : Cow urine diluted with water in ratio of 1: 20 and used as foliar spray is not only effective in the management of pathogens and insects, but also acts as effective growth promoter for the crop.

Fermented curd water : In some parts of central India fermented curd water (butter milk or *Chaach*) is also being used for the management of white fly, jassids, aphids etc.

Preparation of broad spectrum formulation-1: In a copper container mix 3 kg fresh crushed neem leaves and 1 kg neem seed kernel powder with 10 litre of cow urine. Seal the container and allow the suspension to ferment for 10 days. After 10 days boil the suspension, till the volume is reduced to half. Grind 500 gm green chillies in 1 litre of water and keep overnight. In another container crush 250 gm of garlic in water and keep overnight. Next day mix the boiled extract, chilli extract and garlic extract. Mix thoroughly and filter. This is a broad spectrum pesticide and can be used on all crops against wide variety of insects. Use 250 ml of this concentrate in 15 lit of water for spray.

Preparation of broad spectrum formulation-2: Suspend 5 kg neem seed kernel powder, 1 kg Karanj seed powder, 5 kg chopped leaves of besharam (*Ipomea* sp.) and 5 kg chopped neem leaves in a 20 litres drum. Add 10-12 litres of cow urine and fill the drum with water to make 150 litres. Seal the drum and allow it to ferment for 8-10 days. After 8 days mix the contents and distil in a distiller. Distillate will act as a good pesticide and growth promoter. Distillate obtained from 150 lit liquid will be sufficient for one acre. Dilute in appropriate proportion and use as foliar spray. Distillate can be kept for few months without any loss in characteristics.