Mahila Kisan Sashaktikaran Pariyojna

Technical Protocol Document

Sustainable Agriculture Practices

2014

Shroffs Foundation Trust, Vadodara, Gujarat

Index

1. Introduction

Sustainable Agriculture refers to a range of strategies for addressing many problems that effect agriculture. Such problems include loss of soil productivity from excessive soil erosion and associated plant nutrient losses, surface and ground water pollution from pesticides, fertilizers and sediments, impending shortages of non- renewable resources, and low farm income from depressed commodity prices and high production costs. Furthermore, “Sustainable” implies a time dimension and the capacity of a farming system to endure indefinitely. Sustainable agriculture is viewed as an answer to damages caused by chemical intensive and input driven green revolution agenda which besides causing environmental hazards has led to farmer’s distress, indebtedness and deaths.

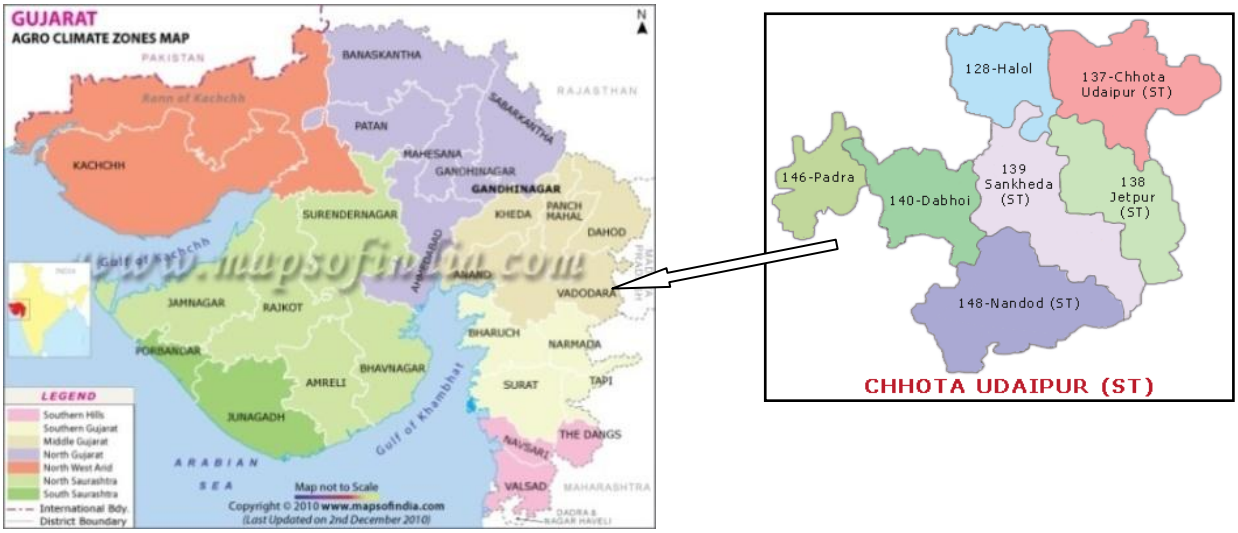
The proposed project shall focus on the following generic practices:

"Agriculture is the backbone of human existence. For any civilization to prosper, agriculture has to be healthy and sustainable. We need to get our focus back on agriculture which is the primary industry. Our earth has plenty for everyone. We only have to manage its resources well. “Some of the standard practices to be promoted are mentioned below:

- Land Development
- Soil and Moisture Conservation
- Water Harvesting & Water Management
- Use of organic manure and bio-fertilizers
- Use of bio-pesticides
- Conservation and use of indigenous seed varieties
- Use of eco friendly appropriate technologies

Here are various practices and processes proposed the farmers will be motivated to adopt suitable practices in their crops

Agro Climate Zone:



State : Gujarat Agro Climatic Region :

Gujarat Plains & Hills Region

NARP (Agro Climatic) Zones of the Region			
NARP Zone	**Zonal Research Station**	**Suitable Crops**	**Districts**
GJ-3 Middle Gujarat Zone	Anand	Rice, Wheat, Gram, Perlmillets,Sorghum, Maize, Kodra, Ragi, Pigeonpea, groundnut, Sesamum, Castor, Cotton, Sugarcane, Chillies, Chickpea,Tobacco, Potato, Rapeseed & Mustard.	Panchmahals, Baroda and Anand, Balasinor, Borsad, Kapadvanj, Kheda, Matar, Ahmedabad, Nadiad, Petlad and Thasara and taluks of Kheda.

District Name: VADODARA Block Name: CHHOTA UDEPUR

Agro Climatic Features of the Sub Regions				
Sub Region	**Rainfall (in mm)**	**Climate**	**Soil**	**Crops**
Middle Gujarat	904	Semi-arid	Medium black	Rice, Maize, Bajra, cotton

Sustainable Agriculture Practices

WHY:

1. The cost of agricultural inputs reduces up to 60% and keeps in the product qualitative, nutritious, healthy & tasty.
2. The demand of organically grown agricultural products like fruits, vegetables, spices. Pulses, cotton, medical plants etc, the international market is more, which fetches 25-30% extra money.
3. Preservation of available natural resources for future generation can be done though optical uses.
4. This is an easy way of preparing plant inputs within less period of time.
5. A well convergence of tradition and modernity.
6. Easy way of earning from waste. Optimum uses of natural waste products.
7. Employment can be ensured in the village itself by preparing vermin culture, vermin compost, bio pesticides etc. thus it creates more wage employment in the village level.
8. It creates an opportunity with the co-operation of nature and neighbors.
9. This keep the water, land & life free from poisonous pesticides.

HOW:

1. Cultivate with the help of local available natural resources like plants, water, animals and neighbors without poisonous chemical.
2. Before taking any new cropping practices, analyze properly for suitable practices.
3. Cultivate crops as per the soil and agro climatic condition.
4. Prepare the land for cultivation purpose and cover the soil with living materials.
5. Apply green manure and animal compost in crop cycle.
6. More water is harmful, so preserve rain water as per requirement.
7. Convert the agricultural waste to compost by applying bacterial culture and natural minerals and use it for cultivation.
8. To make easy availability of nutrients in the soil, apply Rhizibium culture, azotobacter, Phosbacterium, Azoserillum etc and harvest organic crops.
9. Apply leaves, fruits, seeds and oil of trees to control disease and pest.
10. Preserve beneficial predators and parasite insects in the cropping area and collect from the laboratory to control insect and pest if it is required.
11. Increase the number of beneficial insects and reduce the number of harmful insects by putting different insect traps.
12. Apply bio pesticides to the crop. But wait with patience for its usefulness.

The key characteristics of sustainable/natural farming include:

- Protecting the long term fertility of soil by maintaining soil organic matter levels and encouraging soil biological activity (via. crop diversity, crop rotation, residue management, organic manures and biological inputs), and careful mechanical intervention
- Weed, disease and pest control relying on cultural (crop rotations, natural predators, crop diversity), mechanical, biological and limited/minimal non-synthetic chemical interventions

2. Crops planned under MKSP

Following season specific crops are planned to be cultivated under sustainable/natural farming initiatives by MKSP project beneficiaries:

	Kharif	Rabi	Summer
Agriculture Crops	Maize, Paddy, Black gram	Wheat Gram	Green Gram
Horticulture	Brinjal, tomato, chilly, okra, bottle gourd, bitter gourd, cucumber, spinach, coriander, cow pea, cluster beans, French beans		

3. Sustainable/Natural farming practices planned

Following major sustainable/natural farming practices are planned under MKSP:

1) Inter cropping for better resource utilization
2) Soil and Plant Nutrient Management using natural ingredients and living organisms (Manure, compost, Jeevamruta, Amritpani, Liquid biofertilizers, Panchgavya)
3) Plant protection measures following non pesticide management practices
   - Cultural Practices:Summer ploughing, crop rotation, trap crop,
   - Mechanical Control: Hand picking, yellow and white plates, perches, bonfire, etc
   - Chemical control (Traditional household remedies which have no toxic effect):
     - Seed treatment with *cow urine and Beejamrutha*
     - Soil and foliar application of Cow dung Urine solution; neem seed, leaf and neem cake; Agnastram; Bramhastram, etc.
   - Biological control: Use of beneficial insects and bio fertilizers like Trichodermaviridae and Pseudomonas fluorescence

4. Intercropping

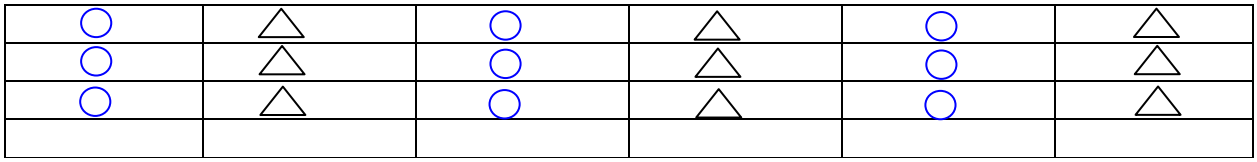
Intercropping is the practice of growing two or more crops in proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop. The intercropping strategies are: planting a deep-rooted crop with a shallow-rooted crop, or planting a tall crop with a shorter crop that requires partial shade. Intercropping also uses the practice of sowing a fast growing crop with a slow growing crop, so that the fast growing crop is harvested before the slow growing crop starts to mature.

In inter cropping system, companion crops are grown generally to avoid diseases & pest attacking the main crop. Inter cropping also suppresses weeds or provides nutrients. This helps in reducing the man power and extra costs incurred on pesticides or insecticides.

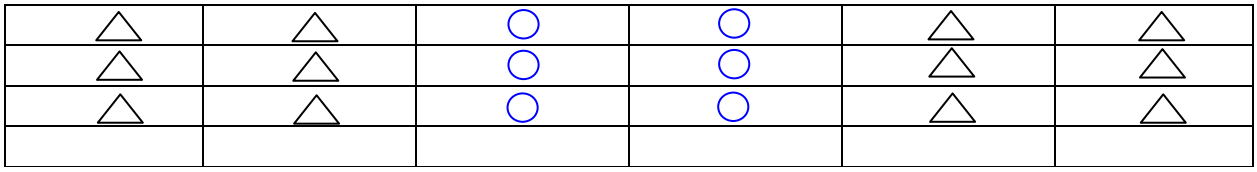
4.1 Types of intercropping planned:

Types of intercropping planned under MKSP project are- row intercropping and strip inter cropping.

Row intercropping (It involves the component crops arranged in alternate rows):



Strip inters cropping, where multiple rows, or a strip, of one crop are alternated with multiple rows of another crop:



4.2 Proposed crop combination under inter cropping system:

Crop-1:	Crop-2:
Kharif Maize	Gram
Rabi- Maize	Groundnut
Paddy	Gram
Kharif Black gram	Wheat

4.3 Maintaining plant density in intercropping in agriculture crops:

Individual plant should not be planted at same density as usual in sole crops. The best way to find out what should be the plant density are, is to experiment with different seeding rates. In an intercrop system with two crops on same field, experiment with three small plots with each crop at different percentage of normally recommended seed/plant rate: 1/3+2/3, ½+1/2, 2/3+1/3. Based on the result of the experiment, make adjustment for future planting

4.4 Requirements, for successful intercropping:

For successful intercropping, there are certain important requirements, as follows:

- Competition for light should be minimum among the component crops.
- Complementary should exist between the component crops.
- The differences in maturity of component crops should be at least 30 days.

5. Soil and Plant Nutrient Management

Topics covered:

- *Bulky organic manures*
- *Jeevamruta*
- *Amritpani*
- *Liquid biofertilizers*
- *Panchgavya*

5.1 Bulk Organic Manure

Manures are plant and animal wastes that are used as sources of plant nutrients. Major sources of manures will be:

a. Cattle shed wastes-dung, urine and slurry from biogas plants
b. Fruit and vegetable processing wastes and crop wastes
c. Green leaf manure

Farmyard manure (FYM), compost and green-manure are planned to be promoted as bulky organic manures under MKSP.

5.1.1 Farmyard manure

Farmyard manure refers to the decomposed mixture of dung and urine of farm animals along with litter and left over material from roughages or fodder fed to the cattle.

Method of preparation:

Prepare a plot on flat land size of 6 m to 7.5 m length, 1.5 m to 2.0 m width and .25 m deep. Collect animal food waste, dung, urine and biomass of agriculture crops and trees, prepare a Urine soaked refuse along with dung and apply on the collected material. Apply bio culture (Madhyam) at the rate of one kg per ton of waste material. Prepare solution mixing one kg bio culture in 50 liters of water and spray the solution on the material, this will help in fast composting process, maintain moisture rate up to 40-50% In a period of 65 to 75 days valuable compost fertilizer will be ready to use.

Direction of Use:

Partially rotten farmyard manure has to be applied three to four weeks before sowing while well rotten manure can be applied immediately before sowing. Generally 10 to 20 ton/ha is applied, but more than 20 ton/ha is applied to vegetables. Leaving manure in small heaps scattered in the field for a very long period leads to loss of nutrients. These losses can be

reduced by spreading the manure and incorporating by ploughing immediately after application.

5.1.2 Compost

Composting is the natural process of 'rotting' or decomposition of organic matter by microorganisms under controlled conditions. Raw organic materials such as crop residues, animal wastes, and food garbage are to be used for composting. Compost is a rich source of organic matter. In addition to being a source of plant nutrient, it improves the physico-chemical and biological properties of the soil. As a result of these improvements, the soil:

- Becomes more resistant to stresses such as drought, diseases and toxicity;
- Helps the crop in improved uptake of plant nutrients; and
- Possesses an active nutrient cycling capacity because of vigorous microbial activity.

5.1.2.1 Farm compost

The compost made from farm waste like trash, straw and weeds called as farm compost.

Method of preparation:

Farm compost is made by placing farm wastes in trenches of suitable size, say, 4.5 m to 5.0 m long, 1.5m to 2.0 m wide and 1.0 m to 2.0 m deep. Farm waste is placed in the trenches layer by layer. Each layer is well moistened by sprinkling cow dung slurry or water. For one ton crop residues40 kg fresh cow dung is required. This 40 kg fresh cow dung is mixed with100litres of water and it should be thoroughly poured over the waste material. Cow dung slurry acts as nitrogen source as well as source of microbial inoculum. Trenches are filled up to a height of 0.5 m above the ground. Sufficient quantity of oxygen should be available inside the compost heap. Normally to allow the fresh air to get inside, the compost heap should be turned upside down, once in fifteen days. Throughout the composting period 60% moisture should be maintained, through weekly watering, for microbial action. On any situation, compost material should not be allowed to dry. If the material becomes dry, all the microorganisms present in the crop residues will die and the compost process gets affected. The compost pit should be constructed in a shade place to avoid nitrogen loss.

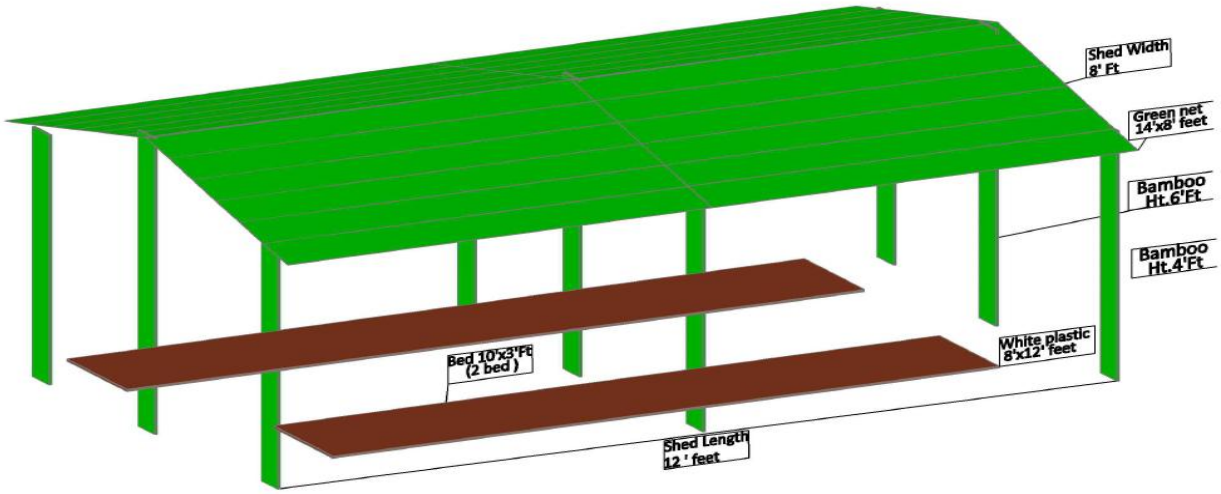
Direction of Use:

The compost gets ready for application within five to six months. For one hectare of land 5 tons of enriched bio compost is recommended. It can be used as basal application in the field before taking up planting work. Spread the manure and incorporate by ploughing immediately after application.

5.1.2.2 Vermicompost

Vermicompost technology has promising potential to meet the organic manure requirement in both irrigated and rain fed areas. Cow dung, water, cow urine, agricultural waste materials are ingredients of Vermicompost.

Method of preparation:



Details of material:

Sr.No	Detail	Size	Cost Rs.
1	Bed Size	10feet x 3 feet (2 bed)	
2	Green net size	14 feet x 8 feet	500
3	Bamboo	5 feet x 12 7 feet x 9	500
5	Vermin cost	1 kg	250
6	White plastic	8 feet x 12 feet	100
7	Plastic rope		50
	TOTAL COST		**1400**

Prepare two pits for beds the bed to be filled with cow urine socked cow dung and agro/kitchen wastes in the ratio of 1:1 to 1:3 to be mixed and filled the pit up to 3 ft height. The feed mix is allowed to predecompose for about 3-4 weeks. The bed is then inoculated with earthworms (1-1.5 kg) when the raw materials turn to black. The bedding should be in a shade place and maintain the moisture of the tank feed (40% moisture should be maintained by daily water sprinkling). One kilogram of worms numbering about 600 to 1000 can convert 25 to 45 kg. of wet waste per week. The total decomposition may take about 75 – 100 days depending on various factors. About 600 kg of compost can be obtained from each cycle. A few days before the harvest watering of the tank are discontinued to allow migration of worms towards the bottom of the bed. The compost is then transferred outside without disturbing the bed. The compost is to be sieved through a 3 mm mesh sun-dried before use. Vermicompost can be

stored for one year without loss of its quality, if the moisture is maintained at 40% level. While sieving the unhatched cocoons can also be retrieved. The excess worms can be retrieved and put in new tanks or sold

One quintal vermicompost to be mixed with 1 kg Azospirillum or Azotobacter, 1 kg. phosphate solubilizing microorganisms (PSM) and 1 kg Trichoderma. Every week sprinkle the material with water and turn the entire material upside down to maintain moisture and aeration. Continue this process upto 3 weeks to complete the process.

Direction of Use:

Application of 2-5 quintals enriched vermicompost per acre as soil application before sowing directly to the soilis found to be beneficial in supplementing the necessary nutrients required by the crop as well as in combating pests and diseases from seedling stage itself.

5.1.3 Green manuring

Addition of leaves, stem and other parts of the plant to the soil when they are still green to improve the fertility of the soil is called green leaf manure.

Ex-situ green leaf manuring method is planned to be followed i.e. getting the green leaves, stem and branchesfrom the trees grown outside like neem, mahua, wild indigo, calotropis, avise*(Sesbaniagrandiflora),* subabul,glyricidia, cassiasemia, jackfruit, pongamia, nigeretc and incorporatingthe same within the soil just 15 days before sowing ortransplantation of the crop in the field. Benefits of green leaf manure are:

- The green leaf manure rots and provides more nitrogen to the plants ultimately saving organic urea application.
- Addition of various types of green leaves to the soil controls pests and diseases.
- Two to three tons of green leaf manure can be added to one acre of land

5.2 Jeevamrutha

Jeevamrutha is a plant growth promoting substance containing beneficial micro organisms that provides all the necessary nutritional requirement for growth and yield of a crop. Microorganisms are well activated in the soil by the addition of Jeevamrutha.

Ingredients of Jeevamrutha (for 20 liters solution):

Drum, 17.5 litres water, 1 litre cow urine, ¼ kg jaggery, ¼ kg gram flour, 1 kg cow dung, small quantity of fertile soil from undisturbed area.

The microorganisms that supply nitrogen like Azotobacter, Acetobacter, Azospirillum and phosphorus solubilizing bacteria Pseudomonas and potash solubilizing bacteria like Bacillus

silicus are present in the dung that is used to prepare Jeevamrutha. Similarly urine has disease resistant organisms.

Method of preparation:

Add 17.5 litres water into a drum. To this, add 1 kg cow dung, ¼ kg jaggery, ¼ kg gram flour, little soil and 1 litre cow urine. Mix all the ingredients and stir properly. Cover the mouth of the drum with a cloth and keep it in shade. Stir the mixture thrice a day (morning afternoon & night) for 4 consecutive days. So prepared Jeevamruta should be used from 4th day onwards within 7 days of preparation.

Direction of use:

- 50-200 litres of Jeevamruthais required for one acre land; it can be applied along with Irrigation or through drenching.
- Jeevamrutha has to be applied once in 15 days Compulsorily during vegetative stage, flowering stage and grain filling stage (@ 250 ml/plant)

5.3 Amrut Pani

Amrut Pani is a foliar spray that provides nitrogen to the growing plants through the leaves. This sprays also acts as insect repellant.

Ingredients of Amrut Pani:

- 1 liter cow urine of indigenous breed
- 1 kg cow dung of indigenous breed
- 250 gms jiggery
- 10 liters water
- 1 Drum or plastic bucket.

Method of preparation:

Clean the drum well and fill it with required quantity of water. Mix indigenous cow dung with water to prepare cow dung solution. Add cow's urine and powdered jiggery. Mix thoroughly the entire ingredients in a drum and keep it closed for one day for curing. 12-13 liters of solution is obtained by this method.

Direction of use:

Dilute one litre of the solution in 10 litres of water and use as a foliar spray or 20-30 litres of Amritpani is applied through irrigation for one acre of land.

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5.4 Liquid Biofertilizers

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. Use of biofertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture.

Biofertilizers are such as Rhizobium, Azospirillum and Phosphobacteria provide nitrogen and phosphorous nutrients to crop plants through nitrogen fixation and phosphorous solubilization processes. These Biofertilizers will be effectively utilized for soil application.

5.5 Panchagavya

Panchagavya is the single organic input that acts as a growth-promoter and immunity booster. It consists of five products from the cow dung, urine, milk, curd and ghee. When suitably mixed and used, these have miraculous effects.

Ingredients:

- Cowdung slurry (from gober gas plant) 4 kgs
- Indigenous cow dung 1 kg
- Cow urine 3 ltrs.
- Indigenous cow milk 2 ltrs.
- Sour Curds 2 ltrs.
- Ghee from cow 1 kg.
- Sugar cane Juice 3 ltrs or Jaggery 1 kg.
- Tender Coconut water 3 ltrs.
- Over ripe banana 12
- Toddy (Neera if available) 2 ltrs

20 liters of panchagavya can be prepared from the above mentioned products.

Method of preparation:

All the above items can be added to a wide mouthed mud pot, concrete tank or plastic cans in the order specified above. The container should be kept open but in the shade. The content is to be stirred twice a day, both in the morning and evening. The panchagavya stock solution will be ready after the 7^{th} day. The products of local breeds of cow are said to have more potency than exotic breeds.

Alternative method:

In places were gobar gas slurry is not available, the following method can be used. Add 7 kgs. of fresh cow dung to 5 litres of cow urine and 5 litres of water and keep in a suitable container in the shade. The container should be kept open for aeration and to allow the gas produced during the fermentation process to escape. Mix thoroughly and stir the solution twice daily for 15 days. On the 16th day, add the rest of the ingredientsand continue stirring twice daily. On the 22nd day the panchagavya will be ready for use. If sugarcane juice is not available, add 500 grams of jaggery dissolved in 3litres of water. Likewise if toddy is not available, add 100 grams of yeast powder and 100 grams of jaggery to 10 litres of warm water. After 30 minutes, add this solution
to replace toddy in Panchagavya. When stirred twice daily, the Panchagavya solution can be kept for 6 months without any deterioration in its quality. Whenever the solution becomes thick due to evaporation of water over a long period, suitable quantity of water can be added to keep it in a liquid state.

Direction of Use:

Flow system: The solution of Panchagavya can be mixed with irrigation water at 50 litres per hectare either through drip irrigation or flow irrigation

Spray system: Generally panchagavya is recommended for all the crops as foliar spray. Three litres of Panchagavya to every 100 litres of water is ideal for all crops.

- *Frequency of application of Panchagavya:*

Pre flowering phase	→	Once in 15 days, two sprays depending upon duration of crops
Flowering and pod setting stage	→	Once in 10 days, two sprays
Fruit/Pod maturation stage	→	Once during pod maturation

- *Panchagavya for seed/seedling treatment:*

3% solution of Panchagavya can be used to soak the seeds or dip the seedlings before planting. Soaking for 20 minutes is sufficient.

- *Panchagavya for seed storage :*

3% of Panchagavya solution can be used to dip the seeds before drying and storing them.

6. Plant protection measures (Non pesticide management practices)

6.1 Cultural Practices/Control

It includes crop production practices that make crop environment less susceptible to pests, such as:

- Deep summer plowing to destroy the pupae of cotton bollworms, army worms and other pests whose pupae are in the soil.
- Planting "trap crops" (e.g., sorghum, marigold, castor, and green gum) around the edge of the field/ in between the rows of main crop to attract pest insects away from the crop. The trap crops are checked daily. Parts of the plants with insect eggs are removed and burned.
- Methods like destruction of the hiding places of pests, removal of weeds, destruction of old crop debris, crop rotation, correct row and plant spacing, avoid water logging, timing out the excess plant population are also include in this.

6.1.1 Crop Rotation:

There are five fundamental reasons why crop rotation should be followed: 1-Not all plants have the same nutritive needs, 2- Soil structure improves, 3- Add to soil nutrients, 4-Pest buildup is avoided, and 5-Helps against the buildup of weeds.

Growing different crops like monocotyledons followed by dicotyledons on a same piece of land is termed as crop rotation. If preceding crops are legume or non-legume grown as intercrops or mixed crops, the succeeding crop may be legume or non legume or both. Highly fertilized crops should be followed by non-fertilized crop. Leaf shedding crop should be followed by non-leaf shedding or less exhaustive crops. Perennial or long duration crops should be followed by seasonal /restorative crops. Deep rooted crops should be succeeded by shallow rooted crops. Dicot crops should be followed by monocot crops.

The proposed crop rotations patterns under MKSP are mentioned below:

Cotton/Maize	→ ←	Gram/Green gram

Legume crop (cluster beans, cow pea, beans etc)		
↓		↑
Leafy vegetables	→	Tomato/Brinjal/Chilly/ Cabbage/Cauli flower/Cucurbit

6.2 Mechanical Control

Mechanical control practices involve:

- Manual removal of leaves that are heavily infested with pest insects.
- Putting yellow and white wooden disks in the fields. The yellow disks, which attract sucking insects (e.g., mites and trips), and white disks which attracts white flies, are covered with sticky grease to trap the insects. Lighting small **bonfires** on moonless nights to attract and kill moths before they can lay eggs in the field.
- Placing perches for insectivorous birds in the fields.

Bird Perches can be fabricated from simple sticks or more elaborate structures but all serve the same purpose of providing insectivorous birds with a safe resting perch from which they can operate in safety to catch insects on the wing. Some proponents suggest as many as 25 T-shaped perches per ha and spreading cooked rice mixed with turmeric powder to attract and retain the birds. Perches are not necessary for crops such as brinjal which have a substantial structure on which birds can perch or tomato where farmers have created a support structure for the crop. Bird perches to be removed from the field post following stage in case of gain and pulse crops as barding could feed on the grains.

6.3 Chemical control:

Chemical control will not be motivated; the farmers will be educated on balanced farming.

6.3.1 Seed treatment

6.3.1 Beejamrutha

Beejamrutha is a very good plant based pesticide to control seed borne diseases .Smearing the seeds with Beejamrutha before sowing controls many diseases that attack the plant right from its seedling stage.

Ingredients:

- 10 liters indigenous cow urine
- 10 kgs indigenous cow dung
- 1 kg jiggery
- 100 gms lime solution mixed with 50 gms turmeric powder.
- 20-25 kg capacity plastic drum

Method of Preparation:

Mix 10 litres of cow urine, 10 kgs. of cow dung and 1 kg. Powdered jaggery in a clean drum. Add 100 gms of lime solution and 50 gms of turmeric powder into the drum. Stir the entire content in the drum properly until a paste is formed.

Direction of Use:

This paste is applied to the seeds 30 minutes before sowing and dried under shade (400 grams of beejamrutha is applied to seeds required for one acre land). This helps to avoid seed borne diseases and other diseases that attack the crop during its growing
stage.

6.3.2 Soil and foliar application

Pesticides are used to keep the pest population below economically damaging levels when the pests cannot be controlled by other means. It is applied ONLY when the pest's damaging capacity is nearing to the threshold.
Traditional household remedies which have no toxic effect can be used safely. Herbal pesticides are very useful in sustainable agriculture practices to control pests and diseases. The spraying of herbal pesticides not only controls the pests and diseases but also provides good nutrients to the plants. Similar form of herbal pesticide should not be used more than twice or thrice for the same crop as the pests gain resistance.

6.3.2.1 Use of Neem seed, leaf and neem cake

Neem seeds are ground into a powder that is soaked overnight in water and sprayed onto the crop. To be effective, it is necessary to spray it at least every ten days. Neem does not directly kill insects on the crop. It acts as a repellent, protecting the crop from damage. The insects starve and die within a few days. Neem also suppresses the hatching of pest insects from their eggs. **Neem has the advantage of not killing predatory insects that provide natural control of pest insects.**

6.3.2.1.1 Preparing of neem seed kernel extract/suspension **(NSKE 5%):**

- Soak neem seed kernels (5 kg) in a minimum of water overnight
- Grind the neem seed kernels and keep the paste in a bag and soak for 2 hr. Fill container with water (10 litre) and place bag of neem seed kernel paste in the container for 30 min, stirring periodically.
- Squeeze the bag thoroughly, remove and filter the resulting white suspension ands add soap flakes (100 g) to the suspension.
- Dilute the suspension for use in a sprayer to spray (10 times, e.g. 500 ml in 5 litres) the crop

Notes

Collect only ripe fruit and separate the seed from the fruit before storing in gunny bags in a cool shaded, dry location. Do not store in airtight plastic bags; store the seeds in gunny bags. Don't store the seeds more than one year . Don't dry under sun light. Large quantities of neem kernels should be treated with either china clay or sulphur (1: 10 ratio).

Neem extracts should be sprayed at the flowering stage of a crop to prevent egg laying and disrupt young larvae feeding on foliage.

6.3.2.1.2 Neem oil:

- Generally Neem oil is available in the market that can be used in pest control
- 5% solution of Neem oil is affective in pest control (5ml of Neem oil in 1lt water; 100lts of such solution can be used for one acre)
- As Neem oil is insoluble in water, made 100gr surf solution and add to this solution. This will act as spreading agent.
- Depending on pest intensity spray 100-150lts of solution per acre
- Sucking pests, fruit borers and leaf folders can be controlled with this solution.

6.3.2.1.3 Neemastram (use against pests that suck the plant.)

Ingredients:

Dung- 2 kgs

- Urine – 10 lits
- Tender neem leaves- 10 kgs
- Water- 200 lit

Method of preparation and application:

Grind 10 kgs of tender neem leaves and add in to 200 lits of water. Later add 10 lit of urine and 2 kgs of dung. Mix it thoroughly and keep for 48 hrs. Filter it and use for 20, 45, 60 days for all crops.

6.3.2.1.4 Neem cake:

- Neem cake kills pest insects in the soil while serving as an organic fertilizer high in nitrogen.
- Neem powder or Neem cake can be obtained after extracting Neem oil. 1-2qtls of Neem cake can be applied in 1acre
- It is affective against soil born pests
- It can be applied at the time of ploughing
- It can be applied before sowing the seeds in nurseries
- Soil born nematodes and root grubs can be controlled by neem cake

Neem leaves can be used to protect stored grain from damage due to insect such as weevils

6.3.2.2Greenchillies – Neem – Garlic – Tobacco decoction:

(Agnastram; to be used against stem and fruit borers, leaf eating caterpillar, pod borer and sucking pests)

- Presence of alkoloids makes this decoction effective in pest controll
- This decoction is affective againesthelicoverpa,spodoptera and redhairy cater pillar

Required materials:

- Urine- 10-15 lit
- Tobacco- 1 kg
- Green chilli- 2 kgs
- Neem leaves- 5 kgs
- Garlic– 0.5 kg

Method of preparation and application:

In urine adding of tobacco, garlic, chilli, neem leaves grinded materials. Heat this mixture and keep for cooling 48 hours.

- 2-3 litsAgnastram is added in 100 lits of water before spraying
- Spray 150 ml. of this formulation per pump. About 6-8 pumps per acre are required to control the infestation. Spray after 10-12 days if infestation is still there.
- This solution should be used within 3 days of preparation.

6.3.2.3 Bramhastram
(Use it to control aphid, white fly and other sucking pests, worms, caterpillars)

Required materials:

Urine- 10-15 lit

Neem and any four leafs out of Custard apple, Castor, Pongamia, Lantana, Papaya, Datura, Guava, Bitter gourd, Parthenium.

Method of preparation:

In urine add grinded leaves. Heat it and and keep for 48 hrscooling

Direction of Use:

Spray 150 ml. of this formulation per pump. About 6-8 pumps per acre are required to control the infestation. Spray after 10-12 days if infestation is still there. For best result, use this formulation within 6 months of preparation.

6.3.2.4Pesticide for Aphids and other sucking pests:

Ingredients: Tobacco (Nicotianatabacum), Aloe(Aloe Vera), Buttermilk

Method of preparation :
Take 1 kg tobacco snuff (Nicotianatabacum) and 2 kg. Aloe (Aloe Vera). Wash both plants properly and chop it finely and boil with 6 litre water at moderate and constant heat till it remains half. Mix 4 liter supernatant of buttermilk.

Direction of Use :
Spray 150 ml. of this formulation per pump. About 6-8 pumps per acre are required to control the infestation. Spray after 10-12 days if infestation is still there. For best result, use this formulation within 6 months of preparation.

6.3.3.2.5 Cow dung Urine solution

- Large number of microbes present in the cow dung and urine which are useful for controlling many fungal diseases
- Nutrients present in the solution are useful for effective plant growth
- This canbe applied for two to three times in a cropping period

Required material:

- Cow dung – 5Kgs
- Cow urine – 5lts
- Lime – 150grs

Method of Preparation and application:

- Store 5Kg cow dung, 5lts of cow urine and 5lts of water in a tub
- Cover the tub and allow the solution for fermentation for 4days
- Stir the solution with a stick every day
- After 4days filter the solution and add 150grs of lime to it
- Add 100lts of water to the solution to spray it in 1 acre

Precautions:

- As this solution is thick use a mesh or gunny bag to filter the solution(first time)
- After that add water and filter through a thin cloth
- Can store the solution for 1 or 2 days (farmers experience)

Note:

- This solution will improve the resistance power of the crops
- Spraying of this solution will improve the drought resistant capacity

6.4 Biological control:

6.4.1 Biofertilizers
Biofertilizers like Trichodermaviridae and Pseudomonas fluorescence are soil borne

Organisms known to combat against diseases effectively. Application of these microorganism to seeds or soil not only controls the disease but also acts as plant growth promoting substances.

Method of preparation :
Mix 1 kg Trichoderma and 1 kg. Pseudomonas to 100 kg.already prepared farm yard manure or vermicompost on a cement floor 15 to 20 days before application to the soil by covering with gunny bags. Every week sprinkle the material with water and turn the entire material upside down to maintain moisture and aeration. Keep covering the entire material with gunny sacs. Continue this process upto 3 weeks

Direction of Use :
1-2 quintals per acre of this manure can be applied to the soil. Controls plant diseases and provides good nutrition to the seedlings for healthy growth of a plant.

6.4.2 Beneficial Insects

Beneficial insects are insects which prey on harmful insects or their larvae.

	Brachonids,Chalcids and Ichneumon Wasps These small beneficial insects destroy leaf-eating caterpillars; can attract them by planting carrots, celery, parsley, caraway and Queen Anne's lace, all members of the Umbelliferae family. These plants are easy to grow, and some should be left to flower. It's the flower that attracts the insects.
	Ladybugs These common insects consume aphids, mites, whiteflies and scale. They can be attracted by planting members of the daisy family (Composite), tansy or yarrow.
	Lacewings Lacewings are avid consumers of aphids, and their larva eat aphids and other varieties of other insect pests. They are attracted to "composite" flowers, such as yarrow, goldenrod, black-eyed susan's and asters. Lacewings can also be purchased online at the sources listed below, and released directly into your garden.
	Hover-flies Hover-flies are avid consumers of aphids, and the larva of hover-flies eat aphids and other insect pests. Like the Lacewings, they are attracted to "composite" flowers, such as yarrow, goldenrod, black-eyed susan's and asters.
	Praying Mantis These large insects have an appetite for most garden pests.

8. Grain storage

Food grains kept in airtight sealed structure remain insect free. Grains with moisture content less than 10% are not suitable for multiplication and survival of most of the insects. Few seed conservation practices to be promoted are
highlighted below :

8.1 Mixing of leaves

Select leaves having pesticidal property like neem, Vitexnigundo, etc and dry themunder shade. Mix these leaves with seeds fill in the bags. Tie the bags tightly and store in dark.

8.2 Sand mixture method

Take a 5 kg capacity mud pot. Any variety of seeds to be stored are collected, cleaned and dried under sun and shade. Into this pot, add a thick layer of sand at the base and spread the seeds to be stored over this sand. Again add sand over the seeds. Continue the same process of filling sand seed mixture layer by layer till it reaches upto the brim of the pot. See that the upper layer is again a thick layer of sand. Close the containerwith a lid and air tight it with cow dung paste. By doing so, can store the seeds for more than a year