Practice Guide to Regenerative Approach of Crop Production

Developed by: The CoE- Agriculture, PRADAN

Agriculture : Comprehensive Goals & KPIs

Comprehensive goals

Economic (Local economy & Farmer prosperity)

Environmental (Climate resilience & Natural resource rejuvenation)

Food quality (Non-toxic and nutritious food)

Social (Women empowerment & Inclusive growth)

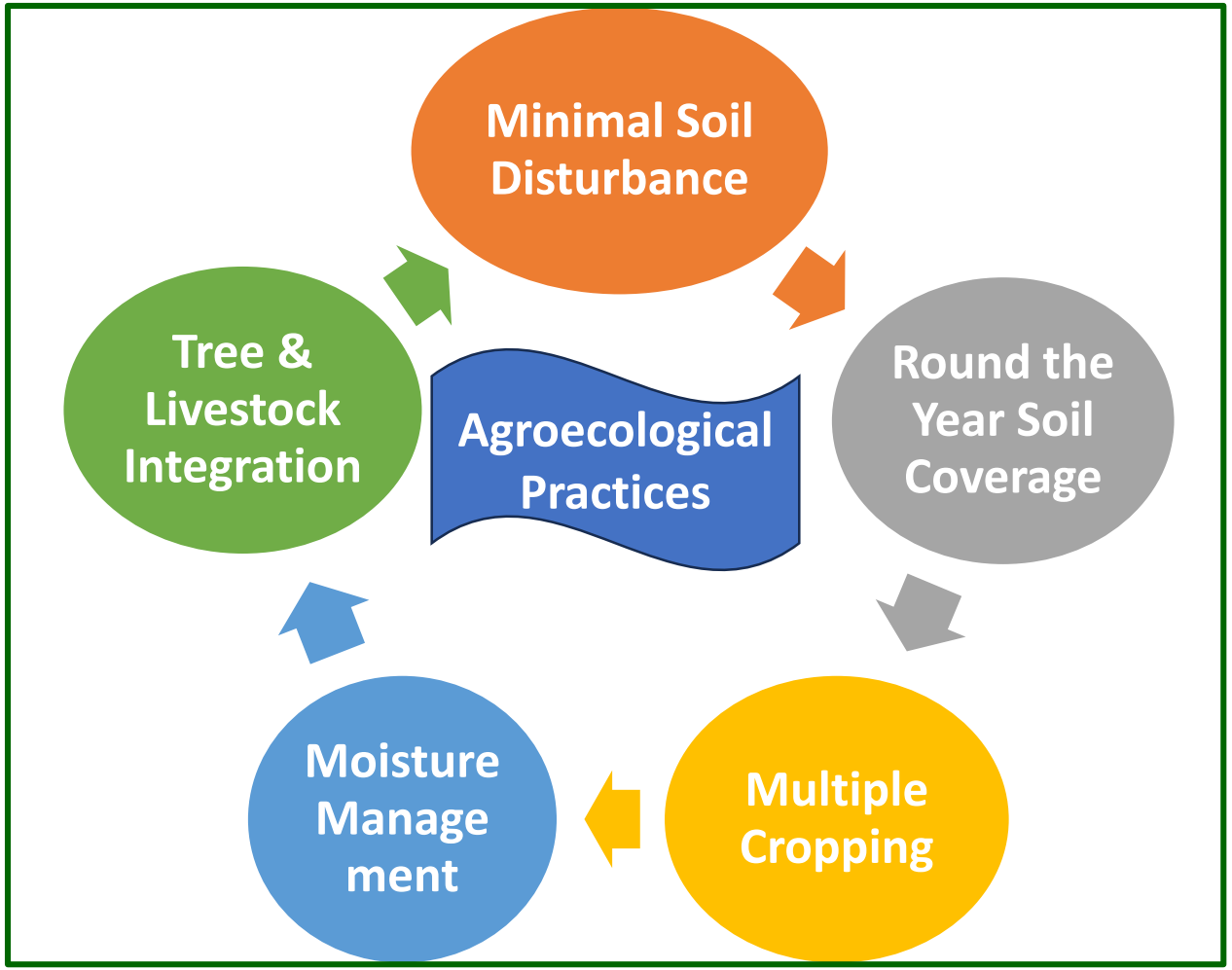
The overall objective of agriculture intervention has shifted now from economic outcome to more comprehensive one that includes environmental, social and food system related outcomes. The table below captures the indicators to track the progress around all these domains both at people level and system level. To attain it, farmers have to make a shift from Conventional Approach (CA) to Regenerative Approach (RA) of crop production.

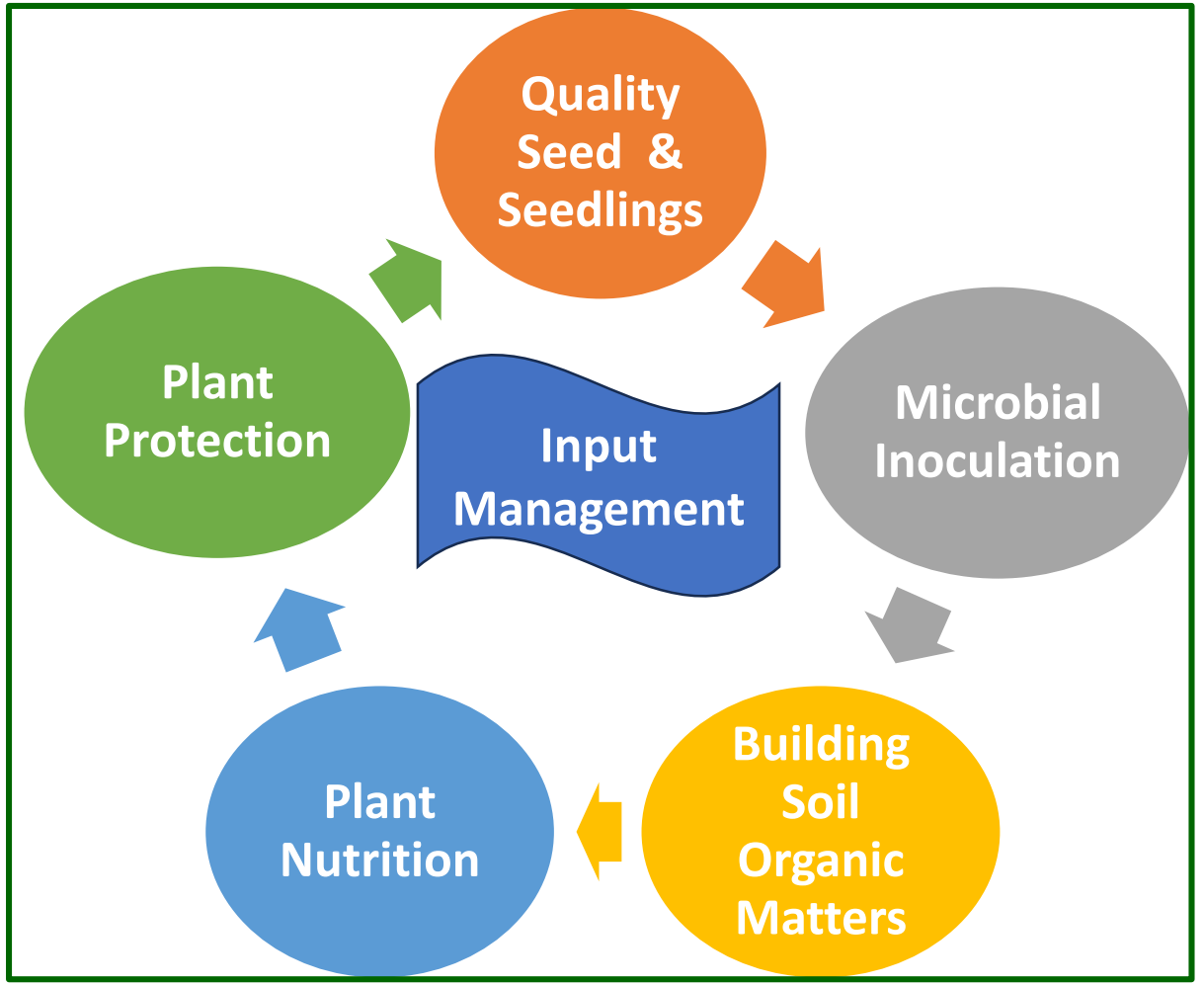
Key Performance Indicators (KPI)

Domains	System level indicators	People level indicators
Economical	• Gross landscape productivity enhancement • Improved local area economy	• Enhancement in net annual income
Environmental	• Enriched natural resources like soil, water & biodiversity • Increase in carbon sequestration & reduced GHG	• Change in soil health/soil organic carbon • Reduced crop loss due to extreme weathers
Social wellbeing	• Benefit (direct & non-direct) realised by the bottom 25% of HHs in the village	• Increased say of women in agriculture related decisions in the family
Food related	• Degree of local self-reliance on food & farm inputs	• Extent of food consumption grown under RA

RA Adoption: Comprehensive Engagement Domains

Farmers have to bring changes both in agroecological practices and in managing agriculture inputs differently (as mentioned below) to make a shift from the CA to RA without experiencing any significant economic loss.





Key Recommendations: Agroecological Practices

Most of the practices followed in conventional approach (CA) like seed sorting, transplanting, pruning, nipping, intercultural, earthing up, harvesting are same in RA. However, following are some practices that significantly differs from CA or need proper attention:

- Keep soil covered as much as possible - avoid keeping soil bare
- Do not use heavy machinery like combine harvester
- Incorporate crop residue in the field. Do not burn as it would kill microbes
- Avoid summer ploughing as it kills soil biology like microbes, arthropods, earthworms
- Always try to grow multiple and compatible crops in field and avoid mono-cropping Minimise soil disturbance - try to grow crops on permanent beds
- Special attention to be given to avoid water stagnation & ensure drainage
- Do not use poisons/ burning of sterilisation to manage termite/ ants in nursery bed
- Soil is critical. Always use soil in nursery bed/peat mix and avoid soil less nursery

Key Recommendations: Input Management

- **Seed:** Do not use genetically modified seeds. Local & O.P seeds are recommended but hybrid seeds can be used in initial few years.
- **Microbial inoculation:** Apart from native soil microbes, externally sourced selected microbes like VAM, NPK consortia, Pseudomonas, Trichoderma have to be included. In long run, only locally sourced microbes would be used.
- **Stop use of synthetic inputs**:
  - No use of synthetic fertilisers like DAP, Urea, SSP, MoP etc.
  - No use of synthetic pesticide and weedicides.
  - Both natural and synthetic salts can be used to source micronutrient.
- **Pest control:** Follow different IPM measures. Botanical extracts, microbial solutions, fermented salts etc. can be used as pest control measures but do not use any synthetic pesticides.

Different Cropping Models

In RA, farmer are encouraged to adopt different cropping models suitable to their farming context. Here, a group of crops are grown together or in sequence throughout the year to maximise landscape productivity and HH income while supporting agroecology rejuvenation

Paddy with relay cropping
- Green manuring
- SRI/DSR followed by grams
- HH Consumption

Intensive vegetable model
- Irrigated land
- Permanent raised bed
- HH income

Rainfed multi-cropping
- Millet + pulses + oilseeds
- Rainfed upland
- Consumption & income

A mix of these models in 2 acres land would help a HH attain Its nutritional security and a net annual income of Rs 1 lakh

Orchard with intercrops
- Mango/Guava/citrus
- Irrigated upland
- Mostly for HH Income

Homestead model
- Mixed cropping with fruits, spices, vegetables etc.
- Round the year production
- HH Consumption

Multilayer model
- Optimal resource use
- Homestead irrigated
- Consumption & Income

1. Paddy with Relay Cropping

- This model is suitable for medium and low land where soil moisture remains till October-December under the rain-fed situation.
- With enhanced soil moisture level under RA, the crop resilience to water stress will be more and second crop or long duration paddy can be taken
- The area should be ideally 50 decimal. However one may start with a full plot of 20-30 decimal
- This model is mainly to meet the consumption need of the Household and the surplus can be sold out for income
- Green manuring before kharif is an integral part of this model.
- In transplanted plots, one can go for green manuring like Dhaincha or Mung.
- In case of DSR paddy, pulses like mung can be grown and plants can be incorporated with ploughing
- The seed rate should be double the normal to maximise the biomass. Different kind of seeds should be
- Multiple crops should be grown for green manuring

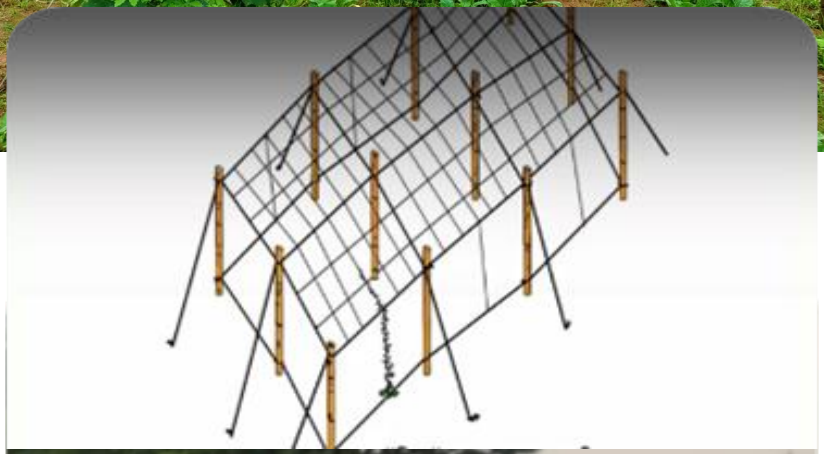
2. Intensive Vegetable

- Area should be ideally 25 decimal of cultivable well drained land. (One may start this model in 10 decimal plot also)
- Crops grown: 2-3 principal vegetable crops are grown along with suitable cover crops
- Primary objective of the model: Cash income to the farmer (Annual net income is Rs. 60,000).
- There will be permanent raised beds on which vegetables are gown.
- There will be round the year vegetable cultivation based on the principle of crop rotation
- Fencing and irrigation support (at least up to March) are two primary needs.
- This model constitute a multi-season permanent arrangement for raising vegetables across several years without tilling it further

3. Rainfed Multi-cropping

- This is primarily suitable for rainfed upland condition where scope of irrigation is limited.
- This is suitable for both Kharif and Rabi season where neither intensive vegetable nor Paddy can be grown
- The unit size of the plot should be 50 decimal. One can go for more area if possible
- The primary purpose of this model is to meet the HH consumption need either as direct produce or after primary processing like oil extraction/milling etc.
- Millet can be considered as a part of this farming model along with other crops
- Practices like line sowing (different crops taken in different rows) should be adopted rather than broadcasting and sufficient space should be provided for each crop.
- In case of pulses like Pigeon-pea, nipping practice should be followed to facilitate branching.

4. Multilayer Vegetable Model



- Area should be ideally 10 decimal of cultivable well drained land. This should be preferably a homestead land with fencing.
- Crops grown: Crops are grown at different layers like below
  - Ginger, turmeric type crops are taken under the soil surface
  - Spinach, Amaranthus like leafy vegetables as cover crop,
  - Tomato, Chilli, Cabbage like vegetables can be taken on the soil
  - Creepers are grown on trellis either vertical or horizontal depending on the creeper type.
  - Papaya, Lemon type of plants can be grown along the fence.
- Primary objective of the model: To help farmers earn regular but significant income of about Rs 3000-4000 per month.
- It also provides diverse and nutritious food for household consumption
- There will be permanent raised beds on which vegetables to be grown without being tilled.
- This model constitute a multi-season arrangement to grow different types of crops across several years

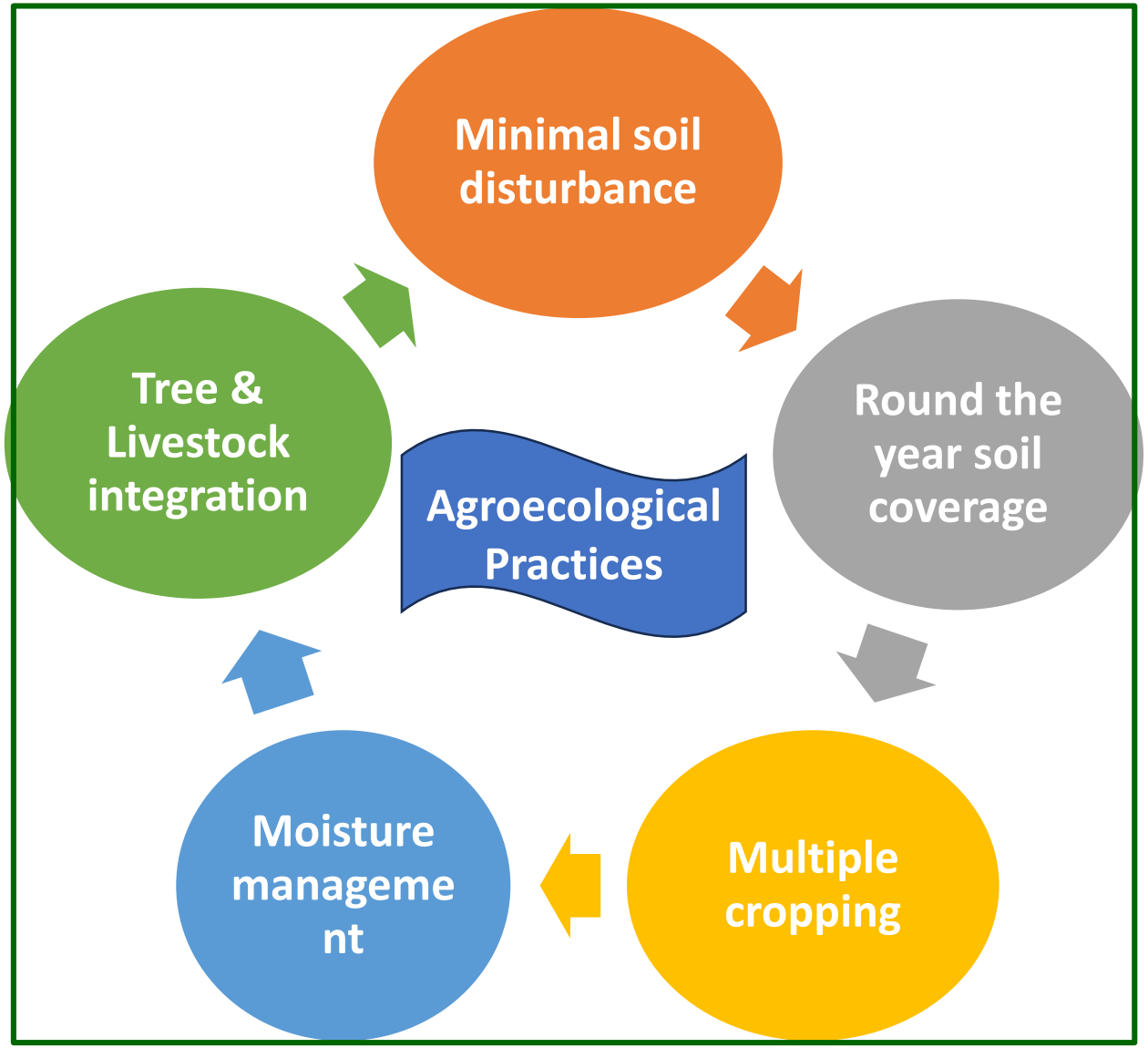
5. Orchard with Intercropping

- A well drained upland with irrigation and fencing facility should be selected for this model
- Ideally this model should be taken in 50 decimal land
- The species and variety should be selected looking at the local climate, market demand and farmer choice Ideally 2-3 species should be taken in the orchard .
- One should grow 2 to 3 main species under this model along with some boundary plantation.
- Primary objective of the model: Cash income to the farmer (Annual net income is Rs. 60,000).
- Intercrops should be promoted in the field in the free space. Once the orchard grows, the farmer should take shade loving crops like Turmeric, Zinger.
- Fencing and irrigation support (at least up to March) are two primary needs.
- Intercropping is important to facilitate economic return to the farmer in initial years and also helps for proper care of the orchard plants.

6. Homestead model

- As name suggests, this model is taken in homestead plot which is usually rich in biomass and have access to water sources
- The area varies from 2-3 decimal to 10 decimals as per its availability
- The primary purpose it to meet most of the household need (food as well as non food needs like fibres, medicines, flowers, rituals etc.)
- In true sense, this entails growing a variety of plants from all groups at all possible scale that can be accommodated in the homestead. it tries to optimise the space both below and above the soil surface.
- Essentially it a mix and match of all the non-field crop based agriculture models like multilayer vegetable, orchard with inter cropping, mixed vegetable etc.
- Three sister model is one of the most prominent cropping system here where standing crops like maize/okra, creepers like cowpea, and ground cover crops like pumpkin, cucumber is grown together.
- Different kind of kitchen garden models can be considered here
- Being close to home, it draws good care and attention from family members. And It is largely under the control of women

Some Details of Agroecological Practices



The aim here is to reactivate the natural ecosystem where soil biology plays critical role. Practices suggested here is primarily to support this reactivation process. The intensity or degree of adoptability would vary widely from place to place depending upon the contextual reality. Therefore we should mobilise farmers to adopt these practices as much as possible. Crop planning is extremely critical here. These practices may not give economic return immediately but would be critical to rejuvenate agroecology which would be extremely rewarding in long run to meet all four goals of agriculture.

1. Minimal Soil Disturbance

Importance/rationale :

- Minimise the disturbance of habitat for soil biology- microbes, earthworm etc. to sustain and perform
- Maintain soil porosity to enhance water holding capacity, aeration, drainage etc.
- Excessive tillage breaks mycorrhizal network, breaking pores developed by earthworms, reduces aggregate stability, enhances soil erosion etc.

Practices can be followed:

- Do not go for deep ploughing (more than 6 inch). It can be done once to break the compaction layer.
- Avoid using heavy machinery, use small equipment like power tiller
- Growing vegetables on permanent bed structure
- Go for strip tilling whenever possible
- Go for soil and moisture conservation measure to give stability to land profile & maximise harvest of water etc.

2. Round the year soil coverage

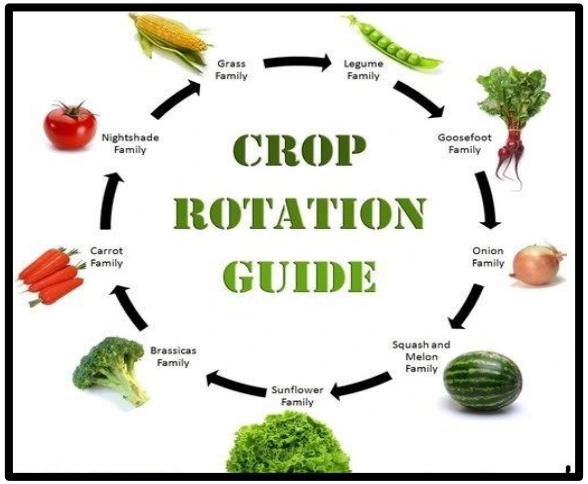
Importance / rationale of soil coverage:

- Protect microbes, earthworm and arthropods etc. from excessive heat and cold
- Provides shelter and enhances biological activity in top soil, critical for crop growth
- Bare soil is vulnerable for compaction (raindrop) and due to runoff and strong winds
- Minimises growth of weed and reduces water loss due to evaporation
- Loosing soil carbon due to oxidation by direct sunlight
- It provides dry organic matter and/or root exudates (living roots) to feed soil biology
- Reduces water loss and enhances harvesting of air vapour

Practices promoted under RA:

- Cover cropping should be practiced always along with main crops
- Crop residue like straw, leaves has to be used as as mulching to cover the soil
- Go for green manuring as much as possible when there is no crop in field
- Follow rotational grazing practice to avoid excessive grazing.
- Harvest the crops leaving a larger portion of crop residue in the soil itself
- Let grass to grow during non-cropping period. But cut those before seed setting.
- Avoid plastic mulching as it restricts air flow into soil and affect microbes

3. Multiple cropping/Crop diversity:



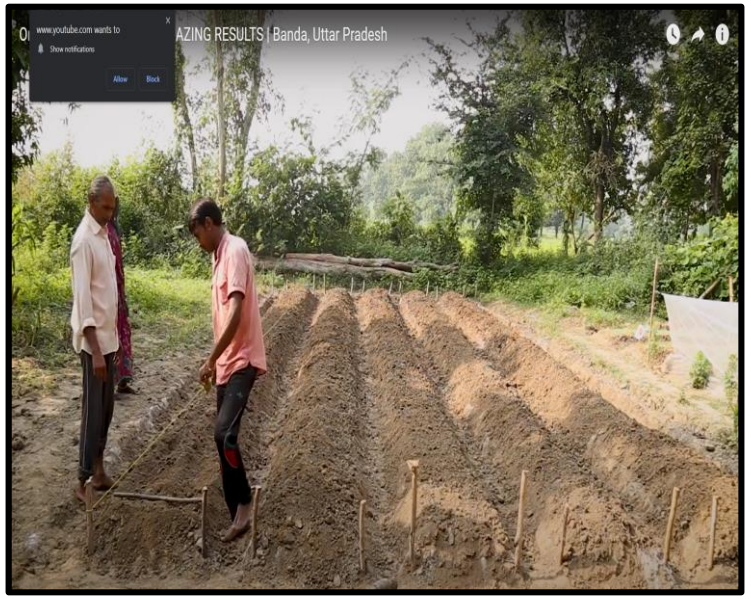
Importance/ Rationale:

- Biological diversity both below and above the soil surface is critical for overall vigour to agroecology and plant growth.
- Different crop nurtures different group of biology (microbes, insects, arthropods, birds etc.)
- Diverse crops often help each other in term of access to water, nutrition, pest management, pollination etc.
- It helps maximise the use of resources like water, soil depth, canopy spread, access to sunlight etc.,
- On economic frontier it minimises risk, reduces weather stress and maximises production and income

Practices to follow by the farmers:

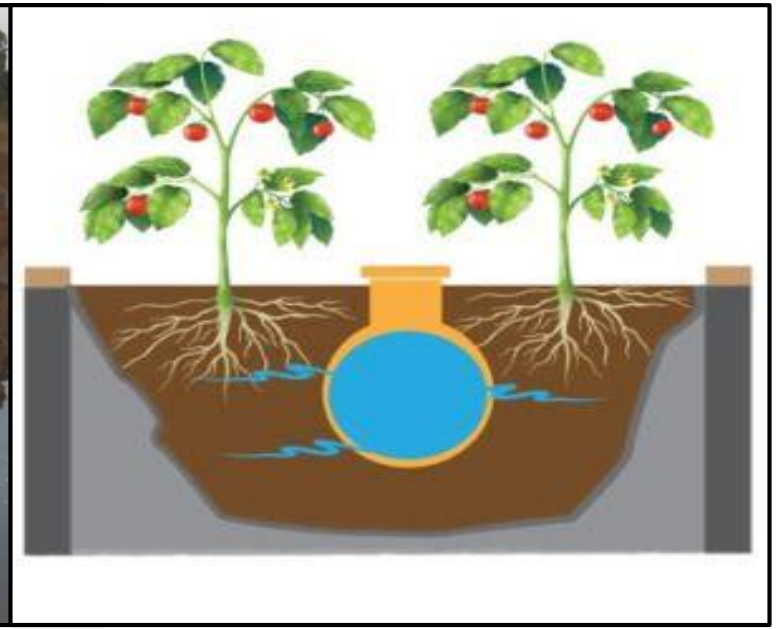
- Farmer should replace monocropping with at least 2 or more crops together looking at their comparability
- Multilayer cropping models should be adopted with or without trellis.
- Crop rotation should be encouraged where crops from same groups should not be taken in subsequent seasons
- Pulses like chick pea, black gram, green gram and cow pea should be included in the annual crop cycle.
- In green manuring also, one should go for multiple species

4. Moisture Management



Importance/ rationale:

- Microbe need air to thrive. Prolonged submergence of soil restricts aerobic microbes
- Plant root also need air for respiration
- Excessive moisture also enhances pathogen attack and crop damage
- Important for rainfed condition where rainfall pattern has become quite uncertain



Practices promoted under RA:

- Selecting crops which are less water requiring
- Efficient water use technologies like drip and pitcher irrigation
- Contour line bed- to minimise water stagnation
- Growing crops on raised bed- ensure drainage
- Water conservation measures like mulching
- Going for relay cropping wherever possible

5. Tree & Livestock integration

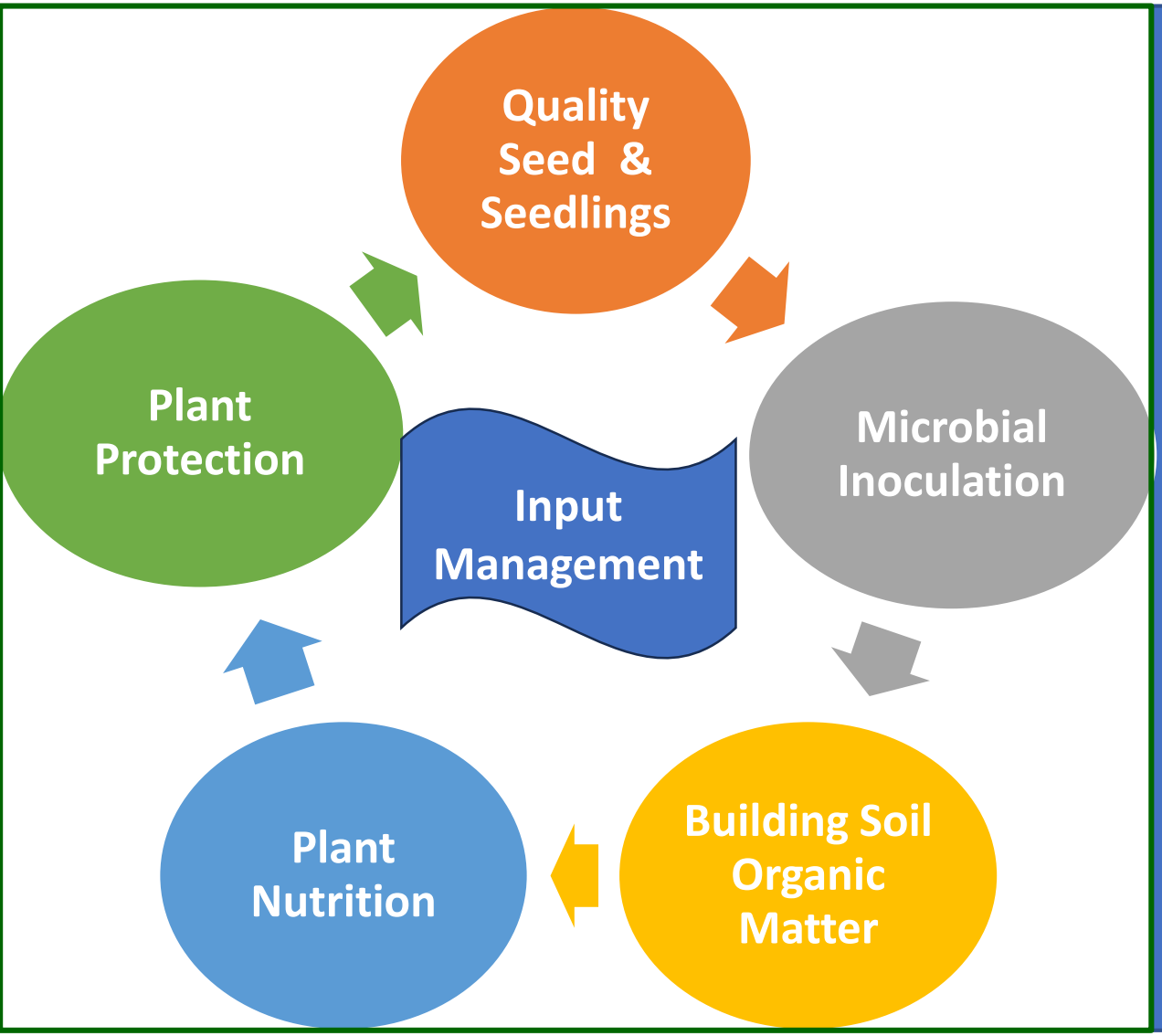
Importance of tree integration in RA:

- It provides shelter for birds and small animals
- It acts as wind breaker and temperature moderator
- Provides biomass for composting and controls soil erosion
- Helps nutrition cycling and water cycling from deep soil profile
- Livestock helps in providing different raw materials like FYM, Urine and dung
- Livestock like chicken often controls insects
- It support the farmer economically

Practices can be followed:

- Taking up different Natural Resource Management (INRM) works
- Going for boundary or bund planation with locally suitable species
- Trees like *Neem/ Karanj* can be grown to support bio-input preparation
- Agroforestry model can be adopted in some current fallow lands
- Bushy tress/plants like Gliricidia can be planted for biomass support
- Rearing livestock like cattle, small ruminants and poultry birds
- Pasture land development to support livestock rearing

Some Details of Input Management



Efforts have to be taken to ensure that farmers intervene or manage inputs to address all these six domains simultaneously so that yield loss can be avoided and soil health improvement can be ensured within a shorter time period of 1-2 years. These inputs have synergistic effects. In the absence of one, the effectiveness of other items will be limited. One need to be extra sure that synthetic fertilisers like DAP, Urea and pesticides should be completely avoided. The amount of inputs or frequency of application will gradually reduce and can potentially be stopped in 5-6 years period. In addition to these inputs *Jeevamrit* solution should be applied to the crop along with irrigation

Different Bio-Inputs

Sl. No.	Input management domain	Bio-products used
1	Quality seed & seedling	Seed treatment kit
2	Building soil organic matter	Improved FYM kit
3	Microbial inoculation-1	Super compost
4	Microbial inoculation-2	Jeevamrit
5	Plant nutrition -1	Multiseed extract (A)
6	Plant nutrition -2	Multiseed extract (B)
7	Plant protection-1	Agneyastra
8	Plant protection-2	Mathastra

1. Seed Treatment Kit

- Importance/ Rationale:
  - Chemically treated seeds can potentially damage/kill the microbial coating practiced in regenerative approach.
  - The seed treatment kit primarily contains diverse microbes to facilitate germination and provide protective environment to early roots. In addition, the kit also contains jaggery, lime and humic substances to support the above microbes.
- Detoxification:
  - Take cow urine and mix water 3 to 4times of the volume of cow urine
  - Soak the seeds in this cow urine solution for 20 minutes to 1 hour depending on the size or thickness of seed coat
  - Wash it thoroughly with clean water at least two times
- Seed sorting:
  - Farmer should sort healthy seeds (physically not damaged, fresh seeds).
  - Brine water test- Add salt to water till an egg floats. Put the detoxicated seeds into this salt water. Mix it thoroughly by hand. Discard the floated seeds and clean the seeds settled at the bottom with fresh water.
- Seed priming:
  - Some seeds needs soaking in water to facilitate germination especially the hard coated seeds like Pumpkin and Corella
- Preparation:
  - For treatment, first prepare lime water and wait till it cools down. Put all other items provided in the kit in this lime solution and mix thoroughly. The seeds need to be soaked at least for 10-20 minutes depending on the size of the seeds for uniform coating.
- Storage/Use: The treated seed should be used within a day or two. Detoxicated seed can be kept for about 6 months.

2. Improved FYM Kit

- Importance/ Rationale:
  - If the soil organic carbon is excessively low. i.e. below 0.5%, green manuring should be done at least once a year.
  - Having sufficient quantity of organic matter in soil makes it healthy to nurture soil biology and improve physical structure
  - There are various ways to attain it like mulching, green manuring, crop residue incorporation etc.
  - Besides the above, farmers apply farm yard manures (FYM) during the land preparation.
  - The quality of FYM can be improved significantly by taking some measures. It is called **improved FYM (*Unnat Gobar Khad*)**.
- Ingredients required:
  - Raw FYM (1 Ton/ 100 cft)
  - Improved FYM kit: Jaggery (2 kg) , Ground nut oil (2 lit), microbial inoculant (2.5 gram each)
- Preparation method:
  - Prepare a solution of all the ingredients in the kit in a container with 100 lit water.
  - Spread the FYM uniformly at a height of 1 feet.
  - Pour the FYM kit solution all over the spread FYM pile. Mix it thoroughly so that the solution reaches to each portion of FYM
  - The mixture should be left covered for at least 7-15 days before applying it to land.
- In special cases where the soil is either acidic or alkaline.
  - Add Dolomite/limestone @ at least 1 quintal per acre if soil is acidic every year till PH comes to 6.5
  - Add gypsum @ 1 quintal per acre if soil is alkaline every year till PH reduces to 7
- Further if the soil is heavily infected with root feeding nematodes, one should add *Neem/Karanj-cake* 50 kg per acre once.
- Improved FYM should be applied to soil at least 7 days after the use of other soil amendments

3. Super compost

- Importance/ Rationale:
  - Practices followed in conventional agriculture have severely damaged the diversity and density of soil biology.
  - Growing healthy crops in RA primarily depends upon these microbes. Thus these microbes need to be re-established.
  - Because of toxic environment, this process (called inoculation) needs repeated effort and proper care care.
  - There is an absolute need of microbial diversity as different microbe play different but crucial roles.
  - The care includes proper environment and food for their proliferation and establishment
  - It also helps digest crop residue, reduces compaction, makes nutrients plant-available through mineralization, promoting a disease-suppressive soil. This is key to unlocking soil fertility.
- The bio-product that plays this crucial role is called **Super compost or *Bhumi Sudharak***.
- The constituents of super compost are:
  - A mixture of different kind of compost like Shivansh, Vermi and *Ghan-Jeevamrit*
  - Additional microbes like VAM, Tricoderma, Pseudomonas, NPK consortia (2.5 ml/gram of each item per Kg of compost)
  - Multiseed extract (B)- 25 ml/kg (Optional to add efficiency) (Multi-seed extract is explained in next section)
- Application process: This dry mixture should be applied close to the root zone during
  - Nursery y bed preparation or pot mix preparation, during transplanting or seed sowing and during intercultural operation
  - It should be applied about 3 inch below the soil to protect microbes from UV light, or else the soil should be covered with mulching.
- Dose: usually 3-4 quintal is applied in splits (50%, 25% and 25 %) per acre per season

4. *Jeevamrit*

- Importance/ Rationale:
  - Jeevamrit is an excellent source of local microbes.
  - This is derived from cow dung and healthy-soil.
  - Being sourced locally these are more adoptable in the field
  - It can easily be prepared and used by the farmers
- The constituents of Jeevamrit:
  - Cow urine and cow dung
  - Jaggery and Gram flour *(Beshan)*
  - Healthy soil (collect from multiple places where chemical s are not applied)
- Preparation process:
  - Take 200 lit water in a plastic container
  - Add 10 lit cow urine and 10 kg fresh cow dung and mix it thoroughly
  - Add 2 kg Jaggery and about ½ kg healthy soil mix
  - Stir the solution at least twice a day for 5 minutes
  - The WD solution can be used in place of cow urine
- Application:
  - Use this solution after 5 days and within 10 days
  - It should be applied close to the root zone while irrigating the plants

If needed one can multiply this solution. With 1-2 litre of *Jeevamrit* and add all other constituents and follow the process

Multi-seed extract (Importance and rationale)

- In regenerative approach, soil biology is expected to feed plant from soil profile through mineralization process. While shifting from conventional practices, it takes time for these microbes to establish, proliferate and do their job effectively.
- During this transition time, till soil biology is not capable to feed the plant fully, the deficit can be supported through foliar feeding of essential nutrients derived from different seeds, selected rocks and mineral salts.
- The above materials are to be bio-fermented using Cow urine/ Jeevamrit/ WD solution for about 8-10 days to extract these essential nutrients in chelated form so that it can be used as foliar for better absorption by the plant.
- Variety of seeds or minerals are used to get different nutrients to perform all required functions in plant body.
- However plant need different nutrient mix of different proportion at different growth phases of its life cycle like vegetative, flowering and fruit filling stage.
- Therefore we have to produce different solutions like Multiseed extract (A) and Multiseed extract (B) to meet the differential need of the plant at these stages.
- This is extremely critical to ensure productivity during the transition phase. The need for these items will be reduced gradually and can be potentially stopped over a period of 5-6 years.

5. Multi-seed extract (A)

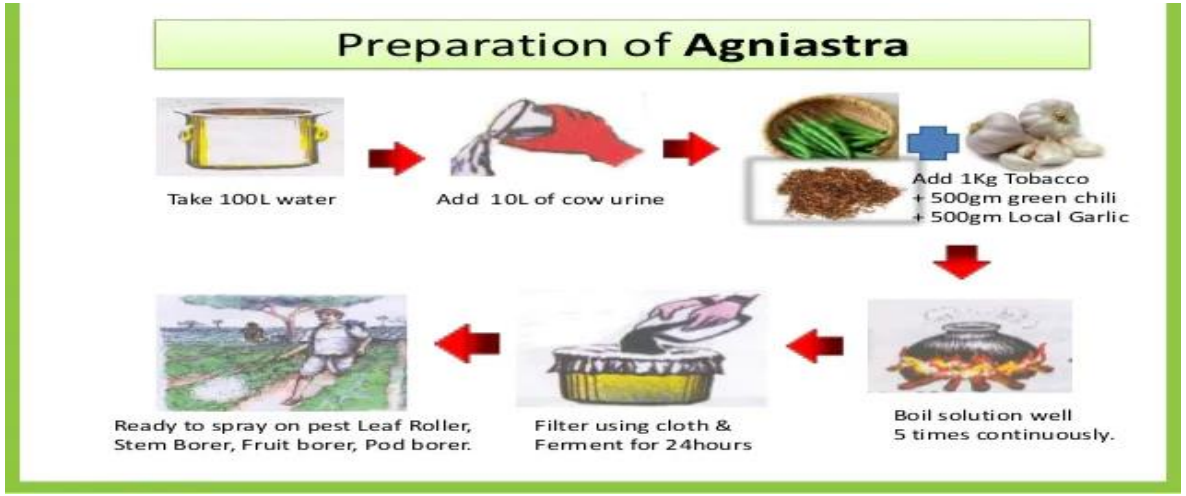
- This is a nutrient supplement primarily designed to help the plant maintain its vegetative growth and develop its immunity and help in fruit filling.
- Ingredients
  - 3 type of oilseed, 3 type of pulses and 2 type of cereals – 8 kg in total (1 kg each)
  - 40 litres of cow urine/Jeewamrit
  - 40 litres of water
  - 2 kg jaggery
  - Add 4 kg of rock phosphate/ lime/ gypsum (rock powders)
- Preparation:
  - The seeds as well as the rock phosphate/ lime or gypsum should be grinded separately
  - Make two separate solutions for seed mixture and rock powers.
  - Take 20 lit of Cow-urine/Jeevamrit, 20 lit of water and 1 kg of jaggery in each container. Add multi seed powder in one container and the rock powder in the other container.
  - The mixture need to be stirred well – minimum 8 times daily and do it for 8-10 days.
  - Strain these solutions using cotton cloth. Mix equal amounts to prepare **Multi-seed extract A**.
- This should be used within 3 to 4 months of final mixing

6. Multi-seed extract (B)

- This nutrient solution is designed to support plant meeting its special nutritional need at its reproductive stage like bud setting, flowering, pollination, cell division etc. and improve immunity.
- Ingredients required
  - Special seeds like pumpkin, sunflower (250 gram each)
  - Mineral salts like Blue vitrol, green vitrol, red vitrol, borax, Manganese sulphate, Epsom salt etc. (250 gram each)
  - 20 litres of cow urine/Jeewamrit and 20 litres of water
  - 1 kg jaggery and 1 kg of groundnut oil
- Preparation:
  - All the raw materials has to be grinded if required thoroughly.
  - Take 20 lit of Cow urine/Jeevamrit, 20 lit of water and 1 kg of jaggery and 1 kg of groundnut oil in one plastic container. Add the above powder (all mixture) in it.
  - The mixture need to be stirred well. Cover the container with cotton cloth. Stir the solution for a minimum of 8 times daily and do it for 8-10 days.
  - Strain these solutions using cotton cloth.
  - Take equal volume of this solution and multiseed extract A and mix it to prepare **Multi-seed extract B**.
- Use this multi-seed extract B within 3 to 4 months of final mixing

7. Agneyastra

- The ingredients are
  - 10 litre cow urine
  - 5 kg well neem leaf/ 1 kg need seed
  - 0.5 kg tobacco powder
  - 0.5 kg crushed green chilli
  - 0.5 kg crushed garlic
  - 0.5 kg crushed ginger



- Preparation:
  - Take all the ingredients in an earthen or aluminum pot.
  - Boil the mixture till the volume reduces to half while stirring it frequently.
  - Then it is kept in shade for 24 hours to cool down to room temperature.
  - After cooling, strain this organic solution with the help of strainer or cotton cloth
  - Keep the strained liquid solution (Agneyastra) in a plastic bottle.
- It can be stored up to six months. The bottles has to be opened regularity to release gas formed to avoid bursting .

8. *Mathastra*

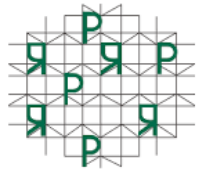
- This is sprayed to protect crops from diseases especially fungal ones.
- Ingredients
  - Butter milk – 10 lit
  - 100 gm copper wire or copper metal piece.
- Put the copper piece inside the solution.
- Keep it for 12 hours.
- It should be used within 2-3 days.
- Equal amount of cow urine can be mixed to it.

BRC- Decentralised Production of Bio-inputs

- Ensuring timely access to quality bio-inputs are critical to ensure crop productivity under RA. It is not advisable to rely on the production of these inputs by individual farmers at least during transition phase.
- Bio-input resource centres has to be established to supply these inputs at a cost. There are two models:
  - All the bio-inputs are produced by single BRC and supply to farmers directly or through CRPs
  - Different BRCs produce and supply different items like nursery, super compost, botanical extracts through FPOs
- However these centres need to collaborate with village level extension agents (CRPs) directly or through FPOs to demonstrate, generate demand, sell inputs, and provide on field support etc. These CRPs should get a part of the profit generated within his/her village from the BRC.
- Many bulky items like compost, seedlings, multiseed extracts can be produced by these CRPs using basic ingredients from BRC entrepreneurs.
- However generating demand for the Bio-inputs cannot be solely left to the BRCs or these CRPs. Dedicated awareness drive is required for this.
- Gradually, along with BRCs, some farmers may learn to produce and use some of these bio-inputs on their own.

Vegetable nursery

Critical Practices to Follow for Raising Nursery



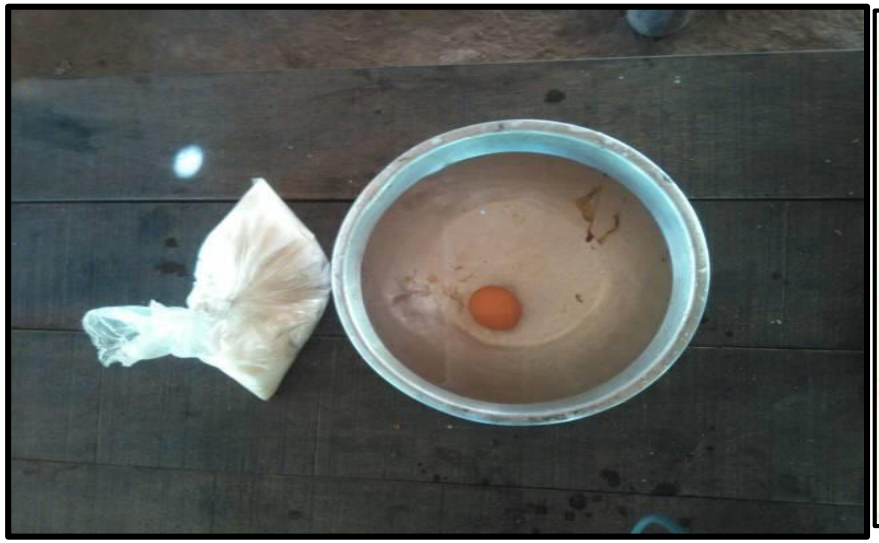
- Healthy (mature) seeds are to be sourced and sorted following different practices including brine water test.
- Chemically treated seeds need to be detoxicated by soaking it in cow urine solution (25% dilution) for 30-60 minutes. Clean it with water.
- Then prepare *Beejamrit* solution (use kit) and soak the seeds in this beejamrit solution.
- Prepare pot mix by using healthy soil, improved FYM and cocopeat if possible in equal proportion. It is advisable to grow seedlings using protray or polybags.
- Drench the nursery bed/ protray with microbial mixture (at 7 days) and drench and spray the seedling with *Jeevamrit* solution/multiseed extract if the growth is weak.
- For thick coated seeds, seed priming is required by soaking seeds in water overnight
- We should use yellow and blue sticky traps (2 traps each per 2 decimal nursery) and apply *Agneyastra* (low concentration10 ml/lit) to control small insects like white fly and others.
- Keep the root zone moist always. Follow some hardening process before using the seedlings in main field.

Input requirement for Vegetable Nursery
(1,00,000 seedlings)/30,000 creeper seedlings)

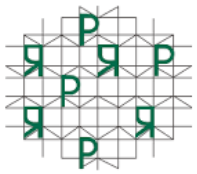
Pot mix preparation	Growing medium-1	Growing medium-2	Growing medium-3
Item	Cocopeat	Super Compost	Healthy soil
Dose & frequency	20 kg	150 kg	Rest amount = 150 kg

Items	Microbial solution	*Jeevamrit* drenching	*Agneyastra*	Sticky traps
Dose & frequency	2% foliar spray and drenching (once but repeat if required)	5 % solution soil drenching. Once or twice if required	10% solution only if infestation is visible	2 sticky traps (blue and yellow) each per 2 decimal nursery

Paddy Nursery



Critical Practices to Raise Paddy Nursery



- Healthy (mature) seeds are to be sources. Brine water test is advised for seed sorting.
- Detoxicate the chemically treated seeds using cow urine solution(25% dilution) for 30-60 minutes. Clean it thoroughly with water.
- Treat the above seed using *Beejamrit* solution (use kit) and store it in dry and cool place
- Pulverise the soil thoroughly and mix improved FYM.
- Prepare 3 feet wide beds. Mix 10 kg of super compost on top of the beds.
- Only in case of wet nursery, seeds need to be germinated by soaking for 1-2 days.
- Put these seeds (germinated or not) on the nursery bed in lines (at least at one inch spacing and one inch ½ inch depth.
- Drench the nursery bed with microbial mixture (at 7 days) to protect from root rotting.
- Drench and the seedling with *Jeevamrit* solution/multiseed extract for proper growth.
- Apply *Agneyastra* (low concentration10 ml/lit) to control small insects like white fly
- Irrigate and uproot the seedlings carefully so as to avoid any damage to the roots.

Input Application Table

1. Paddy (DSR and Transplanted) - 50 decimal
2. Tomato/Chilli/ Brinjal group-vegetable - 25 decimal
3. Creeper group-vegetable - 25 decimal
4. Cabbage/Cauliflower-vegetable - 25 decimal
5. Radish/ Carrot/ Coriander group - 25 decimal
6. Multilayer Vegetable - 10 decimal
7. Pulses/Oilseed/ Millet (Mono/mixed) - 50 decimal
8. Potato/Ginger/Turmeric group - 25 decimal
9. Maize - 50decimal
10. Wheat - 50 decimal
11. Pumpkin/Water melon group - 25 decimal
12. Orchard (mango/ Guava) - 50decimal

A table is given for each of these crop groups where the dose, timing and frequency of application of different inputs are provided. In addition, total quantity of different inputs required for each crop/models has been calculated for some average land size.

1. Paddy-Transplanted/DSR (50decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Once- During land preparation (green manuring/ residue incorporation)	2 T
Super compost	2 quintal/acre/season	Two times	• Transplanting /line sowing (50kg) • 1st inter-culture (50kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	Twice	At tiller initaion and second interculture	1.6 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	Once	Panicle initiation stage	1.2 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	Once	Grain filling stage	0.6 lit each
Agneyastra	100ml/ 15 lit water	Apply alternatively along with above foliar		1 lit
Mathastra	100 ml/15 lit water			1 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

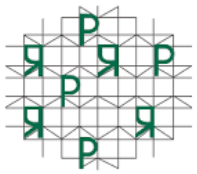
2. Tomato/Chilli/ Brinjal Group (25 decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	4 quintal/acre/season	Three times	• Transplanting (50kg) • 1st inter-culture (25kg) • 2nd inter-culture (25kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	3 times at weekly interval	Start 15 days after transplanting and stop when flowering starts	1.8 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	3 times at weekly interval	Begin when flowering starts and continue till fruiting start	1.8 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	4 times at weekly interval	Start when fruit setting start and continue till harvest	1.2 lt each
Agneyastra	100ml/ 15 lit water	Apply every alternate week	From 1st inter-culture till harvesting	1.5 lit
Mathastra	100 ml/15 lit			1.5 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

3. Creeper Group-Vegetable (25 decimal)

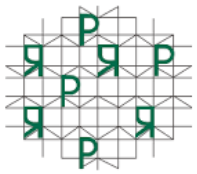
Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	4 quintal/acre/season	Three times	• Transplanting (50kg) • 1st inter-culture (25kg) • 2nd inter-culture (25kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	3 times at weekly interval	Start 15 days after transplanting and stop when flowering starts	1.8 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	3 times at weekly interval	Begin when flowering starts and continue till fruiting start	1.8 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	4 times at weekly interval	Start when fruit setting start and continue till harvest	1.2 lt each
Agneyastra	100ml/ 15 lit water	Apply every alternate week	From 1st inter-culture till harvesting	1.5 lit
Mathastra	100 ml/15 lit			1.5 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

4. Cabbage/Cauliflower-Vegetable (25 decimal)



Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	4 quintal/acre/season	Three times	• Transplanting (50kg) • 1st inter-culture (25kg) • 2nd inter-culture (25kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	6 times at weekly interval	Start 15 days after transplanting and stop when flowering starts	4 lit
Agneyastra	100ml/ 15 lit water	Apply every alternate week	From 1st inter-culture till harvesting	1 lit
Mathastra	100 ml/15 lit water			1 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

5. Radish/ Carrot/ Coriander Group (25 decimal)



Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	2 quintal/acre/season	Once	Transplanting (50kg)	50 kg
Multi-seed Extract (A)	200 ml/15 lit water	4 times at weekly interval	Start 15 days after sowing	2 lit
Agneyastra	100ml/ 15 lit water	Apply every alternate week	From 1st inter-culture till harvesting	0.5 lit
Mathastra	100 ml/15 lit			0.5 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

6. Multilayer Vegetable (10 decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity/Anual
Improved FYM	10 T/acre/year	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	Initiation- 30kg Regular dose -10 kg	Monthly	Regular	140kg
Multi-seed Extract (A)	100 ml/15 lit water	weekly interval	Start after 15-20 days and Continue everywhere except on the crops that starts flowering	6 lit
Multi-seed Extract Booster (B)	100ml/15 lit water	weekly interval	Apply only on those crops where flowering starts and continue till harvesting	2 lit
Agneyastra	100ml/ 15 lit water	Apply every alternate week	Along with other foliar applications	4 lit
Mathastra	100 ml/15 lit			4 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

7. Pulses/Oilseed/ Millet Group (50 decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	2ton/acre/season	Once	Once- During land preparation	1 T
Super compost	2 quintal/acre/season	Two times	• Line sowing (50kg) • 1st inter-culture (50kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	Once	Branching stage	1 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	Once	Flower initiation	1 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	Once	Pod filling stage	0.5 lit each
Agneyastra	100ml/ 15 lit water	Twice	• Branching stage and • Pod filling stage	1 lit
Mathastra	100 ml/15 lit water	Once	Flower initiation stage	0.5 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

8. Potato/Ginger/Turmeric Group (25 decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	4 quintal/acre/season	Three times	• Transplanting (50kg) • 1st inter-culture (25kg) • 2nd inter-culture (25kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	3 times at weekly interval	Start 15 days after transplanting and stop when flowering starts	1.8 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	2 times at weekly interval	Begin when flowering starts and continue till fruiting start	1.5 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	4 times at weekly interval	Start when fruit setting start and continue till harvest	1.2 lit each
Agneyastra	100ml/ 15 lit water	Apply every alternate week	From 1st inter-culture till harvesting	1.5 lit
Mathastra	100 ml/15 lit			1.5 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

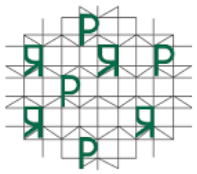
9. Maize (50decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	2ton/acre/season	Once	Once- During land preparation	1 T
Super compost	2 quintal/acre/season	Two times	• Line sowing (50kg) • 1st inter-culture (50kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	Thrice	• 15 Days after sowing • 30 Days after sowing • 45 Days after sowing	1 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	Once	• 60 Days after sowing (flowering stage)	1 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	Once	• 90 Days after sowing (grain filling stage)	0.5 lit each
Agneyastra	100ml/ 15 lit water	Thrice	• 15 DAS • 45 DAS • 90 DAS	1 lit
Mathastra	100 ml/15 lit water	Twice	• 30 DAS • 60 DAS	0.5 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

10. Wheat (50 decimal)

Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Once- During land preparation (green manuring/ residue incorporation)	2 T
Super compost	2 quintal/acre/season	Two times	• line sowing (50kg) • 1st inter-culture (50kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	Twice	At tiller initiation and second interculture	1.6 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	Once	Flag leaf initiation	1.2 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	Once	Grain filling stage	0.6 lit each
Agneyastra	100ml/ 15 lit water	Apply alternatively along with above foliar		1 lit
Mathastra	100 ml/15 lit water			1 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

11. Pumpkin/Water Melon Group (25 decimal)



Input used	Recommended dose	Frequency of Application	Stages of application	Total quantity
Improved FYM	4T/acre/season	Once	Apply on the main bed during bed preparation/ maintenance	1 Ton
Super compost	4 quintal/acre/season	Three times	• Transplanting (50kg) • 1st inter-culture (25kg) • 2nd inter-culture (25kg)	100 kg
Multi-seed Extract (A)	200 ml/15 lit water	3 times at weekly interval	Start 15 days after transplanting and stop when flowering starts	1.5 lit
Multi-seed Extract Booster (B)	200ml/15 lit water	2 times at weekly interval	Begin when flowering starts and continue till fruiting start	1.5 lit
Multi-seed mix (A and B)	100ml(A)+ 100ml(B) per 15lit water	3 times at weekly interval	Start when fruit setting start and continue till harvest	1.0 lit each
Agneyastra	100ml/ 15 lit water	Apply every alternate week	From 1st inter-culture till harvesting	1.0 lit
Mathastra	100 ml/15 lit			1.0 lit
Curative plant protection	If the pest infestation prevails, apply fungal/bacterial/insect control foliar solutions as per the recommendation.			

12. Orchard (50decimal)-No Fruiting Period

Year	Input used	Recommended dose	Frequency of Application	Stages of application
	Improved FYM	10kg per pit	Once	Pit filling
	Neem-cake, Bone meal, forest/healthy soil	1kg each per pit	Once	Pit filling
1st year	Super compost	0.5 kg/ plant	4 times	Apply these inputs alternately every month and repeat the cycle after 3 months
	Jeevamrit solution	200 ml/plant	4 times	
	Multi-seed extract-A	200ml/15 lit water	4 times	
2nd year	Super compost	0.5 kg/ plant	4 times	Apply these inputs alternately every month and repeat the cycle after 3 months
	Jeevamrit solution	200 ml/plant	4 times	
	Multi-seed extract-A	200ml/15 lit water	4 times	
		200 ml/plant		
3rd year	Super compost	0.5 kg/ Plant	4 times	Apply these inputs alternately every month and repeat the cycle after 3 months
	Jeevamrit solution	200 ml/plant	6 times	
	Multi-seed extract-A	200ml/15 lit water	6 times	
All the 3 years	Agneyastra	100 ml/15 lit water	Monthly	Apply alternatively along with above foliar
	Mathastra	100 ml/15 lit water		

12. Orchard (50decimal): Fruiting Period

Input used	Application type	Recommended dose	Frequency of Application	Stages of application
Jeevamrit solution	Drenching at the root zone	2 lit/plant	Bimonthly	Regular
Multiseed extract-A	Foliar application	200 ml/15 lit water	2 times- 15 days interval	• Start at fruit setting till harvesting
Multiseed extract- B	Foliar application	200ml/15 lit water	2 times- 15 days interval	• Bud initiation • Pollination/flowering
			2 times – Monthly interval	• After harvest (June) • After pruning (August)
Agneyastra	Foliar application	100 ml/15 lit water	Apply alternatively every month alone or along with above foliar	
Mathastra	Foliar application	100 ml/15 lit water		
Curative plant protection	Foliar application	If the pest infestation prevails, apply fungal control foliar or bacterial control foliar or insect control foliar as per the recommendation.		

This schedule starts once we go for harvesting fruit from the plants

Pest control: Curative measures

1. Bacterial Wilt Challenge (Low infestation)	
Day-1	Soil Drenching of Cow urine (500ml, Lime (15gm), Hing (20 gm) per 16lit water tank
Day-2	Soil Drenching of Cow urine (500ml, Lime (15gm), Hing (20 gm) per 16lit water tank
Day-4	Soil drenching of Tricoderma (25 gm) and Pseudomonas (25gm) with 16lit water in tank
Day-5	Soil drenching of Tricoderma (25 gm) and Pseudomonas (25gm) with 16lit water in tank

2. Leaf Curl Challenge (Low infestation)	
Day-1	Foliar spraying of Agneyastra (50 ml) in 16lit tank
Day-3	Foliar spraying of Agneyastra (50 ml) in 16lit tank
Day-5	Foliar spaying of 250ml cowmilk and 25ml of Bel/Tulsi leaf-extract per 16lit tank
Day-7	Foliar spaying of 250ml cowmilk and 25ml of Bel/Tulsi leaf-extract per 16lit tank

3. Fungal infection challenge: (Low infestation)	
Day-1	Mathastra 100 ml per and cow urine 100 ml in 16 lit tank spraying
Day-2	Mathastra 100 ml per and cow urine 100 ml in 16 lit tank spraying
Day 7	Solution1: Mathastra 100 ml per and cow urine 100 ml in 16 lit tank spraying

4. Insect infection challenge: (Low infestation)	
Day-1	Foliar spraying of Agneyastra (50 ml) in 16lit tank
Day-3	Foliar spraying of Agneyastra (50 ml) in 16lit tank
Day-7	Foliar spraying of Agneyastra (50 ml) in 16lit tank

Double the dose if the infestation is high.

Some Critical Agronomic Practices

- Nipping/tipping of pulses like Arahar, Gram etc.
- Earthing up in crops like Sugar cane, Ginger, Potato, Groundnut and Maize
- Orchard: Pruning should be done after harvesting
- Line sowing in all field crops- avoid broadcasting
- 3G cutting in case of creepers to encourage branching
- Manual pollination if required especially in creepers
- Provide physical support(e.g. staking) for succulent plants like tomato

Some Consideration in Foliar Application

- Apply all foliar ingredients together where schedule matches. *Agneyastra and Mathastra* should be mixed in the tank at the end while preparing the tank solution. This should be done just before spraying.
- Sequence of mixing different ingredients:
  - Add water to the tank
  - Multiseed extract- A
  - Multiseed extract-B
  - Agneyastra or Mathastra
  - Use adhesive at last
- Timing of spraying: early morning or evening hours
- Do not use hard water (*khar pani*) to prepare foliar mix. Use soft water (rain water, or water which is suitable for drinking)
- Use adhesive like detergent/ *Reetha*/ *Aloe vera*.
- Avoid spraying within 3 hour of rain and when wind blows at high speed.
- Clean the spraying tank thoroughly after each spraying.
- In case of multi cropping scenario, use the bio-inputs as prescribed for the main crop

Thanks

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