

Seed Treatment Techniques

The Revitalizing Rainfed Agriculture Network (RRAN) is a growing network of civil society organizations, research institutions, policy makers, donors and individuals engaged in evolving a differentiated agricultural policy with enhanced public investments and support system for rainfed areas in India. The Comprehensive Pilots (CPs) are part of the RRA Network's action research programme that seeks to establish evidence and experience on the ground, in support of the various propositions that the Network has developed. In order to offer support for CPs a set of organizations have been identified as Nodes on specific identified themes such as – seeds, soils, water, millets, fisheries, livestock, credit, markets and institutions.

The Centre for Indian Knowledge Systems (CIKS) has been identified and functioning as the nodal anchor for the theme of seeds. A series of booklets is being published on various technical and institutional aspects of seed systems to build the capacity of the CPs as well as various field groups who are involved in the efforts to build community managed seed systems.

This book provides information on seed treatment procedures for seeds of a variety of crops. All the procedures that have been mentioned are with the use of natural products. The procedures have been explained in detail.



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PREFACE

The Revitalizing Rainfed Agriculture Network (RRAN) is a growing network of civil society organizations, research institutions, policy makers, donors and individuals engaged in evolving a differentiated agricultural policy with enhanced public investments and support system for rainfed areas in India. Based on the vast experience on the ground and analysis of issues, RRA Network is evolving specific propositions on various aspects of rainfed agriculture such as seeds, soils, water, crop systems, millets, livestock, fisheries, credit, markets and institutions. The Comprehensive Pilots (CPs) are part of the RRA Network's action research programme that seeks to establish evidence and experience on the ground, in support of the various propositions that the Network has developed. In order to offer support for CPs a set of organizations have been identified as Nodes on specific identified themes such as – seeds, soils, water, millets, fisheries, livestock, credit, markets and institutions.

The Centre for Indian Knowledge Systems (CIKS) has been identified and functioning as the nodal anchor for the theme of seeds. The CPs started functioning in the year 2012 and in June 2012 the seed node convened a meeting of representatives of CPs for an inception workshop in Chennai. During this workshop the CPs shared their proposals and plans of work as well as their thinking about the work that they plan to undertake in the area of seeds. Presentations were made during the workshop on how to undertake a situation analysis with respect to seeds, the elements of designing a robust seed system for rainfed areas and also about undertaking a planning exercise through which each CP can proceed towards the establishment of a robust community managed seed system in its area of work. A part of the workshop was to identify the specific needs expressed by each of the CPs in terms of the support and help they would need in the area of seeds. A beginning was made in terms of the capacity building exercise through a series of presentations.

Beginning from the early part of the year 2012 Dr. G. Venkat Raman of the Seed node had started making a series of visits to various CPs. During the visits he provided help and assistance to the CPs for performing situation analysis, evolving a plan for a robust seed system for the area undertaking capacity building exercises and also trying to create linkages between the groups and scientists and institutions who could provide technical support. During this process he also identified various needs in the form of topics on which training and capacity building was required.

Subsequently, on two different occasions when the seed node team met the CPs – in Bagli in Madhya Pradesh in November 2012 and in Tiptur in Karnataka in December 2012 there were opportunities to review the progress of each CP as well as provide technical inputs and training. Earlier this year, towards the end of July 2013 a workshop was held by the seed node in the CIKS Technology Resource Centre in the Kancheepuram district of Tamil Nadu. In this workshop a series of technical trainings were provided on various aspects of seeds. The training was not only in the

form of lectures and presentations but also included field work, experiments, visits to government and private seed farms and seed production centres as well as meetings with the officials of the Directorate of Agriculture and Seed Certification departments. During these meetings drafts of some of the technical training modules that were prepared were circulated and comments and suggestions were sought from the CPs. Based on these efforts and also building upon discussions that took place during the visits to CPs a set of topics had been identified to produce training modules. We expect this process to be dynamic and interactive so that changes can be made based on the suggestions received from the various user groups. A series of reports and books that have been circulated and discussed as drafts and presentations are now being brought out as publications.

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About this Book

This book provides information on seed treatment procedures for seeds of a variety of crops. All the procedures that have been mentioned are with the use of natural products. The procedures have been explained in detail.

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INTRODUCTION

Seed borne infestation of insects and diseases pose devastating consequences to crop production. The concept of seed treatment is the use and application of biological and chemical agents that basically can control or contain primary soil and seed borne infestation. This helps to improve crop safety which in turn leads to good establishment of healthy and vigorous plants which results in better yields.

The benefit of seed treatment leads to increased germination and ensures uniform seedling emergence. As already seen it protects seeds and seedlings from early season diseases and insect pests thereby improving crop emergence and growth. Treating seeds with *Rhizobium* also enhances the nitrogen fixing capability of legume crops and their productivity. Overall seed

treatment leads to improved plant population and thus higher productivity.

It is estimated that 80% of the seeds sown in our country is untreated as against 100% seed treatment practice in developed countries. Seed treatment also gives protection to the emerged seedlings from sucking insect pests. This book provides information on seed treatment procedures for the seeds of a variety of crops. All the procedures that have been mentioned are with the use of natural products. The procedures have been explained in detail. Several procedures have been given for a single crop. The users can choose the method of treatment depending on the availability of the resource or disease / pest prevalent in their region.



SEED TREATMENT TECHNIQUES FOR PADDY

Seed Treatment for Improved Germination

- Dry seeds in bright sun light (between 12.00 p.m. to 1.00 p.m.) for half an hour before sowing to improve the germination and seedling vigour.
- Soak the paddy seeds along with a gunny bag in water for 12 hours and then soak in biogas slurry for 12 hours before sowing.
- Soak paddy seeds in *Panchagavya* (35 ml per litre of water) for 30 hours before sowing.
- Soak paddy seeds tied in khada cloth in sweet flag extract (500 gms of sweet flag rhizome powder in 2.5 litres of water) for 30 minutes and shade dry before sowing.
- Soaking the seeds in cow dung extract enhances the germination capacity. Take ½ kg of fresh cow dung and 2 litres of cow's urine and dilute with 5 litres of water. Soak 10 - 15 kg of seeds that are previously soaked in water for 10 - 12 hours, in this cow dung extract for 5 - 6 hours. Dry the seeds in shade before sowing in the nursery.
- Fill the paddy seeds in a closely-knit bamboo basket lined with *Salvadora persica* leaves at the bottom and pour about 10 to 12 litres of water over the basket. Cover the basket with *Salvadora* leaves and place a weight over it. Leave the setup undisturbed for 24 hours before sowing. This will help in early and vigorous germination.
- Mix biofertilizers like *Azospirillum* / *Phosphobacteria* / *Pseudomonas* (@ 1.25 kg / 60 – 70 kg of seeds) in one litre of cooled rice gruel and mix it with sprouted seeds and shade dry for 30 minutes before sowing.

Seed Treatment for Healthy Seedlings

- Take the paddy seeds in a tightly closed gunny bag and soak it in the biogas slurry for 24 hours before sowing to get green and healthy seedlings with well developed root

system. These seedlings will get established well soon after the transplantation.

- Collect cow's urine in a mud pot and keep it for 48 hours. Soak paddy seeds in 10% of this cow's urine (100 ml cow's urine in 1 litre of water) before sowing for healthy crop. Seeds should be shade dried for half an hour before sowing.
- Mix *Vitex*, *Tulsi* and *Pongam* leaves extract (pound 3 kgs of each leaves and extract) with fresh cow dung solution and soak 25 kg of paddy seeds tied in a gunny bag in this solution for 12 hours. Seeds should be shade dried for half an hour before sowing. This will produce healthy and disease resistant seedlings.

Note : 3 kgs of each of the leaves should be collected and pound. This should be added to 1 litre of water and the extract is filtered. This should be added to fresh cow dung extract (5 kg cow dung in 15 litres of water).

Seed Treatment for the Prevention of Pest and Disease Attack

- Soak seeds in water for 12 hours and then mix it with 10% cow's urine (10 ml cow's urine + 90 ml water) or 5% *prosophis kashaayam* (5 ml *kashaayam* + 95 ml water) and dry it for 30 minutes. Use the seeds for sowing within 24 hours. This will enhance the resistance of the paddy against bacterial leaf blight disease.
- Soak paddy seeds tied into small bundles using kada cloth in cow's urine solution (500 ml of cow's urine with 2.5 litres of water) for 30 minutes and shade dry before sowing. This method of seed treatment prevents the crop from seed borne fungal and bacterial diseases.
- Soak paddy seeds in 20% mint (*Mentha sativa*) leaf extract (200 ml of leaf extract mixed with 800 ml of water) for 12 hours before sowing. This will increase the germination rate and

vigour of seedlings. This will also help in the control of *Helminthosporium* leaf spot disease in paddy.

- Soak the sprouted seeds of paddy tied in small bags in sweet flag solution (500 gms of sweet flag rhizome powder in 2.5 litres of water) for 30 minutes and shade dry before sowing. This will improve the resistance of the seedlings against Seed borne bacterial and fungal diseases.

Seed Treatment for Protection and Nutrition

- Mix paddy seeds with cow dung before sowing. The cow dung covering the seeds will protect them from birds and other insects in the nursery and also acts as manure for seeds. This practice increases the drought resistance and acts as a seed hardening measure. It is generally preferred for dryland paddy cultivation.



SEED TREATMENT TECHNIQUES FOR PULSES

Chickpea

- Soak seeds in water before sowing to enhance the germination percentage of the seeds.
- Smear seeds (1 kg) with a mixture of turmeric and sweet flag powder (50 gms turmeric powder and 15 gms sweet flag powder with 10 ml of water) and sow after 10 minutes. This will enhance the disease resistance of the crop.
- Smear seeds with mustard oil @ 100 ml / 40 kg of seeds before sowing to prevent wilt disease.
- Soak seeds of pigeon pea / chickpea in curd for 24 – 48 hours before sowing to control wilt disease.

Bengalgram

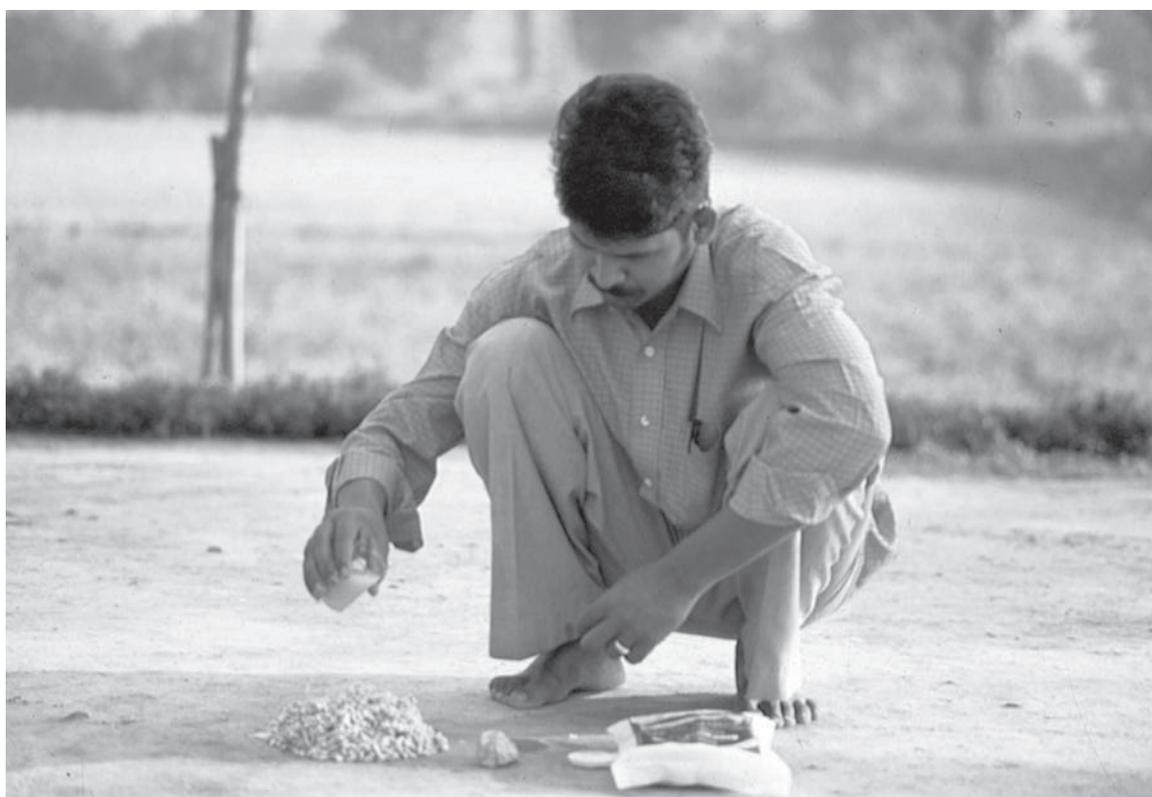
- Mix seeds with well fermented (sour) butter milk and shade dry before sowing. The acidic nature of the butter milk reduces the incidence of wilt and dry root rot diseases.

Blackgram and Greengram

- Treat seeds with *Trichoderma viride* @ 4 gms/kg of seeds or *Pseudomonas* @ 10 gms/kg of seeds for the protection against disease causing microorganisms.

Seed Pelleting in Greengram

- Take the seeds in a plastic tray and add a small quantity of adhesive (10% maida solution) to the seeds. Shake this gently to enable the seeds to spread evenly on all parts of each of the seed. Add *Arappu* powder (*Albizia amara*) as filler material evenly over the seeds and continue shaking until the uniform coating is ensured. Remove the seed clumps manually and also the excess filler material by sieving. Shade dry this before sowing. This process helps to handle small and irregular shape seeds. It also enables precision sowing of seeds and physiological characters of seeds are strengthened.



SEED TREATMENT TECHNIQUES FOR MILLETS

Maize

- Soak seeds in 2% *Panchagavya* (20 ml of *Panchagavya* in 980 ml of water) for 2 hours before sowing for the production of healthy seedlings.

Sorghum (*Jowar*)

- Treat the seeds with asafoetida solution (75 – 100 gms in 1 litre of water) and shade dry before sowing. This seed treatment method prevents ergot disease in sorghum.
- Mix the seeds with the extract of *Ashwagandha* and *Datura* (for 1 kg seeds, pound 250 gms of *Ashwagandha* / *Amukura* (*Withania somnifera*) roots and 50 gms of *Datura* / *Oomathai* (*Datura metel*) leaves by adding water) and shade dry before sowing. This will help in the production of healthy and disease free seedlings.
- Treat the seeds with dried cow dung powder and cow's urine (100 gms cow dung powder

and 250 ml cow's urine per kilogram of seeds). This will break the dormancy and improve germination.

- Soak the seeds in lime water (1 kg lime in 10 litres of water kept for 10 days and the superficial water is collected and used) for overnight. Dry the seeds before sowing.

Pearl Millet and Finger Millet

- Soak seeds of pearl millet / finger millet in *Panchagavya* (35 ml in one litre of water) for 7 – 8 hours before sowing for the production of disease free seedlings.
- Mix the seeds with the extract of *Ashwagandha* and *Datura* (for 1 kg seeds, pound 250 gms of *Ashwagandha* / *Amukura* (*Withania somnifera*) roots and 50 gms of *Datura* / *Oomathai* (*Datura metel*) leaves by adding water) and shade dry before sowing. This will help in the production of healthy and disease free seedlings.



SEED TREATMENT TECHNIQUES FOR OILSEEDS

Groundnut

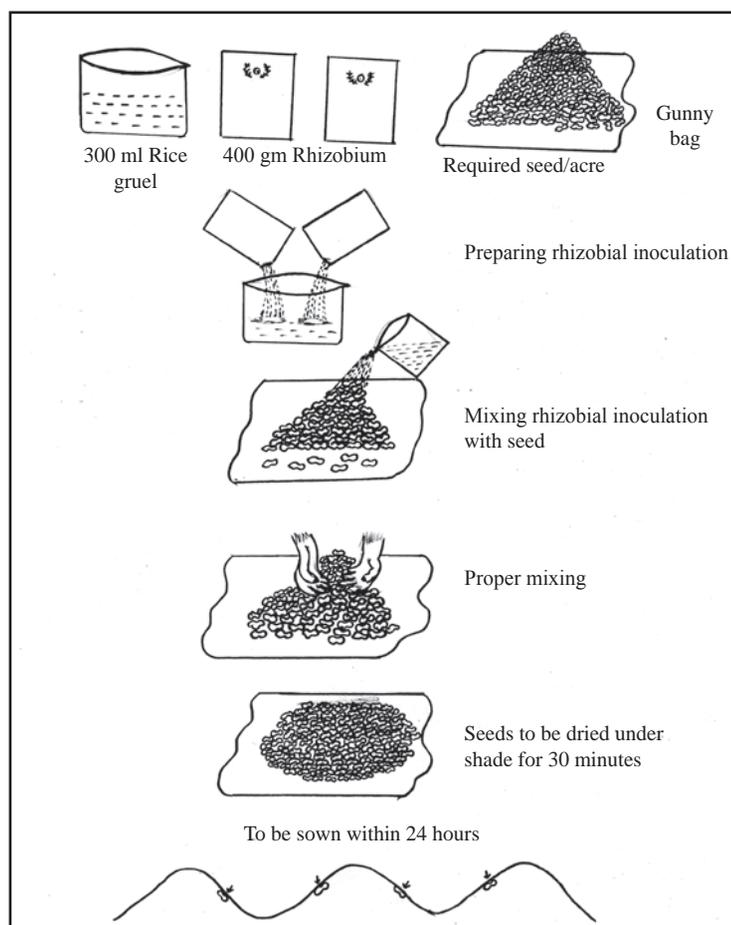
- In Groundnut, the pre germinated seeds are used for sowing to get good yield by maintaining optimum plant population in the field. Soak the seeds tied in a gunny bag in water for 4 – 6 hours. Then untie the gunny bag and cover it with another wet gunny bag for 12 – 14 hours. Shade dry the germinated seeds for 3 – 4 hours and treat with *Rhizobium* (@ 600 gms / 110 – 120 kg of seeds) and sow within 1 or 2 days.
- Smear the seeds with *kallipal* (milky latex from leafy spurge or milk hedge) before sowing @ 100 gms of *kallipal* / 10 kgs of seeds. This will protect the crop from pest and diseases.
- Soak the seeds in asafoetida solution (250 gms in 2 litres water) for 12 hours before sowing to prevent blight disease.

- Treat the seeds with *Trichoderma viride* (4 gms/kg of seeds) or *Pseudomonas fluorescens* (10 gms/kg of seeds) and sow after 24 hours.
- Treat the seeds with *Rhizobium* (5 gms/kg of seeds) mixed with cool rice gruel and shade dry for 30 minutes before sowing. There are chances of tearing of the seed coat hence seed treatment should be done with care.
- Soak the seeds in *Jeevamirtham* / *Amirthakaraisal* / *Panchagavya* for 4 - 6 hours and shade dry before sowing.

Coconut

- Allow the seed coconuts to float on the surface of irrigation well or water. This will enhance the germination and seed coconuts will germinate within a month. This method is widely followed in Kerala.

Groundnut seed treatment



SEED TREATMENT TECHNIQUES FOR VEGETABLES

- Soak all kinds of vegetable seeds in biogas slurry for 30 minutes before sowing.
- Soak vegetable seeds in 2% *Panchagavya* (20 ml of *Panchagavya* in 980 ml of water) for 30 minutes before sowing for the production of healthy seedlings.

Bhendi

- Treat seeds with 15% or 25% raw cow's milk (150 ml of milk in 850 ml of water or 250 ml of milk in 750 ml of water) for 6 hours and then sow. This will increase the germination percentage and seedling vigour. It will also reduce the intensity of the vein clearing disease and increase the yield.
- Soak seeds in cow's urine at 5% or 10% concentration (50 ml of cow's urine in 950 ml of water or 100 ml of cow's urine in 900 ml of water) for 12 hours before sowing for good germination percentage.
- Soak seeds in 1 - 2% of *Panchagavya* (10 - 20 ml of *Panchagavya* in 990/980 ml of water) for 6 hours before sowing. This will improve the germination and seedling vigour.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds.
- Treat the seeds with biofertilizers - *Azospirillum* and *Phosphobacteria* (each @ 60 gms mixed with 60 ml of rice gruel for one kilogram of seeds) and shade dry for 30 minutes before sowing.
- For summer crop, soak the seeds in water for 12 hours before sowing.
- Soak the seeds in sweet flag *rhizome* extract or cow's urine solution (dilution 1:5 ratio – 1 part of extract or cow's urine in 5 parts of water) for 30 minutes before sowing. This will enhance the resistance against bacterial and fungal diseases.

Brinjal

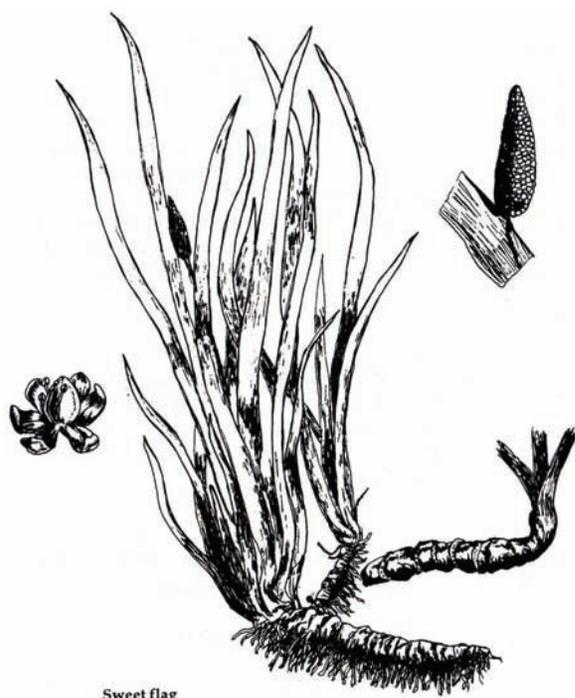
- Soak the seeds in 12% raw cow's milk (120 ml of raw cow's milk in 880 ml of water) for good germination percentage and seedling vigour. The germination speed is also increased.
- Seeds should be soaked in a solution of cow's urine (1 part cow's urine + 5 parts of water) for 30 minutes prior to the sowing. This will inhibit the seed borne diseases like fruit rot and die back.
- Seeds should be bundled using a thin cotton cloth and soaked in the biogas slurry for 12 hours prior to the sowing. This will kill all the disease causing microbes and also enhance the seed vigour.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds or with *Pseudomonas* @ 10 gms/kg of seeds and then sow after 24 hours.

Bitter Gourd

- Soak the seeds in diluted cow's urine for 12 hours and in diluted cow's milk for 6 hours before sowing for good germination percentage. The dilution should be at the ratio of 1:1 (1 part of cow's urine or cow's milk with 1 part of water).
- Soak the seeds in raw cow's milk for 24 hours before sowing for good germination and yield.

Tomato

- Fumigate the seeds with *Vasambu* (*Acorus calamus*) and *Vaividanga* (*Embelia ribes*) powder. Take seeds in a metal sieve. Take hot coal in a metal plate and sprinkle *Vasambu* or *Vaividanga* powder over the hot coal and hold the sieve with seeds against the fumes in a standing position for 2 – 3 minutes. This will enhance the germination rate and protect the seedlings from fungal pathogens. For treating 100 gms of seeds 5 gms of Sweet



Sweet flag

flag or *Vasambu* and 5 gms of *Vaividanga* is required.

- Soak the seeds tied in a khada cloth in diluted milk solution (75 ml milk and 425 ml water) for 6 hours and then sow. This will prevent the infection of seed borne diseases and enhance germination.
- Soak the seeds in a mixture of fermented buttermilk (3 days old) and water in 1:4 ratio for 6 hours and shade dry before sowing. The practice is applicable only for 6 to 12 months old seeds. Buttermilk can be replaced by Coconut or Palmyra toddy.
- Soak the seeds in sweet flag rhizome extract (dilution 1:5 ratio – 1 part of extract in 5 parts of water) for 30 minutes before sowing. This will enhance the resistance against bacterial and fungal diseases.
- Treat the seeds with *Trichoderma viride* and *Pseudomonas fluorescens* (@ 5 gms /100 gms of seeds). This will help in the control of early blight and other pathogens.

Chillies

- Soak seeds in sweet flag extract or cow's urine at 1:5 ratio (1 part of extract or cow's urine with 5 parts of water) for 30 minutes before sowing. This will inhibit the seed borne diseases like fruit rot and die back.
- Soak seeds tied in a cotton cloth in biogas slurry for 12 hours before sowing. This will

kill the disease causing microbes and enhance the seed vigour.

- Treat the seeds with *Trichoderma viride* @ 4gms/kg of seeds and then sow after 24 hours.

Bottle Gourd

- Soak seeds in water for 24 hours before sowing to break the dormancy and to quicken the germination.
- Soak seeds in warm water for 30 minutes before sowing. This helps in the softening of the hard seed coat.
- Soak seeds in cow's urine solution (1 part cow's urine + 5 parts of water) for 30 minutes prior to the sowing. This will inhibit the seed borne diseases.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds and then sow after 24 hours.

Snake Gourd

- Treat the seeds with cow dung @ 1 kg per kg of seeds for 30 minutes. This will increase the drought resistance and make the seeds germinate quickly.

Beans

- Soak the seeds in raw cow's milk for 24 hours before sowing for good germination and yield.
- Treat the seeds with powder form of *Trichoderma viride* @ 4 gms/kg or *Pseudomonas* @ 10 gms/kg of seeds. Seed treatment with *Trichoderma* or *Pseudomonas* protects the crops from disease causing microorganisms.

Root Vegetables

- Soak the seeds of beetroot and radish tied in a cotton cloth in water overnight or in warm water for 30 minutes before sowing. This will help to quicken the germination and result in fast growth and healthy plants.
- Soak seeds in a solution of cow's urine (1 part cow's urine + 5 parts of water) for 30 minutes prior to the sowing. This will inhibit the seed borne diseases.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds and then sow after 24 hours.

SEED TREATMENT TECHNIQUES FOR OTHER CROPS

Banana

- Dip the banana setts in medium hot water for half an hour before planting. This will help in the prevention of root rot and root borer attack.
- Treat the banana setts in diluted *Panchagavya* @ 1.5 litres in 50 litres of water. Dip the banana setts in this solution for half an hour before planting.

Sugarcane

- Dip the sugarcane setts in an extract of *Keezhanelli* (*Phyllanthus niruri*), *Poovarasu* (*Thespesiapopulnea*) and *Pongam* (*Pongamia pinnata*) (Dry and boil 1 kg of leaves of each type with enough water and filter after 2 days and use) and cover it with a wet gunny bag for a day and plant on the next day. This will control the seed borne diseases.

Cotton

- Seeds for rainfed and summer sowing should be hardened using 1% *Prosopis* and *Pungam* leaf extract (10 ml of each extract in 980 ml of water) to resist water stress.
- Treat seeds with termite hill soil to get resistance for drought and grow luxuriantly. Prior to this treatment seeds should be soaked in water for 6 hours. Mix equal quantities of termite hill soil and water and mix it with seeds and dry for 1 hour before sowing. Seeds should be shade dried for half an hour before sowing.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds. Mix *Trichoderma* in 100 ml of cooled rice gruel and mix it with seeds and then sow the seeds within 24 hours. Seeds should be shade dried for half an hour before sowing.

Cardamom

- Soak one kilogram of seeds in a mixture of *Panchagavya* (100 ml), *Pseudomonas* (100 gms) and water (5 litres) for 30 minutes. Then mix the seeds with ash and shade dry before sowing.

Cumin

- Smear the seeds with castor oil @ 2 litres / 25 kg of seeds before sowing for the prevention of wilt disease.
- Mix the seeds with salt water (250 gms of salt in 5 litres of water for 10 kg of seeds) before sowing. This treatment is also believed to increase the yield.

Flower Crops and Trees

- Soak the seeds of Sunflower and Tamarind in a mixture of wheat flour, rice flour, black gram, ground sesame and milk (50 gms of each diluted in 1 litre of fresh buffalo milk) overnight. Shade dry and fumigate with turmeric for one minute before sowing. For fumigation take the seeds in a sieve or a wire mesh. Take hot coal in a metal plate and sprinkle the turmeric powder over it. Stand close to the hot coal plate and fumigate the seeds by holding the sieve against the fumes for one minute. This will enhance the germination percentage and growth rate.
- Soak the seeds of Balsam in a mixture of wheat flour, rice flour, black gram flour, turmeric and milk (50 gms of each diluted in 1 litre of fresh buffalo milk) overnight and shade dry before sowing. This will enhance the germination percentage and growth rate.

General Seed Treatment Techniques

- Smear all types of seeds with a paste of ash and water and dry it under the sun before sowing. This will control the seed borne diseases and enhance seed vigour and germination percentage.
- Treat the seeds with butter milk (125 ml / kg of seeds) to prevent fungal diseases in crops.
- Mix the seeds of cereals, legumes and cotton in cactus (*Euphorbia nerifolia*) milk solution (100 ml in 1 litre of water) and dry in darkness for 8 hours before sowing. This will enhance the protection from stem borer larvae, termites and other pests.

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APPENDIX – I PREPARATION PROCEDURES OF BOTANICALS AND ANIMAL PRODUCTS

1. Panchagavya

Requirements: Plastic Barrel, Measuring cylinder, Khada cloth

Raw Materials

Cow dung	5 kg
Cow's urine	3 L
Cow's milk	2 L
Curd	2 L
Ghee	1 L

Procedure

1. Collect fresh Cow dung, mix it with ghee and keep it in a plastic barrel separately for 3 days.
2. On the same day, mix the other ingredients [Cow's urine, cow's milk and cow's curd] in a plastic barrel separately.
3. On the 3rd day, mix the contents in a barrel and keep it open for 7 days. Stir the contents with a wooden stick twice a day.

4. Cover the mouth of the barrel with the wire net or khada cloth.
5. After 7 days, filter the product with a khada cloth / Terracotta (TC) cloth and store it in closed containers. (Pierce small holes in the cap of the containers to prevent bursting)
6. Quantity obtained is 10 litres.

Observations

Colour	Light Brown colour, highly dense fluid
Aroma	Fermented odour

Note:

- Avoid airtight bottles for storage.
- Shake the bottle once in 3 days to avoid fungal mycelia growth on the surface.
- Use wooden sticks for stirring
- The water used can be tap water.
- Milk should be boiled and cooled before mixing with other ingredients.



2. Sweet Flag Extract

Sweet flag extract is prepared by mixing 500 gms of powdered sweet flag rhizome in 2.5 litres of water. The seeds should be tied in small cloth bags and soaked in the extract for half an hour. They should then be dried in shade before sowing.

3. *Prosopis Kashayam*

- Collect 2 kg of *Prosopis* plants except roots and weight it in balance.
- Cut into small pieces.
- Transfer the chaffed leaves into a wide mouthed brass vessel and add 8 litres of water (4 times the quantity of leaves)
- Boil the vessel on a low flame until the contents are reduced to 1/4th of the original volume.
- Allow it to cool.
- Filter the solution using khada cloth.
- Store the product in white colour canes.
- Quantity collected – 2 litres

5. *Amirthakaraisal*

Take fresh cow dung (10 kg), cow's urine (10 litres), country jaggery (1 kg) and water (100 litres) in a cement tank and mix well. This extract can be used on the next day for seed treatment.

6. *Jivamirtham*

Ingredients: Cow dung – 10 kg, cow's urine – 10 litres, jiggery (old) – 2kg, flour of gram / pigeon pea/ moong dal / cowpea / urad dal – 2 kg, live soil – 1 kg and water – 200 litres. Take 100 litres of water in a barrel and add 10 kg of cow dung and 10 litres of cow's urine. Mix well with the help of a wooden stick, add 2 kg of old jaggery and 2 kg of flour. Mix this solution well with wooden stick. Keep the solution undisturbed for 2 to 7 days for fermentation. Stir the solution regularly three times a day.

7. *Amrit Pani*

Mix 10 kg of cow dung with 500 gms of honey and mix thoroughly to form a creamy paste. Add 250 gms of ghee and mix at high speed. Dilute with 200 litres of water.



APPENDIX – II

COMMON AND SCIENTIFIC NAMES OF PLANTS

Sl. No.	English Name	Scientific Name
1.	Ashwagandha / Amukura	<i>Withania somnifera</i>
2.	Arappu / Oil cake tree	<i>Albizia amara</i>
3.	Banana	<i>Musa paradisiaca</i>
4.	Balsam	<i>Impatiens balsamina</i>
5.	Bean	<i>Phaseolus vulgaris</i>
6.	Beetroot	<i>Beta vulgaris</i>
7.	Bhendi	<i>Abelmoschus esculentus</i>
8.	Bitter gourd	<i>Momordica charantia</i>
9.	Blackgram	<i>Vigna mungo</i>
10.	Bottle gourd	<i>Lagenaria siceraria</i>
11.	Brinjal/Egg plant	<i>Solanum melongena</i>
12.	Cactus	<i>Euphorbia neriifolia</i>
13.	Cardamom	<i>Elettaria cardamomum</i>
14.	Cedar (<i>Thevatharu</i>)	<i>Cedrus deodara</i>
15.	Chickpea / Bengalgram	<i>Cicer arietinum</i>
16.	Chillies	<i>Capsicum frutescens</i>
17.	Coconut	<i>Cocos nucifera</i>
18.	Cotton	<i>Gossypium hirsutum</i>
19.	Cowpea	<i>Vigna sinensis</i>
20.	Cumin	<i>Cuminum cyminum</i>
21.	<i>Datura</i> / Oomathai	<i>Datura metel</i>
22.	Finger millet	<i>Eleusine coracana</i>
23.	Greengram	<i>Vigna radiata</i>
24.	Groundnut	<i>Arachis ipogeeae</i>
25.	Horseshoe vitex	<i>Vitex negundo</i>
26.	<i>Keezhanelli</i>	<i>Phyllanthus niruri</i>
27.	Leafy spurge or milk hedge	<i>Euphorbia tirucalli</i>
28.	Maize	<i>Zea mays</i>
29.	Mint	<i>Mentha sativa</i>
30.	Mustard	<i>Brassica sp.</i>

31.	Paddy	<i>Oryza sativa</i>
32.	Palmyra	<i>Borassus flabellifer</i>
33.	Pearl millet/ bajra	<i>Pennisetum glaucum</i>
34.	Pigeonpea	<i>Cajanus cajan</i>
35.	Pongam	<i>Pongamia pinnata</i>
36.	Portia (<i>Poovarasu</i>)	<i>Thespesia populnea</i>
37.	Prosopis	<i>Prosopis juliflora</i>
38.	Radish	<i>Raphanus sativus</i>
39.	Sesame	<i>Sesamum indicum</i>
40.	Snake gourd	<i>Trichosanthes cucumerina</i>
41.	Sorghum (<i>Jowar</i>)	<i>Sorghum bicolor</i>
42.	Sugarcane	<i>Saccharum officinarum</i>
43.	Sunflower	<i>Helianthus annuus</i>
44.	Sweet flag	<i>Acorus calamus</i>
45.	Tamarind	<i>Tamarindus indica</i>
46.	Tomato	<i>Lycopersicon esculentum</i>
47.	Tooth brush tree	<i>Salvadora persica</i>
48.	Tulsi	<i>Ocimum tenuiflorum</i>
49.	Turmeric	<i>Curcuma longa</i>
50.	Vaividanga	<i>Embelia ribes</i>
51.	Wheat	<i>Triticum aestivum</i>