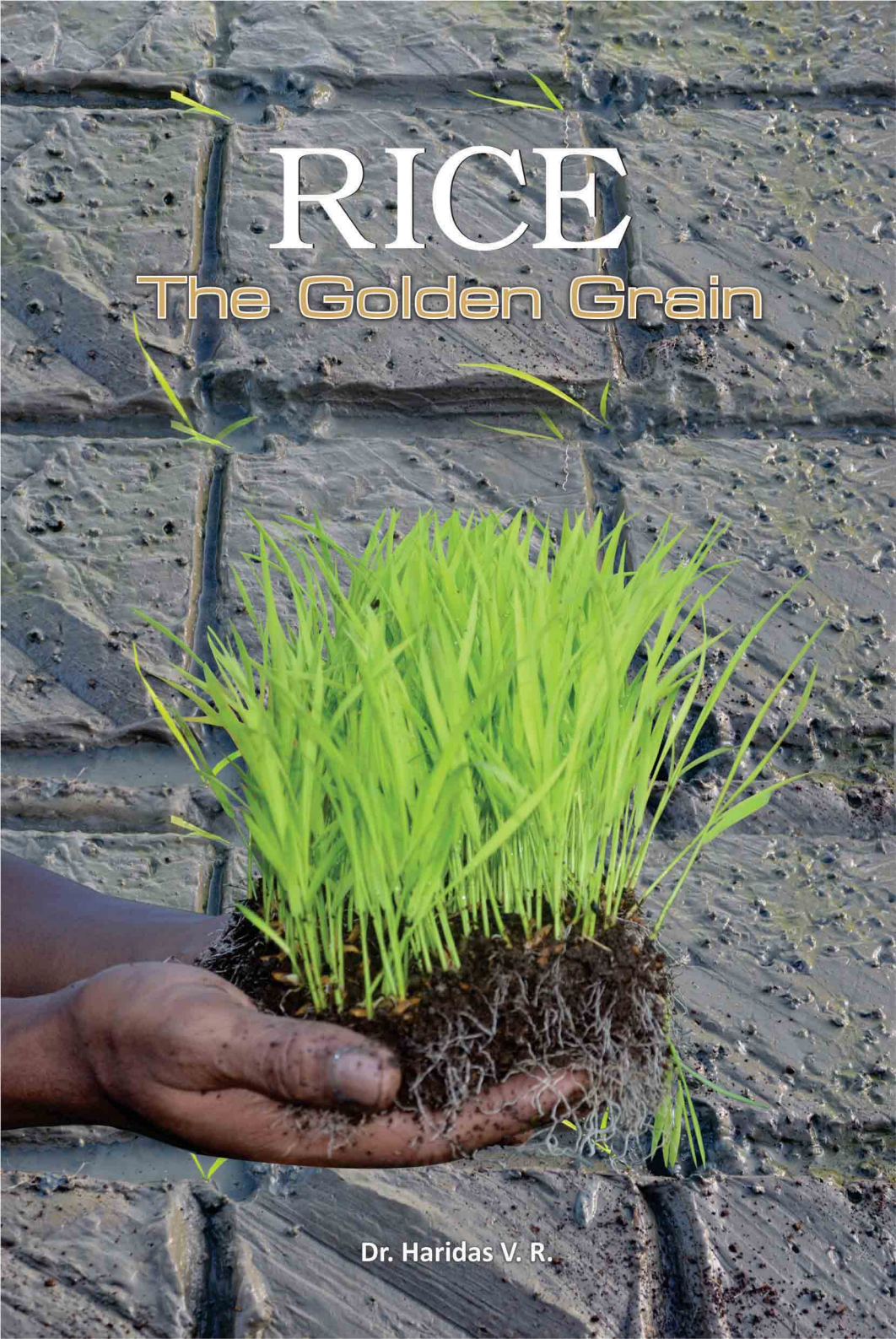
RICE
The Golden Grain
Dr. Haridas V. R.

RICE: THE GOLDEN GRAIN

Grow more and healthier organic rice

Organic System of Rice Intensification (SRI)

A Handbook for practicing farmers

Rice - The Golden Grain

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FOREWORD

Caritas India is the official organization of Church in India for social concern and development. Organic farming has been one of the thrust areas under the Natural Resource Management programme of Caritas India. This book is the outcome of the experiences of Dr. Haridas V.R. in promoting Organic Farming in various parts of Asia. It has proved to be the successful option to reduce external inputs, improve soil fertility and to ensure food safety.

The field testing of System of Rice Intensification (SRI) by our partners across the country has proved that this can be scaled up to more areas through capacity building of farmers by way of training, Farmers' Field School and by linking with agencies that support organic SRI.

Dr. Haridas has elaborated the whole process including seed selection, bed preparation, transplantation, water management, weed management, organic manure making and its application and methods of pest management. I am sure that this book will be a great contribution to organic farming sector, serving as a practical guide to agencies and practising farmers involved in organic rice cultivation.

It is happy to note that the publication of this book is at a time when Government of India is envisaging food security for all, offering practical steps in sustainable practices in rice cultivation, a major strategy to address food requirements of our country.

Fr. Varghese Mattamana
Executive Director
Caritas India

PREFACE

In the era of food scarcity, it is the time to seriously reflect on the ways and means to ensure self sufficiency in food as well as its safety. Concerted effort in organic rice cultivation is deemed as an effective strategy in this context.

Organic rice cultivation through System of Rice Intensification (SRI) is emerging as an effective alternative to conventional water and chemical intensive practice. It is an innovative way of rice cultivation solely driven by farmers. Field-testing in different parts of Asia has proved that rice production can be increased with less seeds, less water, no fertilizers, no pesticides, more soil organic matter and less input cost, thus reducing the burden on small farmers. The reduction in input and increased productivity has encouraged farmers to opt for this method.

Designed as a Handbook, my attempt has been to provide detailed processes and steps in organic rice cultivation adopting SRI. It is meant as a field resource material for individuals and groups working for the socio-economic development of farmers and a practical guide to practising farmers. I have tried to elaborate the methods of seed selection, bed preparation, transplantation, weeding, water managements, preparation of organic manures and growth promoters, and methods of pest management. Farmers can test this method for experimentation and validation in small experimental plots through control plots of both conventional and organic SRI.

A lot of time, energy and hard work have gone into gathering information and photographs of various measures, consolidation of the text and editing. I am grateful to Mr. Abraham Mathew, Mrs. Patricia Morris, Mrs. Sali Joseph, Mr. Sunil Simon, Mr. Shaji John, Mr. Thomas K Pathrose and many others who have helped me. As always, the affection and care of my wife Smitha and my son Adarsh have been my source of energy and support.

This publication would not have been a reality but for the inspiration and encouragement of Fr. Varghese Mattamana, Executive Director, Fr. Freddy D'Souza, Asst. Executive Director and Fr. Chinnappa of Caritas India to whom I owe my sincere gratitude.

Haridas V. R.
Manager (NRM)
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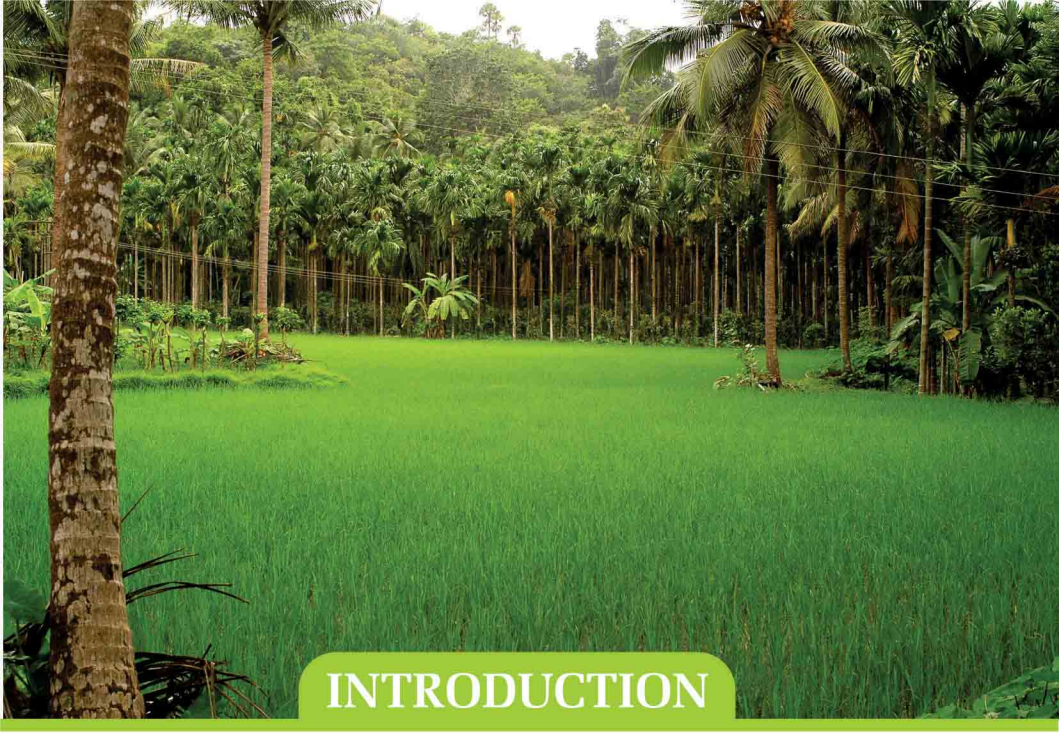
"If the bee disappears from the surface of the earth, man would have no more than four years to live. No more bees, no more pollination … no more men!"

Albert Einstein



INTRODUCTION

Agriculture in India became highly resource intensive with the advent of the Green Revolution. This had its impact on rice cultivation. With the shift from traditional farming practices, rice cultivation is characterized with excessive use of chemical fertilizers and pesticides. High yielding varieties require high chemical and water inputs and these are often applied indiscriminately. Though the overdose of chemical fertilizers and pesticides increases crop yield initially, it disturbs the soil structure. It contaminates the crop, soil as well as the groundwater.

… nitrogen fertilizer is "the third major threat to our planet after biodiversity loss and climate change."
— John Lawton, former Chief Executive, Natural Environment Research Council, UK

Encouraged by the initial increased productivity from modern methods of farming, farmers have adopted improved seed varieties and concomitant use of pesticides and chemical fertilizers abandoning their own traditional system of sustainable agriculture. Eventually, however, some farmers have realized that despite their hard toil, the productivity of the land has gradually decreased and investment has gone up.

The Indian Government contributed thousands of rice variety seeds to the gem plasm of International Rice Research Institute (IRRI) by way of technical collaboration. The Indian rice scientists received training from IRRI to introduce the package of practices instead of continuing with the tradition of maintaining diversity in paddy fields. Government of India introduced 5-6 varities of paddy which was supplied by IRRI to our government under International Agreement. Consequently, mono cropping in rice appeared in different parts of the country. Since heavy subsidies were available for improved seeds and chemical fertilizers, farmers were forced to promote the package of practices abandoning native systems of agriculture. Everywhere in India 2-3 varieties of rice dominated and established the mono cropping pattern. Farmers forgot the native systems of agriculture through the utilization of native seeds, native farm yard manures, green manures and other plant protection practices. This was an ideal system as it contributed to promoting self-reliance of farmers, protection of environment and stimulating harmony between humans, animals and plants for sustainable development.

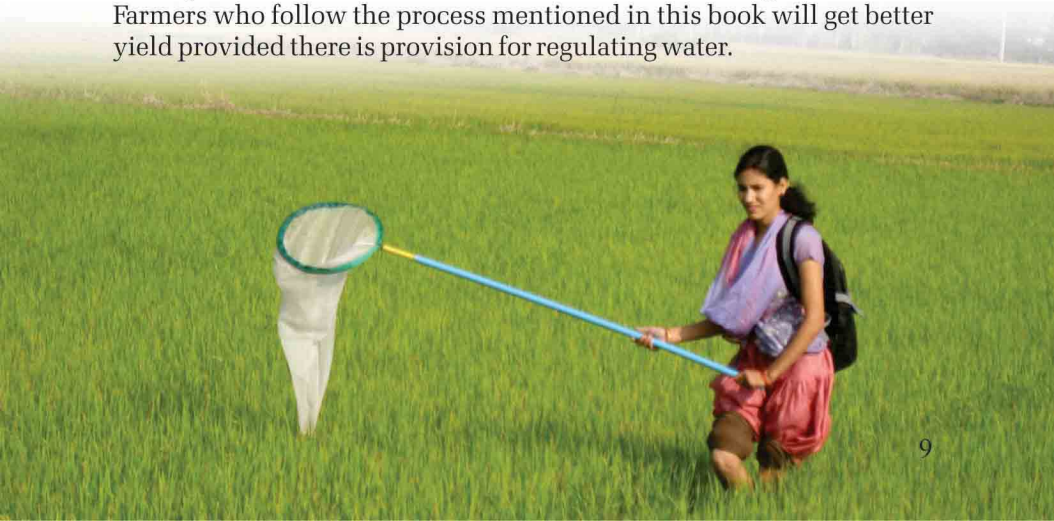
Traditionally farmers were practising different methods in farming. They played a key role in designing and developing various cultivation practices. Hence every farmer has to be treated as a scientist and an experimenter. There is a notion that what has been done in research plots and by scientists is modern and desirable. But farmer should not blindly follow what is suggested by others. They should understand the principles behind and decide upon what is to be done based on the local situation and resources.

In order to help our farmers and consumers we should find a way out from the use of chemical fertilizers and pesticides. In areas hit by water scarcity farmers are opting for crops other than paddy as conventional method of paddy cultivation is water-Intensive. However, the amount spent on seeds, irrigation, chemical fertilizers and pesticides nullifies the profit.

Everyone believes that rice is an aquatic plant and that it grows best in standing water. It is, however, a myth. Rice is not an aquatic plant; it can survive in water but does not thrive under reduced oxygen (hypoxic) levels. Rice plants spend lot of its energy to develop air pockets (aerenchyma tissue) in its roots under continuous inundation. But this is not the most efficient way to sustain the roots, and under flooded conditions, up to 3/4 of roots may die by the time of flowering (panicle initiation).

Organic rice cultivation through System of Rice Intensification (SRI) is emerging as an alternative to conventional water and chemical intensive practice...It is an innovative way of rice cultivation solely driven by the farmers. Rice production can be increased with less seeds, less water, no fertilizers, no pesticides, more soil organic matter and less input cost

Under the method proposed here, the soil only needs to be kept moist during the period of growth when the plant is putting out tillers, leaves and roots, before it begins to flower and to produce grains. Once flowering begins, a thin layer of water (1-2 cm) should be maintained continuously on the field. This requires only about half as much water as normally applied in irrigated rice. This method has been tested in many places and found to be very effective. Since this kind of paddy cultivation requires less water, involves less expenditure and gives more yields it is more beneficial for small and marginal farmers. Farmers who follow the process mentioned in this book will get better yield provided there is provision for regulating water.



In the past, a system of farming which provided the replenishment of soil nutrients and natural regeneration was followed. Thus, the traditional package of agricultural practices did not pose any threat to the stability of the ecosystem and the production was also by and large sufficient to meet the requirements of the population.

Organic rice farming uses no chemical fertilizers or pesticides. Although yields from organic rice are often not as large as from intensive, chemically treated varieties of paddy, the lower cost or production with reduced costs of treatments can actually make organic rice cultivation as profitable, and sometimes even more profitable. Systematic process of cultivation by adopting proper seed selection and use of good seeds, manure application, use of growth promoters in regular intervals, adoption of water and pest management practices will help farmers to spend less on cultivation and to gain more profit. In addition, adoption of organic techniques places a less strain on natural farming ecosystems.

Comparison of resource requirements in conventional and organic SRI method

Particulars	Conventional Method	Organic SRI
Seed requirement per acre	25-30 kilogram	3-4 kilogram
Transplanting seedlings	After 20–25 days	After 8-15 days
Spacing	5 x 5 centimeters	25 x 25 centimeters
No. of seedlings per hill	5 or more	1 or maximum 2
Planting	Deep	Shallow
Tillers	7-8	More than 20
Weeding	1-2 times	4-5 times
Fertlisation	Chemical fertilizers/pesticides	Organic manure, growth promoters and pest repellents
Water usage	Since it is flood irrigation water usage is very high	Nearly 40 % reduction in the use of water
Weed management	Weeds are manually removed from the field	Weeds are turn down in to the field by weeder

Conditions for the rice plant to achieve full potential and give high yield

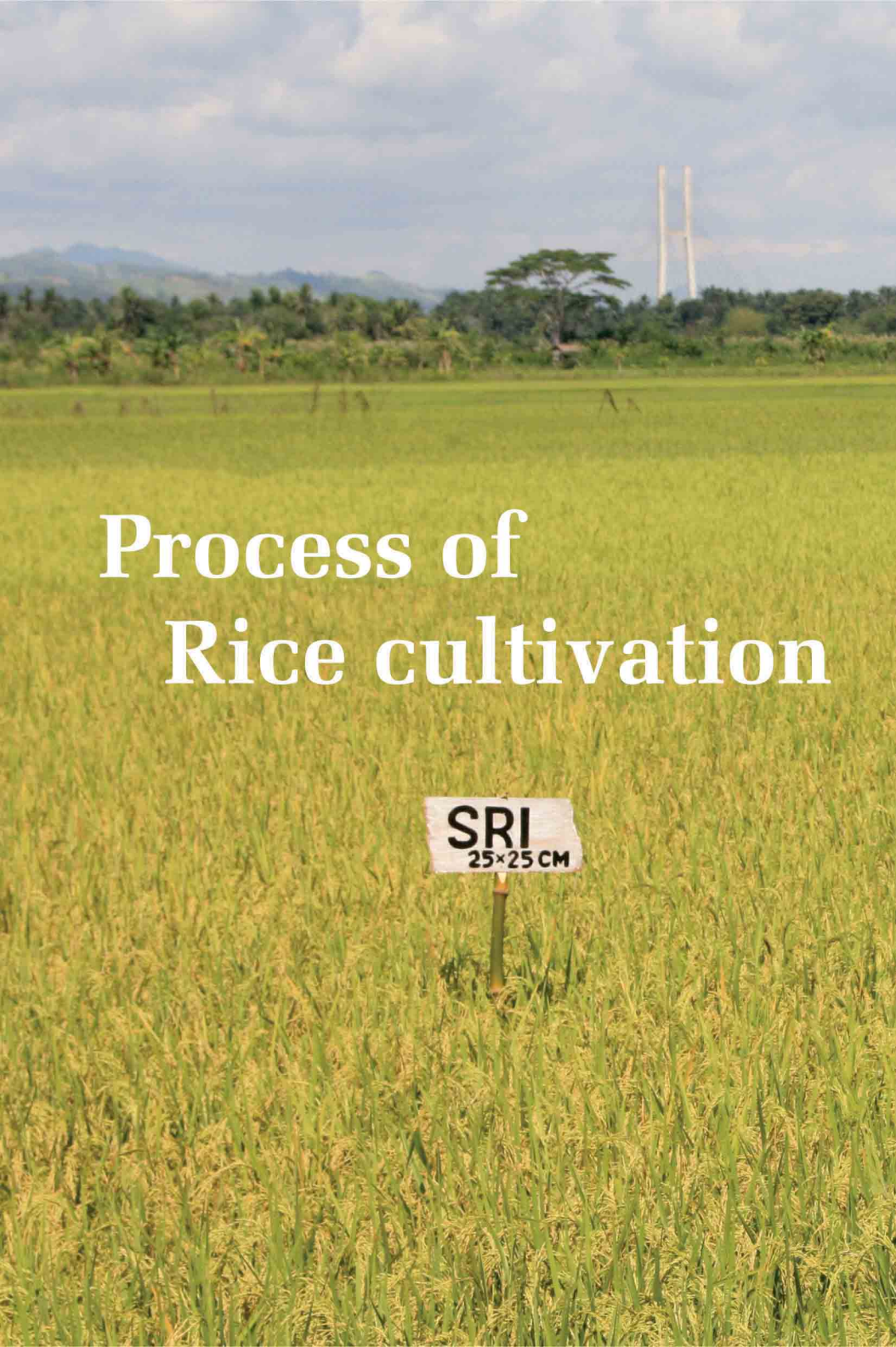
- More number of tillers, which are profuse and strong.
- Large root volume which enables the plant to grow healthy in natural conditions with massive root growth. This also ensures natural nutrients to the plant from deeper layers of the soil, thus increasing the potential for resisting insects.
- More and well-filled panicles
- More grain weight

Organic rice cultivation is very effective. Organic system has got to contribute a lot to sustainable agriculture as it establishes a harmonious relationship with nature. It is important that farmers are made aware of the significance and relevance of promoting organic rice cultivation.

This book is designed as a hand book with detailed process and steps in paddy cultivation and farmers can test this method. In order to facilitate learning, they could try this method in small experimental plots and control plots of equal size following their current practices. The cost benefit ratio of the SRI method such as the input used, output received and the net profit are to be noted.

In many places field testing has been done and it has proved that only less resources are required for this method. This can reduce the burden especially to small farmers. The reduced use of resources and increased productivity and income has encouraged many farmers to opt for this method.

Process of Rice cultivation




under organic
SRI method

LAND PREPARATION

The following measures are to be taken to improve soil fertility, reduce top soil erosion and improve the water-holding capacity.

- Levelling of the land to make the land plain
- Field bunds on all sides
- Farm pond
- Multiple seed sowing

Land levelling

It is important to make the level of the land uniform. In addition to reducing the top soil erosion, it ensures distribution of moisture and manure supply to the land. Each plant can get the required nutrients if the land is made plain. Levelled land facilitates equal distribution of water while irrigating the land. Ploughing to be done after levelling the land and follow multiple seed sowing (Refer the details on multiple seed sowing). There should also be provision for removing excess water from the field.

Marking on the field

Once the levelling and bunding are completed, the straight line marking raw and column is to be done in-order to plant the seedling at the intersection of 25 centimeters. Straight line marking facilitates easy weeding. Different methods are being followed to maintain uniform spacing on the field. Small pegs can be tied on the rope at distance of 25 centimeters. Different types of wooden and iron markers can also be employed for marking 25 x 25 centimeters lengthwise and width wise. There are also bar markers which have to be drawn either way to form a grid and roller markers which would form grids at one go. It is suggested to tie a rope and pull the marker alongside to have the lines straight.

Field bunding

If the land is vast, it is suggested to divide the land into small plots by making bunds on all the sides. The required soil for making bunds can be taken either by making small trenches or while levelling the land. The soil from the upper portion of the land can also be used. This helps in conserving soil and water in the field and hence there will be better moisture for proper growth of plants. Bunds serve as settlements for the micro organisms. During the harvest, these micro organisms go to the bunds and settle there, as there will be moisture at least in the bunds. They return to the field in the next cropping season.

Farm pond

Construction of a small farm pond helps in storing rain water. This pond/pit will provide moisture for the rice field. Design of a farm pond is largely dependent on the total plot size contributing runoff and availability of space to collect runoff water. Generally 2-3 % of the plot size is used to create a farm pond. Depth of 6 to 8 ft. is desirable depending on the soil strata. The construction of a pond involves excavation of soil in a suitable place where the runoff water can be collected by the gravity and stored.

Multiple seed sowing

Immediately after the harvest of the crop, the land is to be ploughed well and different varieties of seeds should be sown in the field 50 days prior to the sowing of the main crop. The following table gives the varieties of seeds that can be used for sowing as manure.

Seeds that can be used as manure

Type of Seeds	Any 5 variety in each (example)	Quantity per acre (Total –20 kg)
Oil seeds	Ground nut, Sesame, Castor, Soya, Mustard	4 kg
Grains	Maize, Wheat, Ragi, any millet	4 kg
Pulses	Green gram, Red gram, Black gram, Cow pea	4 kg
Green manure	Sesbania, Sun hemp, any legume seed	4 kg
Vegetables	Leafy vegetable seeds, beans, tomato, lady fingers	4 kg
Larger quantities of the varieties available in the village can be added to make 20 kg/acre		

This is the feed for the mother earth. It is to be ploughed back to the soil 45 days after the sowing for improving fertility of the soil. The incorporation of different varieties of plants into the soil will make the soil very rich in humus with lots of nutrients required for the healthy growth of the crop. *Adding* Vermi-compost @ 500 kilogram per acre will help to increase the fertility of the soil (Refer the details on Vermi-composting). Multiplying micro-organisms using forest soil also to be applied while preparing the land for cultivation (Refer the details on Multiplying micro-organisms using forest soil).

SEED SELECTION & SEEDING

Good quality seeds are to be selected from trusted sources or farmers who produce their own seeds. Quality seeds are essential for strong and healthy crop. There are several diseases that are transmitted via seeds. If seeds from an infested field are used to grow the next crop, these seed-borne diseases will immediately cause problems. Seed selection should start by obtaining seeds from healthy plants. There are always differences between plants in a rice field. Some plants may have characteristics that are more suitable than those of other plants. In the growing season, farmers can observe these differences and mark the best plants separately. During the harvest, the seeds of these plants can be reserved for growing the next crop. It is recommended to remove seeds that are too small, spotted, deformed, discolored etc. Only very good seeds should be used for sowing.

In order to select the best seeds, the following method should be adopted:

- Take a fresh egg and add it to the vessel containing plain water.
- The egg goes down to the water, settling at the bottom
- Salt or salt solution should be added to the water till the egg comes up
- Remove the egg and put the paddy seeds into the salt solution.
- Select the seed that settles down and discard the floating seeds.
- The selected seeds should be rinsed well in fresh water and soaked in *starter solution* for one hour for better germination.
- This helps to select the best seeds with an ideal weight of nearly 20 mg/seed.

Preparation and use of Starter Solution

Starter solution is an organic solution, which helps the soil to get back its biological properties faster. It is a microbial solution which converts the dead soil into a living one and thus gradually enriches the soil fertility and makes it as a permanent living medium. This solution also helps in the germination of seeds.

Required Materials (per acre)

Cow dung - 20 kgs, Cow's urine - 20 lts, Jaggery -2 kgs, Water - 20 lts

Method of preparation

Mix all the materials mentioned above in a plastic container/mud pot/cement container. Then cover the mouth with a cotton cloth and keep it for 24 hours. The prepared solution can be stored up to 3 to 4 days with regular stirring in the morning and evening. Filter the solution and add 10 litres of water in 1 litre solution and use.

Soil application along with irrigation water will enrich microbial population. Foliar application of this solution will increase the yield and seeds can be kept in the diluted solution for 10 minutes before sowing. This helps for better germination. Metal container is to be strictly avoided as it may react with the solution.

Cow dung

Cow's urine

Jaggery

Water

Less seed for more grains

With wide spacing between plants, less seeds are required. From the experience of testing SRI in different places, it is suggested to have two seedlings per pit. Further, it is easy to use and produce quality seed.

Selecting the best Rice Seeds

It is very important to select the best seeds for sowing. Selection of the best seeds will help in better germination, healthy growth and better grains. For this, farmers used to put seeds in water, consequently lots of seeds of medium quality would also be taken for sowing.

Germinating the seeds

Once the seed selection is done and seeds are put in the starter solution for an hour, they should be soaked again in water for 12 hours. Transfer the soaked seeds into a gunny bag or make a heap and cover them with gunny cloth for 24 hours. The seeds germinate during this time. The white root called radicle breaks open the outer coat and starts emerging out of the seed. At this stage, these sprouted seeds are taken to the nursery beds for sowing. If sowing is delayed, the roots grow and get knotted together making it difficult to sow the seeds with wider spacing.

STRONG BED FOR HEALTHY SEEDLINGS

The seed beds have to be nutrient-rich and established as close to the main field as possible. This will enable quicker and easier transportation between the nurseries and the fields, minimizing both transport time and costs, ensuring efficient transplantation. For 1 acre of land, 4 kilogram rice seeds will be sufficient. A bed with a width of 4 feet is ideal. If the area is large, separate nursery bed for each acre is recommended. The length of the bed can be decided by the farmer depending on the ground situation. According to one's convenience either a single bed or several small beds (say, 4 beds measuring 4x28 feet each) can be prepared.

To prepare the bed, spread a polythene sheet on the bottom, followed by the filling of Farm Yard Manure (FYM)/ vermicompost and soil alternately in 4 layers.

- 1st layer: 1 inch (2.54 Centimetres) thick well decomposed FYM/Vermicompost
- 2nd layer: 1 ½ inch (3.78 Centimetres) soil
- 3rd layer: 1 inch (2.54 Centimetres) thick well decomposed FYM/Vermicompost
- 4th layer: 2 ½ inch (6.3 Centimetres) soil.

All these layers should be mixed well, as the FYM/Vermicompost helps easy penetration of roots. To prevent soil erosion, the beds should be made secure on all sides with wooden reapers/ planks or paddy straw rope or such similar material. Appropriate channels should be provided on all sides to drain excess water. To ensure uniform broadcasting, divide the entire lot of seeds into 4 parts and broadcast four times (each part at a time) thinly over the bed. It is better to broadcast in the evenings. Spread well decomposed FYM or paddy straw (without its grains/seeds) over the sown seed thinly.

The seeds are not to be directly exposed to the sun. This will ensure protection from birds and ants. Straw can be removed once the seeds germinate. Watering should be done twice (morning and evening) daily depending on the requirement. Watering can be done slowly with pots, by controlling the flow with the hand. Care should be taken to see that the seeds do not come out while watering.

TRANSPLANTATION

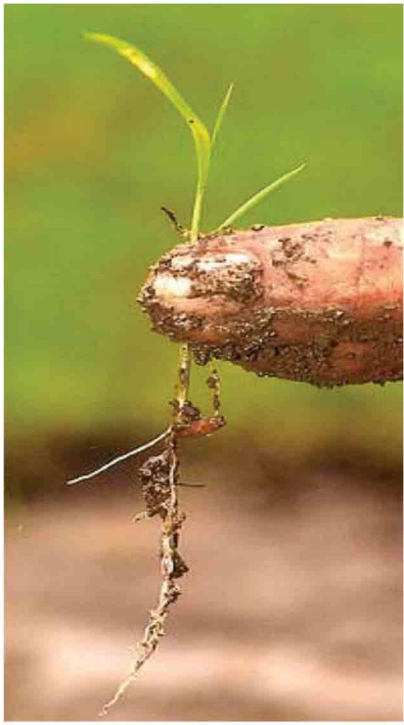
Once the seedlings are grown in a healthy situation, the transplantation is to be done when the seedlings are still having seeds in them. Transplantation will be easy since the beds are being made near the main field. However, transplantation should be done with maximum care. Seedlings are carefully lifted from the nursery and transported to fields in baskets or on trays for immediate transplanting.

Careful transplanting

While removing seedlings from the bed, they should have the seed, soil and roots. The transplantation should be done carefully and the seedlings should be placed in the field without plunging too deep into soil. 1 seedling or maximum 2 per hill are transplanted with shallow depth (1-2 cms) into soils that are not flooded. Roots are to be carefully positioned just under the soil surface to minimize trauma in transplanting. Careful transplanting reduces shock and increases the plant's ability to produce numerous tillers and roots during its vegetative growth stage. This gives the rice plant more access to sunlight and air above ground. If the soil is very fertile, or has been made more fertile by application of organic manure over several seasons, wider spacing (fewer plants per square metre) will give higher yields.

Transplanting young seedlings

The seedlings should be transplanted when the plant develops 2 leaves. It should be done before they are 15 days old, and as early as 8 or 10 days. At that time seedlings will have only their first small root, with seeds still attached, and a first (main) tiller and two tiny leaves. They should be replanted with two seedlings, rather than in clumps of 5 or 6, and within half an hour of removal from the nursery, so that the plants do not dry. Shallow planting is very important. They are laid gently into the soil, not pushed in, so that their root lies horizontally in the moist soil, only 1-2 cms deep. Slipping the seedling in sideways rather than plunging it into the soil vertically makes the shape of the transplanted seedling more like an 'L' than like a 'J'. With an 'L' shape, it is easier for the tip of the root to resume its growth downward into the soil.



WIDE PLANTING

In the conventional method of rice cultivation, the distance between seedlings is usually 5 centimetres and there will be 4 to 5 seedlings in each hill. In this method, the seedlings should be planted at 25 centimetres from each other and in a square pattern. The straight line should be marked parallel and perpendicular in 25 centimetre distance and two seedlings should be planted in each hill. The weeding can be facilitated through the field with a weeder to expose plants fully to the sunlight. Plant gets more space, air and sunlight with wide spacing and as a result each plant gives more tillers. The roots grow healthy and take more nutrients from the soil. As the plant is strong and there is more space in between the plants, the numbers of tillers would be more. The panicle length would be more and the panicle will have more grains and the grain weight will also be more. The experimentation done in a few places shows those 1 seedling should be put in each hill which comes to about 16 plants per square metre. Rice plant roots and canopies grow better if spaced widely, rather than densely.

Increased tillering in wide planting

Due to the presence of only 1 seedling and more distance between plants, the tillers are also more in this method. Keeping the field with minimum moisture also helped in increasing tillers. Since the distance between plants are 25 centimetres, the maximum tillering (30 tillers/plant) can be easily achieved; 50 tillers per plant are quite attainable. Under excellent management, even 100 fertile tillers per plant or even more can be achieved due to early transplanting and absence of die back of roots.

MORE CROP PER DROP

There used to be lot of water use for rice cultivation in the conventional method. There has been the practice of continuous flooding of rice fields with 5-15 cms of water throughout the growing cycle. In SRI method, the water use can be reduced to at least 40 %. Regular water applications are required to keep the soil moist, but not saturated with intermittent drying, alternating aerobic and anaerobic soil conditions. This is because rice is not an aquatic plant; it avoids root degeneration which occurs with continuous flooding. The root system is challenged to seek out water in the soil and is able to acquire more and more varied nutrients from the soil. There should be minimum moisture in the field or alternate wetting and drying during the growth period and just 1-2 cms of water on fields after the flowering of the plants. In following smart water management practices, farmers can get better benefit from rice cultivation.

Water management

Water is applied only as needed to keep the soil moist, but never letting it become saturated. The paddy plant can grow even when there is standing water. But, for a healthy rice plant, water should not be stagnant in the field. When irrigation is provided intermittently, the roots are aerated and grow healthy. If there has been no rainfall during the day, irrigation water is applied in the evening or late in the afternoon, and any water still standing in the field can be drained off the next morning. This leaves the soil and plants fully exposed to the sun and air during the day. When water is stagnating in the field, the roots die due to lack of air. The soil should have soil particles, air and moisture for the plants to grow well. During the growing period, the field is left un-watered several times for 2-6 days so that the soil dries to the point where the surface cracks. For convenience and to save labour, fields can be alternately flooded and drained, for 3-5 days in each period (the range can be 2-7). Rice plants can tolerate loss of direct access to oxygen through the soil for a few days. The field should be drained 25 days before harvesting.

WEED AS MANURE

The weed population will be more if there is less water use in the field. So efforts must be made to eliminate them and prevent competition with the rice plants. A simple mechanical weeder that is pushed by hand should be developed to enable farmers to eliminate weeds easily, quickly and sufficiently early.

Weeding should start about 10 days after planting and should be done at least twice, but preferably 3 or 4 times, until the canopy closes and makes further weeding difficult (and unnecessary). A manual weeder

is to be operated perpendicular in both directions in between the hills within 10 to 12 days of transplantation, and at intervals of 10-12 days afterwards. This operation not only controls the weeds but churns the soil which causes a lot of changes in the soil, favoring better growth of the crop.

There can be dramatic benefits if the weeding is done more than once. Instead of weeding and throwing the weeds outside the plot, there are several advantages of turning the weeds into the soil by using a 'weeder'. By incorporating weeds into the soil, the soil gets aerated and the weeds get decomposed in the soil and become organic matter. This helps healthy growth of the plant and subsequently higher yields. Weeding and aeration are needed as there is no standing water. Use simple mechanical "rotating hoe" that churns up soil. Two weeding are required, but four are recommended before panicle initiation, first weeding is 10 days after transplanting. Due to reduced weed competition and aeration of soil, roots get more oxygen and nitrogen. Each additional weeding after two rounds results in increased productivity.

BORON IN THE SOIL

Boron is an essential micronutrient element required for the normal growth of plants. Boron deficiency is of great concern in areas receiving heavy rainfall because of leaching losses.

Compared with other micronutrients, the chemistry of Boron in soils is very simple. The pH is one of the most important factors affecting the availability of Boron in soil. Study shows that Boron becomes less available to plants with increasing pH. Available Boron in the soil decreases with increasing pH because of more fixations to the soil sites at high pH values. Maximum Boron fixation occurs at pH 6 to 9.

The primary role of Boron is its involvement in the stabilization of the primary cell walls in plant cells. Adequate Boron nutrition is critical for high yields and quality of crops. Deficiencies of Boron result in many anatomical, biochemical and physiological changes in plants. Boron is also involved in the carbohydrate metabolism in plants, protein synthesis, seed and cell wall formation, germination of pollen grains and growth of pollen tubes and sugar translocation. Presence of calotropis plants indicates the presence of Boron in the soil. Including calotropis leaves while making vermicomposting or any other compost adds more Boron to the soil. Spraying of the extract of calotropis also helps in supplementing Boron.

MANURE APPLICATION

The following organic manures need to be prepared and applied in different stages of rice cultivation.

1. Vermi-composting
2. Vermiwash
3. Multiplying Microorganisms
4. Panchagavya
5. Jeevajal (Amrith pani)
6. Fish Amino Acid (FFA)
7. Effective Microbial Solution (EM)
8. Coconut milk/water + Butter milk

Vermi-composting and Multiplying microorganisms are to be applied on the field while preparing the land along with multiple seed sowing. This helps in improving the fertility of the land. Growth promoters like Panchagavya, Jeevamruth, EM, and Fish amino acid are to be applied alternatively during the vegetative stages. Fermented Coconut milk or water mixed with butter milk is to be sprayed during the flowering stage. Spaying of diluted coconut water also helps during the flowering stage. Method of making various manure/growth promoters and its use in various stages is given in the following paragraphs.

Vermi-composting

Vermi-composting is the method of processing the organic wastes into better plant food by using earthworms. Vermi-compost converts the degraded soil into the natural form and accelerates the healthy growth of plants by giving the required micro-nutrients. Vermi-composting uses earthworms for the decomposition of organic wastes. They churn out the soil and increase the water holding capacity and permeability of the soil. Hence the recharging of groundwater can be improved. The disposal of wastes for the

preparation of this manure adds to cleanliness and purity of the environment. Earthworms can consume practically all kinds of organic matter and they can eat their own body weight per day; for example, one kilogram of worms can consume one kilogram of residues every day. The excreta or "castings" of the worms are rich in nitrate, available forms of phosphorus, potassium, calcium and magnesium.

The passage of soil through earthworms promotes bacterial and actinomycetes growth; actinomycetes thrive well in the presence of earthworms and their content in earthworm casts is more than in the original soil.

The materials needed for preparing vermi-compost:

- Organic wastes, (remove plastic bags/stones and glass pieces)
- Cow dung
- Earthworms
- Saw dust

Preparation

The vermi bed made using stone bricks should be filled with saw dust to about 1 centimetre, 30 earth worms per square feet area of the vermi bed, 60% of organic wastes mixed with 40% of cow dung to a height of 2 feet and then it should be covered with jute cloth. The vermi bed (4 feet breadth and length of any size) should be watered well to maintain moisture throughout. A shed over the vermi bed is needed to protect it from sunlight and rain. The compost will be ready in 50 days time. Vermi-compost should be applied on the field once the land levelling and first ploughing is done.

Minimum 500 kgs of vermi-compost per acre is to be added in the initial stage of organic paddy cultivation. The quantity can be reduced in the next year. Adding vermi-compost to the seed bed is also beneficial.

Benefits of Vermi-compost

Soil	Plant Growth	Economic
-Improves its physical structure -Enriches soil with micro-organisms (adding enzymes such as phosphates and cellulose) -Microbial activity in worm castings is 10 to 20 times higher than in the soil and organic matter -Improves water holding capacity	-Enhances germination, plant growth, and crop yield -Improves root growth and structure -Enriches soil with micro-organisms (adding plant harmones such as auxins and gibberellic acid)	-Bio wastes conservation reduces waste flow to landfills -Elimination of bio wastes from the waste stream reduces contamination of other recyclables -Creates low-skills job at local level -Good source of income generation -Low capital investment and relatively simple technology.

Vermi-wash

Vermi-wash is a highly nutritious solution that carries the enzymes secreted by the earthworms and very rich in nutrients required by the plant. Vermi-wash is sprayed on the plants as a foliar spray and provides nutrients to the soil.

Preparation

- Collect the half decomposed organic matter in a pot or drum. Introduce a handful of earthworms. Then they will convert the organic content into fine vermicompost.
- When water is allowed to enter drop-by-drop into this compost drum or pot, it washes away the enzymes and hormones secreted by the earthworm
- This wash water can be collected from the pot, by making a hole at the bottom.
- The collected vermi-wash is mixed with water in the ratio of 1:10 and sprayed on crops

Multiplying micro organisms using forest soil

Soil in the forest will be rich in micro organisms due to its rich biodiversity. The method comprises multiplying these micro organisms so that the same effect can be provided to the soil in the rice field.

Various steps to breed micro-organisms to improve soil condition are as follows:

1st step: Collect soil containing micro-organisms from a diverse / dense forest area

- Select a good growing tree from a diverse forest
- Clear the leaves from the top of the soil
- Collect one fist of soil

2nd step: Prepare micro-organism cake

- Take a jute / plastic bag sheet to mix the ingredients
- Mix the following together
- 1 handful of Soil
- 5 handful of Rice husk
- 1 handful of Rice bran
- Add water to bring 40 % moisture (Cluster should break when drop)

- Fold-wrap the mixture in the same sheet and keep it under a dry shade for 7 days. After 7 days, the material will become like a cake which is dry and hard. It will also have white coloured fungus on it. Micro organism is ready to prepare the solution. In case of delay in preparation of micro-organism solution, the cake could be crushed and spread around any tree with sufficient canopy so that next time we do not have to go to the forest for collecting good micro-organisms. Moisture level should be maintained.

3rd step: Prepare Micro-organism solution

Mix the following together:

- 1 kg micro-organism cake in a net
- 100 litre water in a container (mud pot / plastic)
- 5 kg molasses / sugar /jaggery / boiled broken rice
- Mix the ingredients properly
- Sprinkle one handful of rice bran
- Cover the container with the lid (allow breathing) and keep it for 7 -15 days. If this solution has to be kept for a longer period, add any fruits at periodic intervals

Micro-organism cake

Rice bran

Water

Jaggery

Method of using micro-organism solution

- 1 litre micro-organism solution diluted with 20 litre water
- 30 litre diluted solution should be sprayed in 1 ha land area
- The solution should be sprayed during land preparation
- The solution could also be mixed with irrigation water for uniform application.

Benefits of using micro-organism solution

- Improve the soil quality by microbial activity
- Pest resistance capacity of soil increases
- Constant improvement of soil quality.

Panchagavya

Panchagavya is a growth promoter made from five products of the cow -- its dung, urine, milk, ghee and curd. *Panchagavya* is also a method used to safeguard plants and soil micro-organisms and to increase plant production.

Panchagavya is considered to be highly effective liquid organic manure. It has multiple functions and can effectively replace chemical fertilizers and pesticides. It is very nutritious bio-promoter that can be used in farming. "Pancha" means five and "gavya" means– product of cow; five elements derived from a cow such as dung, urine, milk, ghee and curds.

Preparation and use of Panchagavya:

The proportion of each of the ingredients for 2.5 acres farm is as follows:

Cow dung	:	5 kg (fresh of the same day)
Cow's urine	:	4 litres
Milk	:	3 litres
Curd	:	2 litres
Ghee	:	1 litre

For preparing Panchagavya, an earthen pot/plastic drum of 20 litres is required. Mix both cow dung and ghee and cover it with a lid. This should be kept for 10 days, stirring the same every day. On the 11th day, add urine, milk and curd, mix well and leave for 12 days. On 23rd day, it is ready for spraying – mix 3 litres of "Panchagavya" with 100 litres of water and spray it. Since ghee does not dissolve easily, power sprayer is the best option for spraying. One can also add 5 to 10 bananas fruit and 1 litre coconut water and about half a kg of black jaggery or honey to this solution. This can be kept for 2 to 3 months. It can be sprayed 2 to 3 times for a crop of 3 months duration. For plantation and coconuts, it can be sprayed 4 to 5 times.

3% solution of Panchagavya can be used to soak the seeds or dip the seedlings before planting. Soaking for 20 minutes is sufficient. 3% of Panchagavya solution can be used to dip the seeds before drying and storing them. After transplantation, Panchagavya is to be applied to the crop once in every 10 days, 15 days, 30 days and 50 days. The solution should be sprayed when there is very little sunlight or after 4.30 pm in the evening for good effect. The uniqueness of Panchagavya is that it provides growth promoting hormones and immunity boosters for plants. Adding Panchagavya during the composting process helps to improve the quality of compost. It also helps to increase the yield and quality of the products.

Compared to chemical fertilisers, this is less expensive and more eco-friendly with no side effects. Physico-chemical properties of Panchagavya have revealed that it possesses almost all the major nutrients, micro nutrients and growth hormones required for crop growth. It also helps in improving the fertility of soil, increasing disease resistance, developing immunity of the plants and enhances taste, flavour, colour and weight of the grains.

Jeeva Jal (Amrith Pani)

Jeeva Jal (Amrith Pani) is a growth promoter made out of cow dung, cow's urine, Jaggery/Molasses, horse gram powder or the powder of any pulses, soil from undisturbed location and water. It provides a congenial environment to micro-organisms that help in making available the essential nutrients for plant growth viz., nitrogen, phosphorus and potassium to the plants. Application of Jeeva Jal to soil improves the soil considerably. It also encourages microbial activity in the soil. 'Jeeva Jal' is to be provided once in a fortnight or at least once in a month. It promotes immense biological activity in the soil and makes the nutrients available to the crop. Jeeva jal is not to be considered as nutrient for the crop but only a catalytic agent to promote biological activity in the soil.

Ingredients required for making Jeeva Jal:

Cow dung	: 1 kg
Cow's urine	: 1 litre
Jaggery	: 200grams
Horse gram powder	: 200 grams
Soil from un-disturbed location	: 1 kg
Water	: 10 litres

Preparation of Jeeva Jal

Mix all these items well in a mud pot or bucket and keep it in the shade for 5 days. Stir the mixture once a day. Before using it in the fields, 10 times more water has to be added. Apply the mixture when the ground is wet for the plants. It can be mixed with canal water, which directly goes to the field. It contains many microbes. This seems to work wonders for the plants due to increased microbial activity. It only activates the soil ingredients necessary for a plant's healthy growth. This is an excellent culture for enabling the exponential increase of beneficial microbes.

Fish Amino Acid (FAA) / Fish tonic

Fish Amino Acid (FAA) is a liquid made from fish waste. FAA is of great value to both plants and micro-organisms in their growth, because it contains abundant nutrients and various amino acids. Amino acids are nitrogen (N) part of the five elements of fertilizer. It is absorbed directly by the crops and it stimulates the activity of microorganisms.

Preparation of FAA

- Cut fish into small pieces or fish trash (preferably blue or back coloured fish) and put into a clay pot or plastic jar.
- Add equal amount of jaggery /brown sugar/molasses
- In about 2-3 days, due to osmotic pressure the fish meat will get liquefied and completely ferment in about 7-10 days.
- Dilute the solution at 1 litre of solution with 50 litres of water and apply on the crops/soil

  FAA, being a nitrogen fertilizer, will boost the growth of crops during the vegetative growth period when applied on both soil and leaf. Fish tonic is the proteinaceous solution that fastens the vegetative growth of the plants and also acts as an effective pest repellent. Depending on the type of fish used, the distinctive scent may function as an insect repellent.

Effective Microbial solution (EM)

Effective microbial solution is a biological preparation; rich in anaerobic microbes that brings back the physio-chemical and biological properties of the soil within a shorter duration. This helps in enhancing soil fertility, increasing the microbial population and helps the plant to strengthen the immune system. When it is applied as foliar spray, it increases the vegetative growth and yield of the crop.

Materials required (per acre):

Papaya (ripe)	– 3 kgs
Banana (rip)	– 3 kgs
Sweet pumpkin	–3 kgs
Egg	– 2 Nos
Jaggery	– 3 kgs
Water	– 10 litres

Preparation and use of making EM

- Mix all the fruits (after cutting them into small pieces), egg, jaggery and water in a plastic container/mud pot/cement container.
- Close the container airtight for 45 days to facilitate the growth of anaerobial microbes.
- After 45 days, filter the prepared solution using a thin cloth.
- 500 ml of EM solution can be mixed with 10 litres of water and sprayed on the plants as a growth promoter.

Coconut milk - butter milk solution

There are different applications with coconut water, coconut milk and butter milk during the flowering stage of the rice plants. Coconut water is traditionally used as a growth supplement in plant tissue culture/micro-propagation. The wide applications of coconut water can be justified by its unique chemical composition of sugars, vitamins, minerals, amino acids and phytohormones. It acts on plants by promoting strong root systems and more rapid growth and development.

- 1 litre of Coconut water diluted with 50 litres of water is to be sprayed during the flowering of plants.

- The mixture of coconut water and butter milk is also used in increasing the number of flowers in rice. 1 litre of coconut water and 1 litre of butter milk to be kept in a mud pot and the pot to be buried in soil for 7 days. Later the solution to be diluted to the proportion of 1 litre with 10 litres of water and spayed on the crop to increase the number of flowers in the crops.

- The fermentation of Coconut milk and butter milk is also a growth promoter to be applied during the flowering stage. Mix about 1 litre of coconut milk and buttermilk each in a mud pot and bury the pot under the soil for a period of 10 days for fermentation. After the stipulated time, the fermented concoction should be distilled and diluted in water in the ratio of 1:10 and sprayed over the crops.

Coconut milk

Pest management

Pests and diseases that attack crops cause 20-90 percent loss in yield. Excessive use of synthetic insecticides over the past several decades has resulted in development of resistance in insect pests to commonly used insecticides, resurgence of minor pests to major pests and thereby posing a serious problem in their management. Therefore, the need for adopting Integrated Pest Management (IPM) is gaining importance.

Pest Preventing Planting Pattern (P4)

Being monoculture, rice attracts many pests. In order to reduce the attack of pests, it is suggested to grow plants of other species on the field bunds as well as intercropping. On the boundaries (Field bunds) marigold along with legumes (nitrogen fixing plants) can be grown.

The marigold is probably the most well known plant for repelling insects. Marigolds repel whiteflies and kill bad nematodes and are host of useful insects. While this plant drives away many bad bugs, it also attracts spider mites and snails. Intercropping with Tuar or any legume crops is highly beneficial in controlling pest attack and farmers can get additional income too from legume crops.

Tonal tonic – The pest repellent

For making pest repellents, the following types of leaves are needed:

- Leaves which are bitter.
- Leaves which smell.
- Leaves which produce Sap (Milk).

A handful of each type of leaves should be smashed properly to make a pulp. Take a mud or plastic pot and put the pulp of leaves into it and pour cow's urine into the pot till the mixture is covered fully. Keep the mixture for 10 days. Spray the solution by mixing 1 litre with 10 litres of water. The smell misleads the mother insect and it moves away from the plants. A fist full of ginger, garlic, wild chillies and a pinch of asephoitida could be added to every litre of the same solution and sprayed over the plants to give more powerful results.

Trichogramma egg Parasitoids for Pest Control

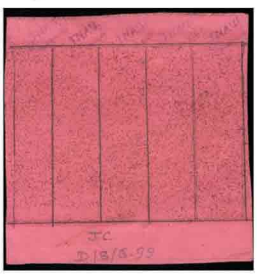
Trichogramma species (Hymenoptera: Trichogrammatidae) are the egg parasitoids that are frequently used as biological control agents against pests. Release of trichogramma egg parasitoids is one of the important components in IPM. Trichogramma egg parasitoids are effective on several lepidopteran pests viz., stem borers, leaf eating caterpillars, hairy caterpillars etc. Trichogramma are among the smallest of insects, having a wingspread of about 1/50th of an inch.

Despite its size, it is an efficient destroyer of eggs of many moth which are the leaf-eaters in the larval stage. These parasitic insects disperse readily in their search for over 200 species of eggs to parasitize. The Trichogramma seeks out eggs, but does not feed on or harm vegetation. It is effective tool because it kills its host before the plant can be damaged.

Tricho-cards

Tricho-cards with parasitized host (corcyra cephalonica) eggs are safely packed in packets, indicating the date of emergence of adult parasitoids. Each tricho-card contains 20,000 trichogramma parasitized eggs. Tricho-cards get pasted onto them eggs of a surrogate host infested with Trichogramma larvae, which release pests that tackle other pests like leaf roller worms or stem borer worms, which are common threats in rice fields. The pests that emerge from the eggs on the card, after doing their job, either move on or die without enough food, thus creating no further threat for the crop.

Each hectare requires around three to five cards. The cards are attached to coconut leaves, and are planted among the rice three to four times every 10 to 15 days. Cut or tear each "Tricho card" in to small pieces and hang them in the field. The parasitoid on emergence disperses in search of host eggs. They commence releasing as soon as



the adults of the pests are noticed in the field. Monitoring activity of adult moths is possible using pheromone traps or light traps, whichever is available. To delay the emergence of adult Trichogramma, Tricho cards can be stored in refrigerator at 10oC for 7 days. On removing the cards to room temperature, the parasitoids complete their development and emerge normally

Bird perches

Pieces of tree branches/bamboo/wooden perches are randomly fixed in the rice field to control some major insect pest through biological means. The idea is to attract birds to perch on the branches fixed in the rice field and eat up the insects. Placing perches in rice fields can attract these insect-predatory birds. These perches serve as watchtowers and resting places for these birds during the hunting stage. The practice is being followed since long by many farmers.

Sticky board traps (yellow board)

Flying insects are attracted to bright yellow colour. Traps, consisting of square/rectangular pieces of cardboard or hard plastic coated with sticky substances placed throughout the growing area among the plants, attract them. Strips of yellow sticky plastic can also be used around or inside the growing ranges.

- Cut plywood or sturdy cardboards, 3 inches wide x 5-7 inches long
- Paint boards with yellow or blue.
- Spread grease on the board to trap insects

Light trap

Light traps can be used to monitor and trap the adult moths, thereby reducing the population. Some common light traps that could be used are traps with electrical bulbs. The adult moths have an inherent capacity to get attracted to the light. Lights are hung at a certain height above the crop. A large plate or vessel filled with kerosene mixed with water is kept near the light trap. Insects are attracted towards the light and fall into the vessel and die. Lights should be set up in the field after 5.30 p.m.

To control Rats

Rats attack rice crop at vegetative, ripening and harvesting stage and creates maximum damage to the crop. Gliricidia plant helps in controlling rats. The name Gliricidia comes from the Latin word "Glis-Caedro" meaning "Mouse-Kills". Gliricidia leaves to be smashed well with boiled rice to make a pulp and kept in few places to control rats. Planting Gliricidia on the boundaries of the rice field also helps in controlling rats. It is a very good nitrogen fixing plant too.

Pappaya fruit also helps in controlling rats. Raw Pappaya to be cut into small pieces and kept near the rat burrows. When rat eat the papaya pieces the milk of Pappaya (pappine) get into the gums of the rats. This prevents them in attacking the rice crop.

Some other tips for Pest Control in Paddy Cultivation

- **To control Stem Borer:** The stem borer larvae bore at the base of the plants during the vegetative to flowering stage. On older plants, they bore through the base stem part and feed on internal soft part of stem. Late infestation causes whiteheads. To control stem borer, select improved rice varieties with greater resistance, destroy egg masses seen in nursery by handpicking, transplant rice widely apart with less number of plants per location, and provide extensive irrigation at least for 3 days at 7 cms of water. Promote control of pests by predators such as Spiders, Dragonflies, Wasps, Lady Bird Beetles, and even some birds that are natural enemies of the stem borer.

- **Leaf folder:** Rice leaf folder is very common and can be found in all stages of rice growth. The damage is seen as it affects more than half of the flag leaf and the next two youngest leaves in each tiller. Farmers used to scrub away insect larvae from rice leaf with the help of a thorny branch. Once the larvae falls to the ground, ponding of water is done in the rice field (for about 2 days) and this drowns the insects. Organic spray (a fermented mixture of Neem with water and cow's urine) is sprayed to kill larvae and to keep away adult insects. There are many predators of Leaf Folder in Rice Field including Crickets, Spiders, Ground Beetles, Ladybird Beetles, Wasps and Ants.

- **Rice bug:** The rice bug is an insect pest during the milky stage of the rice plant. Both the nymphs and adults prefer the endosperm of the rice grain resulting in production of smaller grains. They also feed during the soft or dough stages and can cause grain discolouration. Use dirty (smelly) trap to attract adult rice bugs away from the field. Pick and throw away eggs of the insect (present on leaf of the rice plant). The natural enemy of insect is the Tiger Beetle, Spider, Dragonfly, etc. Wasps prey on eggs.

- Spraying of Jatropha leaf extract (20Kg of Jatropha leaf + 200litres of water) controls leaf folder in rice.
- Spraying of salt and ash solution (2Kg of salt + 8 kg of ash + 200 litres of water per acre) controls leaf folder in rice.
- Neem oil (500 ml) mixed with fresh soil (3 Kg) and cow dung (2 kg). Dry all these in shade for 2 days and later dilute with 50 litres of water and 200 grams of soap and spray to control stem borer and leaf folder in rice.

- Spraying of papaya leaf extract (10Kg of papaya leaves + 200 litres of water) to control bacterial and viral diseases.
- Chilli powder solution spray (2kgs of chilli powder + 200 litres of water) to control aphids and hairy caterpillars.
- Spraying of *Prosopis* leaf extract (20Kg of leaves + 200 litres of water) to control blast in rice.
- In places Calotrophis is grown on the bunds of rice field to check the insect pests.
- Rope dipped in Kerosene oil drawn over the standing rice crop can control rice bugs.
- Fresh fish kept in a pot for 4 to 5 days, dilute it and spray on the crop. The bad smell help in controlling rice bugs.
- Leaves and seeds of custard apple contain chemicals having insecticidal properties. Insects/pests of rice are controlled by broadcasting leaves or seeds of custard apple. The smell of leaves acts as repellent.

- Neem seed kernel is soaked in kerosene overnight and the next morning the suspension is filtered and diluted with water (1:10) and spray to control insect pest in rice.
- Dry fish kept for 3-4 days and diluted with water is sprayed to control aphids in Rice.

Making A Difference (MAD) in Rice Farming

ABSTRACT

With regular accompaniment and the concerted effort of the Sisters of Daughters Mary and Joseph (PMY) and Caritas Purwokerto (Indonesia), some farmers started System of Rice Intensification (SRI) in Ringgit Village of the sub district in Purwerejo, Indonesia. As part of the South East Asia Farmers Conference held in Indonesia (Puwerkerto) for the year 2009, a field exposure was arranged in a different location, where farmers are practising organic farming. Ringgit village was one of the places where a small group of 7 participants went for exposure. The team interviewed Mr. Darso (43 years) who started practicing SRI in 70 cents of land in February 2009. An effort has been made in this paper to assess the difference between SRI and the conventional method of Rice farming with the data collected from Mr. Darso. It is found that the SRI method is cost effective and productivity is found to be more. This is encouraging many farmers to practice SRI in Ringgit Village. Many farmers are being trained on SRI by the local Administration. It is hoped that there will be more farmers practicing SRI in the near future.

SRI initiatives in Indonesia

The SRI practice is common in Indonesia now as the Department of Agriculture started supporting SRI cultivation, building the capacity of farmers in SRI cultivation, creating model SRI plots. We took part in one such training program organized by the village administration and PMY. The farmers are trained for three days on the need of SRI, the negative impacts of chemical farming, methods to know the water holding capacity, nutrition of the soil, various stages of SRI etc. Sr. Alphonsa of PMY convent started her effort of promoting organic farming in the year 1997 and in 2003 she selected 12 farmers and trained them on SRI. There was hesitation in the beginning, as farmers were used to the conventional method of rice cultivation. The constant accompaniment and continuous training made 5 farmers to follow the SRI method. Farmers who are in SRI are very happy, as the input cost has reduced and the net profit has increased. There are many farmers coming forward as the local administration is helping them to grow rice cultivation through SRI method.

Mr. Darso's Experience in SRI : 43 years old Darso, a small farmer in Ringgit Village started experimenting SRI in his 70 cents of land in February 2009. Till then, he was using high dose of chemicals and pesticides and his conviction of SRI made him to take the risk of doing SRI in his field for just testing. This experiment in SRI boosted his confidence as he got a bumper yield of 9 quintals, as against 6 quintals in the conventional method last year. In place of chemical fertilizers, he uses organic compost and indigenous micro-organism as the substitute. One can see rice seedlings (1 seedling each in a pot) grown in 4 pots in front of his house, 10 days and 50 days old plants respectively. The 50 days old plant has 210 tillers (branches) since it is kept in the pot. He has mentioned that it is usually 50 tillers (branches) per seedling when it is being cultivated in the field. The increase in yield and income encouraged him to continue cultivating in SRI method. He said that he will continue promoting SRI and try to convince others on the same. The following table shows the expense of cultivation, yield, and net income from 70 cents of land for both conventional and SRI method.

Advantage of SRI method over conventional method in 70 cents of land

Conventional Method		**System of Rice Intensification (SRI)**	
Expense for cultivation (Rp -Indonesian currency)		Expense for cultivation (Rp)	
Plowing	100,000	Plowing	100,000
Planting	70,000	Planting	70,000
Chemical Fertilizer	150,000	Organic Compost	0
Pesticides	25,000	Weeding	150,000
Weeding	150,000		
Total Expense	495,000		170,000
Income from the Crop		**Income from the crop**	
Yield = 6 tons x 250,000	1,500,000	Yield = 9 tons x 290,000	2,610,000
Income = 1,500,000-495,000	**1,005,000**	Income = 2,610,000–170,000	**2,440,000**
	US$ 104		**US$ 251**

Difference in income from 70 cents of Land: 2440000-1005000 = Rp.**1435000 (US$ 148)**

Organic rice cultivation: An experiment in Wayanad, Kerala

75 Kilograms as against 40 from 6.18 cents of land

Organic rice cultivation through SRI method has been promoted as part of the implementation of FARM project in Wayanad. This has been tested on a trial basis in the plots of the Tribal Community of Arikkalam colony of Padinjarathara Gram Panchayat of Wayanad District, Kerala. This colony is inhabited by 24 tribal families of Kuruchiya community. The tribals over here used to practice the conventional method of farming with farm yard manure and cow dung as the manure.

In order to find out the difference in expenditure and income, the testing was done through the control plot system in both conventional and SRI method. The testing done on rain-fed organic rice cultivation as against the conventional method boosted the confidence of the people in this area and they are planning to practice the same in the future. The lead-farmers were trained by FARM_Wayanad and Caritas India personnel on various aspects of organic rice cultivation. All the methods were systematically followed up with the guidance of Ms. Sheela V, the Community Facilitator of the FARM project in Wayanad for Wayanad Social Service Society (WSSS).

Land levelling has been done well with strong field bunds on all the sides. Vegetables are cultivated on one side of the field and medicinal plants and Marigold are cultivated on the other side which has helped to control pests to some extent. In addition, pest repellents have been made with different leaves and cow urine. Seed selection has been done by putting a fresh egg in salt water and the bed for seedling was filled with mud, sand and compost. Transplantation was done after 15 days and the distance between plants was 25 centimetres.

The testing was done in the control plots of two areas of 25 metres (82.5 feet) length and 10 meters(33 feet) width which is equal to 2722 square feet. Hence, the rice cultivation was done in 6.18 cents of land. Both the methods were experimented in order to show the difference in the cost of cultivation and production. The organic rice cultivation yielded 75 kilograms of paddy from 6.18 cents of land. The same in the conventional method was 40 kilograms of rice from the same area of 6.18 cents.

The use of organic manure and growth promoters improved the fertility of the soil, indicated by the presence of plenty of earthworm casting on the field. The presence of earthworms in the soil improved the moisture, air space, and fertility of the soil, which was contributing to the healthy growth of each plant and hence the production. It has been done through the application of growth promoters like '*Jeevajal*', '*NPK Organic*' and '*Fish Tonic*'. During the harvest, it was found that, in the conventional method all the plants had fallen to the ground and not even a single plant fell in the case of organic paddy cultivation method.

Cost Benefit analysis of both conventional organic and SRI in 6.18 cents of land

Particulars	Conventional Organic	SRI
Land preparation	150	150
Bed Preparation, Seed & transplantation	50	50
Weeding	75	150
Fertilizing	Cow dung : 70	Jeevamruth: ₹ 20
		Fish Amino acid: ₹ 30
		NPK Organic: ₹ 30
		Pest Repellents : 00
Harvesting	100	50
Thrashing	115	115
Total Expense	560	595
Yield from 6.18 cents	**40** kilograms	**75** kilograms
Rate per 1 kilogram of paddy	₹ 17	₹ 17
Amount received	40 x 14 = 680	75 x 14 = 1275
Net profit from 6.18 cents	680-560= ₹ 120	1275-595 = ₹ 680
Difference in income from 6.18		**₹ 560**

The cost benefit analysis shows that there is a net profit on ₹ 680 as against ₹ 120 from the conventional method and the difference in profit from 6.18 cents of land is ₹ 560. This variation motivated farmers in the area to follow the SRI method.

Dr. Haridas V.R, born in Valancherry, Malappuram District, Kerala in 1969 completed his M.Sc in Geology from Mahatma Gandhi University, Kottayam, Kerala, M.Tech. in Remote Sensing and Ph.D in Water Resources from Bharathidasan University, Tiruchirapalli, Tamil Nadu. He worked as Research Fellow for 3 years in a project of the Ministry of Environment and Forests and for a year as guest lecturer in the Government College, Kottayam. He then served the Peermade Development Society for 1 year as Hydrogeologist/Team leader for Watershed projects. He has published several research papers in journals and articles in magazines. He has written a book on "Soil and Water : the cradle of life", compiled a book on "shades of Green" and "Songs of Oasis". He has been working in Caritas India since 1999 and is presently the Manager of Natural Resource Management Progrmme and also Co-ordinating the sustainable agriculture programme of Caritas Asia.

It is a handy book for farmers and development functionaries which gives in depth understanding about the rice intensification process. It covers the whole process of rice cultivation right from seed selection to harvesting including various aspects of organic farming. The process reflected in this book could be tested for assessment and validation at micro farming situations. I sincerely appreciate efforts of Caritas India and of Dr. Haridas V.R in particular.

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Planning Commission,
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Caritas India, the official development Organisation of Catholic Church, shares the development priorities of the people of India. Organic rice cultivation would go a long way in realising the commitment of Govt of India in ensuring food safety and security to the people. Training and capacity building of farmers through the partner network of Caritas India and the collaborative linkages with Govt programmes are envisaged as effective strategies in this regard. This book on organic rice cultivation adopting SRI would serve as a Guide for agencies and individuals. Dr. Haridas V.R bases this book on his experiences in promoting organic rice cultivation in India and other parts of Asia.

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