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SYSTEM OF RICE INTENSIFICATION (SRI): A MODEL FOR SUSTAINABLE AGRICULTURE

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Introduction

The population is increasing rapidly all around the world while agricultural land is decreasing, which creating additional demand for food crops. To meet out this situation farmers are using more of chemical fertilizers, irrigation and pesticides that have adverse impact on soil health/quality and on its productivity. Due to which resource poor farmers are loosing interest in rice cultivation as its profitability is declining with rise in input cost. There is need for a viable alternative method of rice cultivation that saves the expensive inputs, improves soil health/ quality and protects the environment substantially apart from ensuring higher yield. At this critical juncture SRI appears as a ray of hope for rice farmers.

What Is Sri?

This was originated in **Madagascar** and was first synthesized in **1983** by Fr. Henri de Laulanie, a French Jesuit Priest. SRI is an acronym for System of Rice Intensification. It is a suite of management practices that raises factor productivity of land, labour and capital. SRI is a model of **sustainable agriculture** that reduces inputs, conserves water, improves soil structure and increases yield. It mainly emphasizes on careful transplanting of younger seedlings at a wider spacing, which ensures more root growth and profuse tillering.

Attributes of Higher Productivity

Less seed rate

The recommended seed rate for SRI is 5kg/ha. Thus the cost of seed in rice production can be minimized and use of quality seeds (Foundation Seeds) can be ensured. Higher seed replacement ratio can be achieved**.**

Transplanting young seedlings

Seedlings are transplanted at 2-leaf stage (10-12 days old). At the time of transplanting the endosperm still remains intact. So the transplanting shock is less. During planting root system remains vertical or takes “L” shape. The seedlings get established very quickly and grow healthily. Due to early transplanting the production of tillers is continuous and uninterrupted. Therefore more tillers are produced giving rise to higher yields.

Single seedlings are planted at wider spacing

Instead of 2-3 seedlings, only one seedling is planted at a spacing of 25cmX25cm. Each plant gets more space, air and sunlight, produces healthy and extensive root system and there is more nutrient absorption. There is profuse tillering in plants, longer panicles. More no of grains are produced. The grain weight is also more.

Maintaining field saturation

In conventional rice production system, standing water creates anaerobic condition. The roots become brown/rusty and dead under hypoxic situation. By P.I. stage, as many as 75% rice roots degenerate and become defunct. On the contrary, intermittent irrigation to maintain the soil at saturation makes the rhizosphere aerated and promotes healthy growth of roots. Soil aeration prolongs the functional life of root and enhances nutrient absorption.

Incorporation of weeds through operation of weeder

Weeding is done mechanically by weeder. Weeds are incorporated in to soil and add organic matter. The soils get aerated. Better root growth is achieved and higher yield is obtained.

Use of organic manure as source of nutrition

Soil physico-chemical and biological properties are improved. Microbial population and activity of microorganisms increase. Mineralization of nutrients increases. Enzymatic and hormonal activities increase. Healthy and better plant growth takes place leading to higher yield.

Sri- Packages of Practices

Selection of suitable site

Leveled lands having good water control with fertile soil are suitable for SRI. Leveled lands facilitate uniform spread and drainage of water. Saline soils are not suitable, as they need flooding to decrease salinity level. But in SRI method, flooding with water is not allowed. Further, in saline soils draining and drying of soil leads to accumulation of salts on soil surface, which harms the plants.

Nutritional management

SRI method aims at fully realizing the yield potential of rice plants. Hence it responds better to a natural growing environment with organic sources of nutrition, rather than chemicals. Organic matter encourages microbial population and activity of microorganisms. Nutrients are found in readily available form. Plants are healthy and posses resistance to insect pests and diseases. Organic manure sources: The various organic sources are tank silt or FYM or compost @ 15-20 t/ha. Besides, green manuring crop like Dhaincha can be grown and incorporated at pre flowering (45 days) stage to add approximately 15-20 t/ha fresh biomass (2.7-3.5 t dry matter). Paddy nursery is sown on the day of incorporating the green manure crop, so that by the time green-manure plants are well decomposed in soil, the seedlings are ready for transplanting. In addition to these, vermicomposts / oil cakes/ biofertilizers etc. constitute the other organic sources of nutrition. If the soil is fertile, there is yield enhancement with organic nutrition alone, else to safeguard against yield reduction, 50% of recommended fertilizer dose along with full dose of organics may be applied basally till the soil is organically enriched.

Nursery raising

In SRI method, utmost care is taken in preparation of nursery beds, as 10-12 days old seedlings (2 leaf stage) are transplanted. Nursery may be raised near the main field to overcome the problems of transportation and reduce the time lag between uprooting and planting. Nursery is grown on raised beds of 15 cm height. The beds should be 1.5 m wide and of convenient length. The bed is covered with a thick mat of powdered FYM to facilitate easy penetration of roots, uprooting of seedlings and their separation for planting. A channel is made around the bed for letting in and draining out of water. The bed is made secure on all

sides with wooden planks or bamboos to prevent the wet soil dropping down. Two kg of seeds is raised in a bed of 40 m2 for transplanting one acre. Any variety can be used for SRI method. But, considering the controlled water situation and yield compensation through tillering, medium duration varieties with good tillering ability seem to be better than short duration and shy tillering varieties. Presoaked sprouted seeds are sown sparsely. Over sprouting should be discouraged as it causes root entanglement and becomes difficult to separate. Seeds are broadcasted and covered with a thin layer of FYM/dry soil and straw. This maintains temperature, protects from rain, direct sun and birds. Straw is removed on appearance of shoots. Watering by rose cane or letting in water into the channel surrounding the nursery bed also keeps the nursery bed moist. Seedling becomes ready for transplanting in 10-12 days (2 leaf stage).

Main field preparation

Field is dry ploughed, watered and puddled. Tractor puddling is avoided. The field should be leveled and standing water should not be allowed in the field. Beds and channels are prepared. A channel of 30 cm is left after every 1.5-2 m width depending upon soil type. Cleaning of bunds, leveling, markings on the beds etc are done a day before planting. Seedlings are planted at a spacing of 25 cm X 25 cm. There are several ways by which transplanting is done at this spacing. A rope with tie knots or marker sticks at every 25 cm may be used as guide and transplanting may be done in rows one after the other. Using this rope as guide, transplanting may be done one row after the other. However, markers made of wood or iron are available for transplanting at 25 cm X 25 cm. There are bar markers, which have to be drawn either way to form a grid, but roller markers form grids at one go.

Transplanting

Young seedlings of 10-12 days old are transplanted. Seedlings are lifted carefully with the endosperm in tact. A metal sheet is pushed 4-5” below the soil to lift the seedlings along with the soil. Single seedling is transplanted within half an hour of lifting to minimize trauma of seedling. In conventional method of transplanting, the root takes “U” turn and takes time to turn downward but in SRI the root takes “L” shape. It requires about 20-22 persons to transplant 1 ac. In case of casualty, the gaps should be replanted immediately.

Weed management

In SRI method, water is not allowed to stand in the field. This encourages more weed growth. Weeders are used at every 10-12 days interval to turn the weed in to the soil. It requires a run of 16 km per acre to complete one weeding, for which 2-3 persons are required. The weeds are controlled and incorporated in to the soil to add organic matter. The soil becomes aerated, surface layer roots are exposed to air and profuse growth of roots as well as diverse soil microbes take place. Nutrients, enzymes and hormones secreted by microbes promote plant growth. Chemical herbicides should not be used.

Water management

Rice plant tolerates standing water but responds better to aerobic condition like other plants. Roots die under flooded condition due to lack of oxygen (hypoxic situation). In SRI, water is provided only to wet the soil. Irrigation is given before the soil develops hairline cracks. The roots grow healthily, deeply and in all directions. The condition favors microbial activity. A day before using weeder, the field should be lightly irrigated. After weeding water should not

be allowed to drain. From P.I. to maturity one inch of water should be maintained in the field. The water is removed after 70 % grains get hardened.

Pest management

Chemical pesticides and herbicides are not used. Wider spacing and organic manures result in healthy growth. Incidence of pest and diseases is naturally low. Pest can be managed by use of organic concoctions. Pot manure/ Amrit pani/ etc are few such preparations, which are quite effective in controlling insect pests. Preparation of Amrit pani: Cow urine one Litre + Cow dung 1Kg + Jaggery 250 g + Water 10 Litre. All these materials are mixed in an earthen pot. Allowed to ferment for 24 hrs. Diluted with water in 1:10 ratio, then filtered and sprayed. This also provides N and repels insects and microorganisms.

Harvesting

The grain matures even while the crop is green in colour. Farmers should be ready to take up timely harvesting at this stage. Harvesting is advanced by 7-10 days in SRI.

ADVANTAGES OF SRI

- ✓ Water savings up to 25 - 50 %
- ✓ Saving in cost of seed
- ✓ Stronger tillers, large root system and less lodging
- ✓ Reduced pest and disease attack
- ✓ Low cost of production
- ✓ Seed multiplication with less quantity of parent seed
- ✓ Environmental benefits

CONSTRAINTS

- ✓ Lack of good water control. Generally field-to-field irrigation is in practice.
- ✓ Lifting tiny seedlings and transplanting them is seems to be difficult and time consuming
- ✓ Seedling mortality
- ✓ More weed growth and Difficulty in workability of the weeder in varied soil type
- ✓ Inadequate organic manure availability

OPPORTUNITIES

In spite of the limitations, the potentiality of the SRI method can be best exploited for the following programs in rice production.

- Seed production and multiplication
- Aromatic rice production
- Organic rice production
- Rice production in small farm holdings

Conclusion

Rice yields all over the world have leveled out under the present system of flooded cultivation. Submergence of crop fields under rice-rice cropping system has led to development of soil sickness and environmental problems. Since agriculture in Orissa to a large extent means growing of rice and Orissa farmers cannot afford to go for agriculture without growing rice, there is need for an alternative method of rice cultivation. We are looking for alternatives in open mind. SRI is a type of method diversification. SRI is still

evolving. Scientists-Extension workers-Farmers linkage will further refine it to suit to our situation for higher productivity.

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