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System of Rice Intensification

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INTRODUCTION

The Rice Intensification System entails cultivating rice with as much organic manure as possible, beginning with young seedlings planted singly at wider spacing in a square pattern; intermittent irrigation that keeps the soil moist but not inundated; and frequent inter cultivation with a weeder that actively aerates the soil. SRI defies all established wet rice cultivation rules. To begin, instead of waiting a month, seedlings are transplanted at the two-leaf stage (between 8 and 12 days old). Second, rather than planting single seedlings in bunches, the single seedlings are planted with a spacing of around 25 cm. Seedlings develop stronger roots and more tillers as a result of this method, as they are not competing for nutrients, space, or sunlight. Third, rather than continuously flooding fields to prevent weed growth, plants are only given the appropriate amount of water and the soil is kept dry for a short period of time. This encourages microbial growth in the soil and reduces methane emissions. Because weeds must be manually controlled with a mechanical hand tool, the soil is well aerated, allowing for better plant growth. Fertilization is completed with organic manure and compost. SRI isn't a pre-packaged, pre-programmed technological solution. It's more of a set of ideas, a methodology for holistically managing and conserving resources by altering how land, seeds, water, nutrients, and human labour are used to boost productivity from a small but well-tended number of seeds. SRI, as Father de Laulanié pointed out, is a collection of various beneficial practises.

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Fig 1. System of rice intensification

SRI Principles

There are six principles guiding system of rice intensification (SRI) (Toungos and Dahiru, 2018). These are:

- Seedlings are transplanted at a younger age;
- Instead of a handful of seedlings, only one seedling is planted in each hole;
- Increased use of organic fertiliser to improve soil fertility;
- Instead of continuous flood irrigation, intermittent watering is used to increase wet and dry soil conditions;

Plants are spaced wider apart instead of close, dense planting, with seed rates of 50-100 kg/ha, Plants were set out carefully and gently in a square pattern, 25x25cm or wider if the soil is very good; the seed rate is reduced by 80-90 percent, netting farmers as much as 90-95 kg of rice per hectare; and

Rotary weeding to control weeds and promote soil aeration, with seed rates of 50-100 kg/ha, plants were set out carefully and gently in a square pattern, 25x25cm or wider if

Farmers can adapt recommended SRI practises to their agroecological and socioeconomic conditions using these principles. Adaptations are frequently made to accommodate changing weather patterns, soil conditions, labour availability, water management, access to organic inputs, and whether or not to practise fully organic agriculture.

Critical steps in SRI (TNAU, 2022)

1. Nursery area and seed rate

For a 1 ha field, only 7-8 kg of seed is required. The nursery area per hectare has been reduced to 100 m2. For 1 hectare, 20 raised beds measuring 1 x 5 m are required. Spread polythene sheets evenly over the rice seed beds for better germination. Fill the soil to a depth of 4cm on the Polythene sheets. After that, evenly distribute 375 g of seeds in each nursery bed of 5 sq.m. It is recommended that water be provided via a rose can. Use locally available mulching materials like coirpith/straw to cover the seed bed.

Fig 2. Nursery area of rice

2. Seedling age

Seedlings that were 8-12 days old were recommended for transplanting (3 leaves stage). The seedling growth will be manageable if the nursery bed is properly prepared with enough organic manure.

Fig 3. Transplanting of rice seedlings

3. Water Management

One of the most important steps in SRI is water management, and providing an aerobic environment in rice fields is the core point. Plants with truncated roots are unable to access the residual soil moisture in lower horizons that plants with large and functional root systems can access in order to maintain their growth and productivity. As a result, alternate wetting and drying is recommended. Irrigation is only used to moisten the soil during the first 10 days. After the development of hairline cracks in the soil, restore irrigation to a maximum depth of 2.5cm until panicle initiation. After panicle initiation one day after ponded water disappears, increase irrigation depth to 5.0 cm.

4. Mechanical (Cono) weeder usage

Square planting makes it easier to use a cono/rotary weeder in two directions, allowing for more efficient weed control. Weeders should be used in SRI at a 10-day interval after transplanting. One acre can be weeded in three hours of work. Weeds are trampled, and the nutrients are ploughed back into the soil as they decay. Soil is disturbed frequently, which has beneficial physico-chemical and biological effects. Tillering, which results in the bursting out of tillers, is triggered by root pruning. When using a weeder, the water level should be carefully monitored. It is critical to remove any remaining weeds by hand. Weeding costs are reduced by 52.5 per cent as a result of this.

Fig 4. mechanical weed control in rice field

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Table 1. SRI practices and their effects

Practices	**Effects**
Transplanting of young seedlings	● No or reduced transplanting shock ● Early and increased tillering and root growth ● Earlier transplanting date into the main field extends the time for rooting and tillering
Single seedling per hill transplanted at shallow depth	● Seed requirements are greatly reduced ● Reduced competition for nutrients, water, radiation, and space within a hill ● Open canopy structure gives greater light interception by leaves and less shading of lower leaves, enhancing the supply of photosynthate, especially to the roots ● Early root growth enhanced, leading to increased cytokinin flux toward the shoots, delayed senescence of leaves and roots, and increased photosynthesis
Wider spacing	● More space (below- and aboveground) for roots and shoots to access nutrients, water, and light ● Promotes more profuse growth of roots and tillers
Moist and nonflooded water management regime	● Aerobic (nonhypoxic) conditions of the soil favor root health and functioning, and also support more abundant and diverse communities of beneficial aerobic soil organisms ● No degeneration of roots, which under flooded soil conditions become degraded by as much as 75% by the phase of flowering ● Water savings up to 40% ● Energy savings for pumped water ● Reduced GHG emissions
Intercultivation to control weeds	● Churning up and aerating the surface soil ● Activates beneficial microbial, physical, and chemical soil dynamics ● Weed biomass is incorporated into soil as green manure ● Weeding costs can be reduced
Increased use of organic manures	● Improves soil structure and porosity ● Promotes root growth and root activity ● Sustained nutrient supply over longer period ● Favors growth and activity of soil biota

(Source: Thakur et al. 2016)

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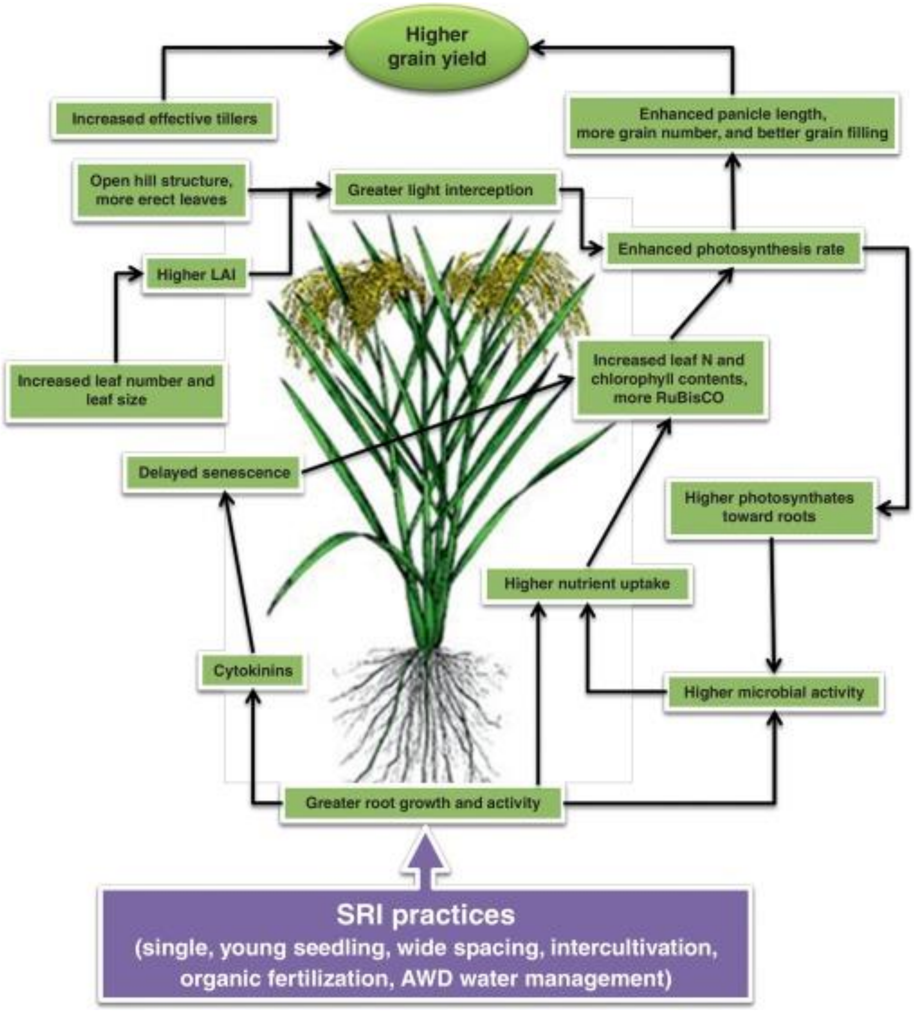

Fig 5. A schematic model showing factors that explain the increased grain yield of rice plants grown under SRI management practices (Source: Thakur et al. 2016)

Advantages of SRI:

- Higher yields – Both grain and straw
- Reduced duration (by 10 days)
- Lesser chemical inputs
- Less water requirement
- Less chaffy grain %
- Grain weight increased without change in grain size
- Higher head rice recovery
- Withstand cyclonic gales
- Cold tolerance
- Soil health improves through biological activity

Disadvantages of SRI:

- Higher labour costs in the initial years
- Difficulties in acquiring the necessary skills
- Not suitable when no irrigation source available

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CONCLUSION

SRI is a promising option for rice growers, more appealing than most other, currently available methods of rice cultivation, given the constraints of growing water scarcity and concomitant pressure to produce more grain – that is, to achieve more crop per drop. SRI provides an agroecological and climate-smart form of agriculture that integrates the economic, social, and environmental dimensions of sustainable development, addressing food security and climate constraints simultaneously.

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