GREEN FARMING STRATEGIC VISION : 9

(Volume 3 Number 3 May-June, 2012)

Rice production technology tools for water resource saving and environmental protection

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Rice (*Oryza sativa L*) is an important food crop of the world. With the growing world population, paddy production has to be increased to 810 million tones by the year 2025. Similarly Indian rice production has to be stepped up to 140 million tones. Increasing the production and productivity of rice with decreasing land and water resources is a herculean task. Agriculture accounts for 80 per cent of the total water consumption in India and about 60 per cent is consumed by paddy alone. Traditionally flooding method of irrigation is used for growing paddy with 2-3 centimetres of water on the field throughout the growing period. Paddy fields are allowed to dry-up only before the harvesting. This practice of irrigation results in large scale evaporation losses and low water use efficiency. It is estimated that 5000 litres of water is needed to produce 1 kg of paddy. By 2025 water scarcity is predicted to be severe and management of the available water resource for various purposes will be challenging situation. Therefore, framers are seeking alternative methods of rice cultivation. Such of most promising approaches of water resource saving and for environment safe tools (methods) are summarized as below.

System of rice intensification (SRI) is a revolutionary method of rice cultivation, which is first initiated at Madagaskar during 1980. Fertilizer could be reduced in addition to reduce seed requirement by 10 times and double the rice production than submerged method. In some of the field experiment studies and large scale demonstrations up to 50-55 % water saving was recorded. This method presently adopted in China, Indonesia, Cambodia, Thailand, India, Bangladesh and Sri Lanka like seventeen countries in the world. Soil-water-crop and nutrient management is the important to increase rice production in SRI method. Transplanting 8-12 days old seedlings with wider spacing (25cm x 25cm) will ensure to produce more number of tillers per plant, root development, panicles per hill. Passing cono weeder helps for free exchange of gases, root pruning and enhances better root establishment. Therefore, plant will become robust, resistant to pests and diseases and crop produces up to 100 tillers / hill. This resulted that 18-25 t/ha grain yield in SRI as against 3.87 t/ha in submerged conditions in A.P. was recorded.

Aerobic rice is a method of growing rice characterized by direct seeding of HYV in non puddle condition without standing water. The total water requirement from sowing to harvest is estimated about 650-830 mm under aerobic condition and about 1350 mm under flooded condition and water productivity will be increased from 20-40% further water use in aerobic rice is about 60% less than that of low land rice. Dry sowing is carried out and surface irrigation of 40 mm of water is given before sowing. One light surface irrigation is given at an interval of 5 days upto 20 days, irrigation to be continued once in 5-7 days upto 50 days. During grain filling stage, irrigation provided once in 3 days on field should be irrigated to a depth of about 5cm. Water must be with held 8 days before harvest of the crop to facilitate uniform ripening of grains. Yield level of 5.5 t/ha grain and 6.0 t/ha fodder yield could be achieved in aerobic method.

Modified aerobic rice cultivation, besides all recommended practices here paddy is transplanted by limited puddling and later on crop is maintained as in aerobic method. The main intension is to escape from initial weed competition which is otherwise major problem in aerobic method.

Alternate wetting and drying (AWD) is water saving technology that, low land rice farmers can apply to reduce their water use in irrigated fields. In AWD, irrigation water is applied to flood the field, a certain number of days after the disappearance of ponded water. Hence the field alternately flooded and non flooded. The number of days of non flooded soil in AWD between irrigation can vary from 1 day to more than10 days. A practical way to implement AWD is to monitor the depth of water table on the field using simple perforated “field water tube.” Average about 40-50% water can save by this method.

Ground cover rice production (GCRP) a low land rice is cultivated without a standing water layer during the entire growth period. Irrigate the crop when soil water tension drops below the certain threshold value *i.e.* 80-90% of the WHC is reduced. In order to prevent soil evaporation, the soil surface is covered with plastic film or mulch. Water saving GCRP system may be promising alternative that greatly reduced seepage and evaporation. This will save water resource about 60-65% contrary to continuous submergence.

Raised-bed method, here crop is grown on top of the bed and irrigation is applied through furrows, It is usually practiced in Indo-Gangetic area under rice-wheat cropping system. The main advantages are easy mechanical weed control, increase WUE, reduces crop lodging and furrows can be used for draining out excess water. In this method water resource can be save up to 24-45% compared to flat bed.

Methane produced in flooded rice cultivation which is greenhouse gas and is estimated up to 25% from submerged paddy fields. However, in various water saving methods, 80-85 % less methane gas and nitrous oxide is emitted into the atmosphere. In addition, about 47-56 % over all water resource saving could be achieved in these methods. Hence, above mentioned promising water saving rice production methods are environmentally safe and the possibility for sustainability of rice production and productivity in the future.

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