

Weed management in system of rice intensification

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Weed management in rice is important to prevent yield loss, decrease production costs, and preserve good grain quality. Weeds decrease yields by direct competition, especially for sunlight, nutrients and water. System of Rice Intensification (SRI) is a sustainable low-cost alternative to the conventional rice farming. This system ensures high yields with less input, especially with respect to irrigation water and seed. Heavy weed infestation is a major problem in SRI, mainly because of the wider spacing and lack of flooding in the field. Therefore, SRI warrants repeated weeding either manually or by mechanical weeder such as the cono weeder.

Keywords: Cono weeder, Rice establishment methods, System of Rice Intensification, Weed control efficiency

RICE (*Oryza sativa* L.) is one of the world's most important staple food crops. It is the primary source of income and employment for more than 100 million households in Asia and Africa. It is grown on 161 million hectares (m ha) in 114 countries, ranging from the flood plains of Bangladesh to the Himalayan foothills of Nepal, and from the rain forests of Indonesia to the desert plains of Australia. Rice production in Asia alone represents more than 90% of global production (143 m ha area; 612 m tonnes production) and consumption. In 2015-16, the rice area was 44.5 m ha

with production of 159.8 mt and productivity of 3.59 t/ha in India. The estimates for the potential losses averaged 37, 25 and 13%, due to weeds, insect pests and pathogens, respectively, worldwide. In India, about 33% of rice yield losses are caused by weeds and the annual loss of rice has been estimated to be 15 million tonnes.

Major weeds of national significance in rice

- *Echinochloa crusgalli* (L.) (Beauv.)
- *Cyperus rotundus* (L.)
- Weedy rice (*Oryzae* spp., wild rice)

Major weeds of regional significance in rice

- *Commelina benghalensis* (L.)
- *Eclipta alba* (L.) Hassk.
- *Ischaemum rugosum* (Salisbury)
- *Eleusine indica* L. (Gaertn.)
- *Amaranthus spinosus* (L.)
- *Monochoria vaginalis* (Burm.f., C.Presl ex Kunth)
- *Digitaria sanguinalis* (L.) (Scop.)
- *Fimbristylis littoralis* (Vahl)
- *Leersia hexandra* (Sw.)
- *Leptochloa chinensis* (L.) Nees.
- *Paspalum* spp.
- *Brachiaria* spp.
- *Panicum* spp.
- *Marsilea quadrifoliata* (L.)



Fig. 1. Paddy field under system of rice intensification (left) and conventional transplanting (right)

- *Oxalis latifolia* (Kunth)

The System of Rice Intensification (SRI) method of rice cultivation is based on a set of practices to manage plants, soil, water and nutrients that reduce seed requirement, save water and lower the costs of production while enhancing crop yield. The Management practices include transplanting young 8-10 days old seedlings, widely spaced transplanting with one seedling per hill in a square pattern, use of compost and other organic amendments, intermittent irrigation before panicle initiation and shallow water management thereafter, up to maturity and mechanical weed control. Purpose of SRI is to convert the realizable genetic potential of a variety into reality on farmer's field. About one million farmers are reported to have tested SRI in more than 350 rice growing districts in the country. SRI became part of National Food Security Mission in 2007.

Weed problems are generally of lower magnitude in the traditional method of rice cultivation because of puddling, transplanting and continuous submergence of water. But in SRI fields, weeds infestation is higher as compared to traditional transplanting system due to alternate wetting and drying of field. The cono weeder and rotating weeder are generally used in SRI for weed management. Adoption of rotary or cono weeder use in SRI plays a significant role in improving growth, yield and also the economics of rice. It also decides the number of labourers needed, cost of weeding and rate of increase in yield. Cono weeder is used for controlling the wet land weeds and getting more yields in the SRI. Small farm implements and machine *i.e.* power tiller, marker and cono weeder played imperative role in controlling weeds, enhancement of productivity and reduction in drudgery in SRI. Even Cono weeder need to incorporate daincha and azolla resulted in higher weed control efficiency during the early stages of rice crop. Twin wheel hoe is generally suitable for weed management in dry land. Alternate wetting and drying in SRI may provide conducive to excess weed growth which if not controlled in time may cause immense loss of

Table 1. Performance of mechanical weeders under SRI

Particulars	Weeder			
	Cono weeder	Rotary weeder	Twin wheel hoe	Farmer's practice
Field Efficiency (%)	60	65	60	NA
Cost of Operation (₹/ha)	600	500	800	1400
Saving in Time (%)	60	60	70	NA
Saving in Cost (%)	40	50	40	NA

Source: Deshmukh and Tiwari, 2011

Table 2. Weed control efficiency under various crop establishment methods in rice

Crop establishment methods	Weed control efficiency (%)	Reference
Transplanting	71	Hassan and Upasani, 2015
SRI	59	
Drum seeded	62	
Direct Seeded	61	Singh and Singh, 2014
Zero-till DSR	56	
Zero till DSR with residue	59	
Reduced tillage DSR	54	

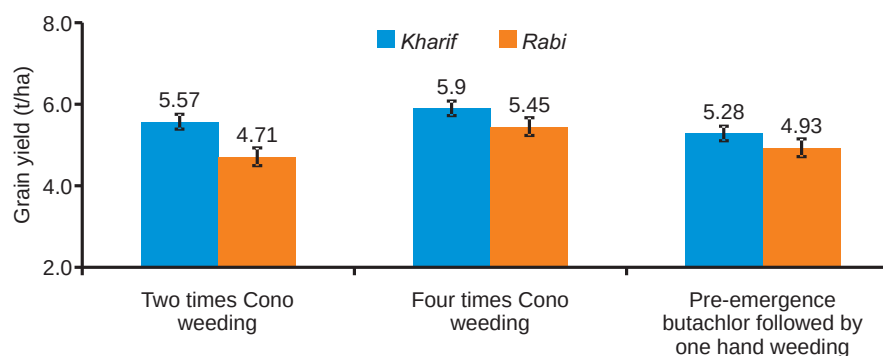


Fig 2. Effect of Cono weeding on grain yield of rice

grain yield. Increasing cost of labour and low-efficiency of weeder operation has necessitated working on integrating herbicidal weed control and weeder in SRI method for increasing weed control efficiency and yield. Results from All India Rice Improvement Project revealed that Cono weeding is an efficient mechanical weeding method as compared to the traditional hand weeding in SRI (Fig. 2). In *kharif* season, cono weeding either two times or four times was resulted higher rice grain yield than pre-emergence application of butachlor followed by one hand weeding. Similarly, the performance of different mechanical weeders (cono weeder, rotary weeder and twin wheel hoe) were also worked out and found that all these are efficient, need a lower cost of operation, save time and money compared to traditional farmer's practice of hand weeding (Table 1). Crop establishment methods also play a critical role in weed management.

Various sources revealed that transplanting was the best method to control weeds recorded the highest weed control efficiency (71%). All other establishment methods such as SRI (59%), drum seeding (62%), direct seeding (61%) resulted in comparatively lower weed control efficiency (Table 2).

SUMMARY

Weeds are responsible for about one-third of rice yield loss. About one million farmers are reported to have tested SRI in the country. Weed infestation is higher in SRI as compared to traditional transplanting system due to alternate wetting and drying. Different mechanical weeders (cono weeder, rotary weeder and twin wheel hoe) were found efficient in terms of time and money compared to manual weeding in SRI.

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