

# Weed management strategy for dry direct seeded rice

## Editorial

Rice is the staple food for over half of the world's population. This crop is conventionally grown by transplanting or wet direct seeding under lowland flood irrigated system. Scarcity of irrigation water has become a serious obstacle to sustain rice production through these conventional puddle systems. At this situation, dry direct seeding has been evolved as an alternate water-wise rice cultivation technology that offers saving of about 50-60% irrigation water compared with conventional system. In addition to irrigation water saving, dry seeding saves labour cost by avoiding seedling raising, uprooting and transplanting. Despite its huge potential, the technology is highly impeded by high weed pressure with a broad spectrum compared to lowland flood irrigated conventional system. In conventional puddle transplanted system weeds are suppressed by standing water and by transplanting rice seedling, which have a "head start" over germinating weed seedlings. The dry tilled aerobic soil and alternate wetting and drying conditions are conducive for germination and growth of weeds causing severe grain yield loss. Thus, development of effective weed management strategy for dry seeded rice has become a serious challenge for the researchers and farmers for rapid adoption of this potential most efficient water-wise rice production technology.

Weed imposes serious threat to the productivity of rice by exerting competition with the crop for light, nutrient, moisture and other resources. The removal of competitive effect of weeds by weeding reduces inter-specific competition for resources more efficiently and enables the plants to utilize available resources more efficiently throughout the growth cycle, which in turn positively influences crop yield and biomass production. Thus, effective weed management is crucial for higher yield of crop. Weeding is traditionally done by hand in many parts of the world. Hand weeding is very easy and environment-friendly but tedious and highly labour intensive. At present, farmers very often fail to remove weeds due to unavailability of labors, especially at peak period. Moreover, the labour cost is increasing day by day which increases production cost making rice production as highly non-profitable business venture. In such conditions, herbicides offers the most practical and economic means of weed management. Reports show that herbicidal weed control is much cheaper and gives two to three times much more net benefit than manual weed control.

Herbicide controls weeds very effectively and increases the yield of rice. Nonetheless, indiscriminate use of herbicide causes development of herbicide resistance weed and environmental hazard. Therefore, judicious use of herbicide is the prerequisite for avoiding development of herbicide resistant weed and environmental hazard. Application of herbicide with different mode of action in rotation helps to avoid development of herbicide resistance in weed. In addition, use of herbicide mixtures may help prevent resistance problem as well as shift in weed population. Proprietary mixture or tank mixture of different herbicides could also be preferred as they require less time, cost and increase the spectrum of weed control. Herbicides are of four types based on their time of application. These are pre-plant, pre-emergence, early post-emergence and post-

Volume 3 Issue 5 - 2016

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**Received:** May 20, 2016 | **Published:** May 23, 2016

emergence herbicides. However, the success of weed control depends on selection of appropriate herbicides of these groups and their judicious application. The choice of herbicide depends on the level of potential weed infestation from the weed seed bank, type of weeds to be present in the crop field and level of field management in previous seasons. Therefore, farmers need to select the appropriate herbicides considering all these aspects.

Phytotoxicity may occur in crop plants if inappropriate herbicides are selected. However, most of the rice herbicides such as Pretilachlor, Bispyribac sodium, Propanil, Thiobencarb, Fenoxopro-p-ethyl, Quinclorac and Bentazon/MCPA causes no injury to the rice plants under aerobic soil conditions. In fact, rice plants show high tolerance to herbicides but may suffer slight initial injuries such as leaf chlorosis and growth stunting during 7 to 14 days after application which disappears shortly. Different factors such as crop growth stage, rate of herbicide application, soil water content, etc. may contribute to the phytotoxicity of herbicide by altering herbicide absorption, translocation and metabolism. Reliance on herbicide alone may lead to many environmental and health problems. It may also create herbicide resistance in weeds which could make weed control more difficult. Thus, different weed management approaches needs to be integrated with the herbicidal technology to make weed control more sustainable and eco-friendly. Before, initiating a weed management program the farmers must consider the available cultural practices to be taken into consideration. It is mentionable that weed infestation in the crop field generally depends on the weed seeds and propagules being present in the crop field or in the seed bank. The seed bank is enriched by seasonal seed raining if weeds are allowed to reproduce. Therefore, the success in weed control depends on the killing or removal of existing weeds and restricting the introduction of weeds by any means. The clean cultivation is therefore, the most important aspect in weed control. Above all, different cultural practices such as mulching, crop rotation, seed priming, plant density, seeding rate, cultivar selection etc. should be considered as an integral part of weed control programme. Incorporation of these preventive and cultural practices into the weed control programme will lead to economic and environment friendly weed control.

Crop rotation has significant impact on weed population. Many weeds grow in association with some specific crop and therefore, selection of suitable crop will reduce the density of some specific weeds in the crop field. In addition, straw mulching restricts weed growth and enhances crop yield. Therefore, selection of proper crops in the rotation and their weed management has positive impact in weed control. Seed priming increases weed competitiveness of crop. Priming enhances faster early growth of crop and rapid canopy development enhancing resource capture and consequently improves competitive ability against weeds. Less vigorous and poor stands of unprimed seeds encouraged weed growth resulting in higher weed rating and weed dry matter. Thus priming could be practiced for increasing weed suppressive ability of dry seeded rice and consequently obtaining higher grain yield. Plant density has significant influence on weed pressure. Reduced density generally provides congenial environment for weed growth and may enhance the survival and fecundity of weeds. The higher seeding rate can keep the weed flora under check through smothering effect. Thus, higher plant population densities might have a competitive advantage over weeds due to fast canopy development. The circumstantial evidences suggest that increased seeding rate of rice might have some positive effect on weed suppression. However, increased seeding rate may not be able to increase the weed competitiveness of a crop due to greater intra-specific competition between the crop plants especially under stressful environmental conditions rather may intensify the negative impact of higher intra-specific competition for nutrient and light. However, closer spacing is congenial for early maturing cultivars to achieve higher yield because insufficient vegetative growth is the main hurdle to achieve maximum yield at conventional spacing. Rice yield

is limited under dense population due to reduced light interception and CO<sub>2</sub> accumulation.

The above discussion suggests that weed problem in dry direct seeded rice could be easily overcome by adopting different cultural practices along with manual, mechanical and chemical control measures. However, the most important thing in weed management is the development of farmers' awareness on adoption and application of these techniques. The integrated use of all the techniques to protect introduction of weed propagules into the crop field by any agents as well as restricting weed seed bank by preventing weed seed raining in the crop field are the most important aspects in weed control programme. Above all, judicious herbicide application could help weed control at lower cost and exerting minimum adverse effect on the environment. Therefore, thoughtful integration of different weed management approaches based on the geographical location, land type and socio-economic situation is very crucial for a sustainable, easy and economic weed control in dry direct seeded rice for the adoption of this potential water-wise rice production technology by the farming community to attain food security at the face of looming water scarcity under the global climate change scenario.

### Acknowledgements

None.

### Conflict of interest

The author declares no conflict of interest.