

# Sustainable weed management for unpuddled transplanted rice

## Editorial

Transplanting of rice seedlings in puddled soil is a common practice of lowland rice production in the tropics and subtropics of Asia. Farmers typically prepare land by two passes of dry tillage followed by exposure to sun for a few days and then inundate the field to puddle the land by ploughing and harrowing with standing water. This tillage practice is laborious, time consuming and costly. In addition, puddling destroys soil aggregates, breaks capillary pores and disperses the soils leading to increased bulk density of surface layers. The ploughing of this soil for the next crop results in formation of large clods, having high breaking strength and very large amount of energy and time for preparing a fine seed bed. Excessive wetness in puddled rice soil can delay the planting of succeeding crops leading to yield loss. The physical changes in soil due to puddling also have detrimental effects on non-rice crops in a rotation such as wheat. Therefore, puddling for rice transplanting should be avoided as it has adverse effects on the succeeding upland crops. Unpuddled transplanting is an alternative method for rice establishment which can be adopted to overcome these problems and also to reduce cost of rice production. For this system, the land is made ready for transplanting by one pass strip tillage (or without tillage) followed by inundation of the land for 48 hours to make the land sufficiently soft for transplanting. Several reports reveal that rice cultivated in unpuddled transplanted system gives similar or higher yield compared with puddled transplanted crop. The seedlings transplanted in unpuddled soil can avoid adverse effect of short-term intense drought where rice seedlings in the puddled field, generally dies due to soil shrinkage and creation of cracks. Despite these advantages, the adoption of unpuddle transplanting system is highly constrained as the crop faces severe weed infestation. Rice yield may drastically be declined in unpuddled system if weed management is not done properly. On the other hand, the weed problem is not a serious issue in case of puddled transplanted crop as puddling of soil destroys weeds just before transplanting.

Tillage helps to destroy standing weeds and to reduce weed infestation at the early stage of crop emergence by burying weed seeds into the soil in puddled land. On the other hand, pre-planting non-selective herbicides (glyphosate) are used to kill the existing weeds on the field for unpuddled system but still the weed seeds remain on the soil surface. Therefore, huge weed pressure usually observed under unpuddled system at the early crop establishment period. Though some partial suppression could create on those weeds by the standing water of the field, season-long effective weed control need to be taken for better crop growth and yield.

Weeds grow in the crop field through emergence from seeds and propagules present in the soil seed bank. The intensity of infestation depends on the amount of seeds or propagules present in the soil. In addition to the seeds/propagules already present in the field, weed seeds and progaules may enter into field through different means. Therefore, weed pressure could be reduced by preventing the introduction of new seeds and propagules from outside the field. Moreover, prevention of seed rain from the existing weed by controlling them

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Moshiur Rahman

Department of Agronomy, Bangladesh Agricultural University,  
Bangladesh

**Correspondence:** Moshiur Rahman, Department of Agronomy,  
Bangladesh Agricultural University, Mymensingh-2202,  
Bangladesh, Email rahmanag63@yahoo.com

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before being reached to the reproductive phase or destroying them before seed formation could help reducing seed bank richness. Thus, clean cultivation is the most important aspect of successful weed management. Reports reveal that continuous cropping following good agronomic management reduces the weed density in the field in the subsequent seasons and years. Several reports indicated that clean cultivation and adoption of preventive measures are the major tools to reduce weed infestation in the crop field. Furthermore, integration of different cultural and mechanical methods with the herbicide technology would lead to attain a sustainable weed management for unpuddle transplanted rice.

Hand weeding is the most common method of weed control for rice but decreased labour availability and high wage, especially during the periods of peak demand, are curtailing the amount of manual weeding on farms. Weed control is fundamental at the critical period of crop growth that ensure better yield but removal of weeds by traditional methods may not be possible due to increased labour demand at the peak period. Herbicidal weed control can be considered as a convenient means of efficient weed control at lower cost. Our study divulge that pre-emergence herbicide followed by one hand weeding at 25 DAT reduced weed density by 75-84% whereas sequential application of two (pre- and post-emergence) herbicides gave 70-86% and three (pre-, early post- and post-emergence) herbicides gave 75-94% density reduction of weed. It has been reported that use of pre-emergence herbicides reduced the weeding cost by 38-46% compared with manual weeding in puddle transplanted rice system. The application of pre-emergence and post emergence herbicides reduces weeds significantly even under minimum tillage system and provide better yield over manual weeding. Our study also reveals that herbicides significantly reduced grass weeds (*Cynodon dactylon* and *Echinochloa colona*) in both the years. *E. colona* was fully controlled by pyrazosulfuron-ethyl fb orthosulfamuron fb (butachlor + propanil) while pyrazosulfuron-ethyl fb orthosulfamuron fb 2,4-D amine reduced this species by 85-100%. Butachlor fb (butachlor + propanil) and butachlor fb orthosulfamuron fb (butachlor + propanil) controlled *C. dactylon* by 85-93% over weedy plots. Moreover, pyrazosulfuron-ethyl fb orthosulfamuron fb (butachlor + propanil) provided effective control on this species. Though weeds usually germinate in several flushes, one hand weeding may not be enough to check further weed

emergence. Moreover, hand weeding might have exposed many buried weed seeds to solar radiation resulting in breaking seed dormancy which may increase weed seedling emergence in some cases. It should be noted that the consecutive use of same herbicide or same mode of action herbicide leads to the development of herbicide resistance in weeds which makes weed control more difficult. It should be noted that herbicides are chemicals and thus, over use of chemicals may have serious environmental and health hazards. The judicious use of herbicides could overcome the herbicide resistance problems and environmental impact.

Our study showed that use of appropriate pre-emergence and post-emergence herbicides in a sequence could provide good control on weeds in unpuddle transplanted system and helps achieve high yield

with higher net benefit over weed free plots. We also observed that the herbicides used in our study did not have any adverse effect on the establishment and yield performance of succeeding crops like wheat, sunflower and lentil. Thus, it could be expected that use of herbicide along with different cultural and mechanical means would give a sustainable weed control at lower cost.

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### Conflict of interest

The author declares no conflict of interest.