Popular Kheti
Volume -1, Issue-2 (April-June), 2013
Available online at www.popularkheti.com

ISSN:2321-0001

# Weed Management in Paddy

**Teekam Singh[1*] B. Lal[2] and B. S. Satapathy[1]**
[1]Regional Rain-fed Lowland Rice Research station, Gerua, Kamrup, Assam-781102, India
[2]Central Rice Research Institute, Cuttack, Odisha-753006, India
***Email of corresponding author: tiku_agron@yahoo.co.in**

Most of the improved crop management practices in paddy fail due to poor management of weed flora present in the field. Weeds compete with the crop for nutrients, moisture, light, heat energy and the growing space and thus, cause drastic reduction in yield of the crop. Successful weed management for paddy crop therefore becomes most important in order to exploit its maximum production potential. This article describes in brief about weed flora and their management in paddy.

## Introduction

Agriculture has been a forefront agenda at national and international level for food security and management of natural resources. Cereals are the most important part of our diet throughout the world and thus, play major role in our food security. Among cereals, rice has been staple food for more than 60 per cent of the world population, providing energy for about 40% of the world population where every third person on earth consumes rice every day in one form or other (Datta and Khushi, 2002). Therefore, crop paddy *(Oryza sativa* L.) has been an important crop which is extensively grown in tropical and subtropical regions of the world. It is cultivated in area of 44.0 million hectares with an annual production of 104.3 million tons in India. (GOI, 2012). Its production has been found to be distributed as 91.5 million tons in *kharif* and 12.8 million tons in *rabi* season. However, its productivity in India is very low (2.37 t $ha^{-1}$) as compared to other rice growing countries like Japan (6.35 t $ha^{-1}$), Australia (6.22t $ha^{-1}$), Spain (6.16 t $ha^{-1}$), Egypt (5.0 t $ha^{-1}$) and China (5.2 t $ha^{-1}$). There are several reasons for its low productivity but the losses due to weeds are one of the most important.

The total annual loss in agriculture due to different pests is about ₹ 6,000 crore in India. More than one third of the total loss (33%) is caused by weeds alone (Mukherjee, 2006). Weeds are most severe and widespread biological constraints to crop production in India. Weeds are responsible for heavy yield losses in paddy, to the extent of complete crop failure under severe infestation conditions. Irrespective of the method of paddy establishment, weeds are a major impediment to paddy production due to their ability to compete for resources. In general, weeds problem in transplanted

paddy is lower than that of direct seeded paddy because of puddling and stagnation of water in transplanted paddy during early growth stage of crop. But in some cases where continuous standing water cannot be maintained particularly for the first 45 days, weed infestation in transplanted paddy also may be as high as direct seeded paddy. According to Singh et al. (2005) weeds can reduce the grain yield of dry-seeded paddy (DSR) by 75.8%, wet seeded paddy (WSR) by 70.6% and transplanted paddy (TPR) by 62.6%. Weeds by virtue of their high adaptability and faster growth dominate the crop habitat and reduce the yield potential. The degree of competition between the crop and weeds mainly depends on crop factors such as cultivars, crop density, crop age, plant spacing, etc. The presently cultivated dwarf high yielding variety with erect leaf canopy promote more weed growth and suffers from yield losses relatively more than the tall traditional varieties of paddy even under transplanted condition. This article describes about weed problems in paddy and their effective possible management strategy for efficient rice production.

**Weed Flora in Paddy**

Paddy field colonized by terrestrial, semi aquatic or aquatic weeds depending on the types of ecosystem. In recent years, paddy production has increased with the introduction of high yielding varieties, but their maximum yield potential has not been fully achieved due to improper weed management practices. Paddy plants grow under different ecosystem, and this could be broadly categorized as rainfed and irrigated ecosystem.

**Table 1: Major weed flora of paddy under different methods of rice establishment**

| Rice ecosystem | Weed group | Major weeds |
|---|---|---|
| Rainfed upland | Non-grasses | *Eclipta alba, Trianthema portulacastrum, Cynotis auxiliaries, Digera arvensis, Bannaya brachiata, Euphorbia hirta, Phyllanthus niruri, Amaranthus viridis* |
| | Grasses | *Echinochloa colonum, Echinochloa crusgalli, Eleusine indica, Dactyloctenium aegyptium, Paspalam sp., Cynodon dactylon, Digiteria sanguinalis* |
| | Sedges | *Cyperus rotundus, Cyperus iria, Fimbristylis miliacaea* |
| Irrigated Lowland | Non-grasses | *Caesulia axillaris, Rotala densiflora,Oxalis corniculata, Arnrnania baccifera, Cornrnelina benghalensis, Corchorus acutangulus, Ammania bacifera, Sphaeranthus indicus, Aeschynomene indica, Sphenoclea zeylanica, Sphenoclea zeylanica, Sagitteria sagittifolia* |
| | Grasses | *Echinichloa crusgalli* (Barnyard), *Echinochloa oryzoids (*Awned grass), *Echinochloa stagnina* (Hippo grass), *Scirpus* |

| | | |
|---|---|---|
| | | *mucronatus* (Bulrush), *Panicum repens* (Ginger grass), *Heteropogon contortus* (Spear grass), *Leptochloa chinensis* (Chinese sprangle top), *Dinebra retroflexa* (Viper grass), *Brachiaria ramose* (Brown top millet) |
| | Sedges | *Cyperus rotundus* (Nutsedge), *Cyperus iria* (Sedge weed), *Cyperus difformis* (Umbrella sedge), *Cyperus nutans*, *Fimbristylis aestivalis*, *Kyllinga brevifolia*, *Kyllinga nemoralis* (White kyllinga) |
| | Semi-aquatic | *Monochoria vaginalis*, *Marsilea quadrifolia*, *Hydrolea zeylanica*, *Pistia stratiotes* (Water lettice), *Ludwigia perennis*, *Ipomea aquatic* (Floating morning glory), *Chara zeylanica*, |

**Crop - Weed Competition**

Paddy plants as well as weeds have the same requirement for the growth and development, and competition begins when crop plants and weeds grow simultaneously in the same field and one of the limiting factors such as nutrient, moisture, $CO_2$ and light etc. falls below the demand of both. In addition to competitive yield loss, weed seeds can reduce rice quality and grade. The overall effect of competition would be a reduction in the biomass and reproductive potential of the competitors. The outcome of the competition would depend not only on the competing species but also on their density, duration and the level of fertility. Secondary effects of weeds are numerous and include reduced harvesting and processing efficiency, increased insect and disease severity, and increased production costs.

**Critical Period of Crop-Weed Competition**

The critical period of crop-weed competition varies considerably with the crop cultivar, weed flora, weed incidence, climatic and edaphic condition. The most critical period for competition between paddy and weeds is when the paddy is in the vegetative phase. In general, critical period of crop-weed competition remains throughout crop growth period in direct seeding situation and whereas it varies from 15 to 45 days after transplanting (DAT) in transplanted paddy. In general, larger the duration of crop-weed competition, the higher the reduction in grain yield.

**Weed Management Strategy in Paddy**

Weed management means to keep weed population below the threshold level through different weed control methods. The best method of weed control is to maintain the crop-weed competition in the favour of crop plants. There are many ways to maintain weeds below threshold level such as cultural, manual, mechanical and chemical weeding practices. The integration of these techniques proves cost effectiveness as well as easy adoption by the farmers. The integration of

weed control techniques depends on method of paddy cultivation. There are two approaches to control weeds in different rice ecosystems.

**1. Indirect preventive techniques**

The indirect preventive techniques comprise all measures which deny the entry and establishment of weeds in the field crop. These techniques include use of weed free crop seed/seedlings, puddling and incorporation of weed before transplanting or direct seeding, or line planting. Use of tall and fast growing cultivars, closer spacing, stagnation of water during early crop growth stage, application of fertilizers after weeding, proper crop vigilance are major preventive methods in field whereas adoption of legal quarantine measures prevent the entry of weed from other states or country. As said prevention is better than cure, weed preventive measures drastically reduce the farmer's efforts to be done in future for controlling weeds. Therefore it is better to adopt preventive measure in time so as to have negligible or less weed flora for future control.

**2. Direct control methods**

**2.1 Weed management in transplanted and wet seeded paddy**

**Hand weeding:** Hand weeding has been practiced by farmers in India since from they initiated agriculture. In this method weeds are pulled by hand or tools like hoe, spade or sickle etc. It is effective when weeds are annual and fast growing but in case of perennial weeds it remains ineffective due to their regenerative capability. One or two hand weedings between 20-45 days after transplanting are sufficient for effective weed control. This method is most common being easy but also costly and laborious.

**Mechanical weeding:** Cono-weeder and rotary weeder can be used in the straight rows of paddy between 20-45 days after transplanting. This method save labour but require row planting.

**Chemical weed control:** There are some chemicals (herbicides) which are capable of killing some weed plants without significantly affecting the crop plants in the same paddy field. Weed control through herbicides is more effective and beneficial as it checks the crop-weed competition at early stage of crop growth. A list of common herbicides used in paddy is given in Table 2, but application of two or more herbicides mixture gives the most effective weed control due to synergistic and additive effect.

***Precautions in herbicide use*:** One should always read the herbicide label before use. Right dosage and time of application at the proper stage of weed growth is a 'must' while using herbicide. Incorrect dosage with untimely application leads to phytotoxicity, more often in direct seeded paddy. Spray

should be avoided in windy condition. Application equipments should be calibrated accurately.

**Table 2: Herbicides for transplanted paddy**

| Herbicides | Doses | | Time of application (Days after transplanting) |
|---|---|---|---|
| | a.i. (g/ha) | Commercial product (kg/ha) | |
| Butachlor 50 EC | 1250 | 2.5 | 5-7 |
| Pretilachlor 50 EC | 500 | 1.00 | 5-7 |
| Bensulfuron methyl 60% DF | 100 | 0.166 | 5 |
| Pendimethalin 30 EC | 1000 | 3.0-3.5 | 3-5 |
| Anilofos 30 EC | 0.45 | 1.50 | 5-7 |
| Oxadiargyl 80 WP | 0.1 | 0.125 | 3-5 |
| Pyrazosulfuron ethyl 10 WP | 5 | 0.5 | 3 |
| Bensulfuron methyl 0.6 G + Pretilachlor 6 G | 75+750 | 12.5 | 3-5 |
| Chlorimuron ethyl + Metsulfuron methyl 20 WP | 4 | 0.02 | 20-25 |
| 2,4-D Sodium salt 80%EC | 2000 | 2.5 | 21-28 |
| Propanil 35 EC | 2500 | 7.5 | 1-2 leaf stage |
| Bispyribac sodium | 20 | 0.2 | 20-25 |

**Integrated weed management:** Judicious integration of agronomic, mechanical, biological and chemical methods of weed control is usually referred to as integrated weed management (IWM). This technique is the best way to manage weed population below threshold level without disturbing ecosystem. There are some packages of IWM in transplanted rice such as:

1. Puddling→Pre-emergence application of Butachlor 50 EC @ 2.5 kg/ha at 5-7 days after transplanting→one hand weeding at 30-40 days after transplanting.
2. Puddling→Pre-emergence application of Pyrazosulfuron ethyl 10 WP @ 500 g/ha at 3-5 days after transplanting→post emergent application of 2, 4 DEE @ 1.0 kg/ha at two to three leaf stage of weeds.

### 2.2 Weed management in rainfed upland dry seeded paddy

Weed problem in rainfed upland dry seeded paddy is more severe as they start competition with paddy plants just after seed germination. Thus, the preventive techniques like use of pure, high density quality seeds without admixture of weed seeds, deep summer ploughing, close line sowing (20 cm) and properly prepared seed bed are quite useful for reducing weed population. In severely infested areas, use of stale seed bed technique wherein weed seeds are allowed to emerge but killed before sowing either by non selective herbicides like Glyphosate or by shallow tillage, is more effective. Pre-emergence and post-emergence herbicides listed in Table 2 can also be used for suppressing the early flush of grassy weeds and sedges when weather and soil moisture

conditions are appropriate. Manual weeding at 50-55 days after sowing for removal of late emerging weeds can be done. Mechanical weed control can also be done by cono or rotary weeder operating between crop rows at 15 and 30 days after sowing combined with hand removal of weeds within the rows. In dry seeded paddy brown manuring technique in standing crop can also be helpful for managing weeds. In brown manuring practice *Sesbania* seed (20 kg/ha) is broadcasted three days after rice sowing and allowed to grow for 30 days and then spray of 2, 4-D ethyl easter (0.75-1.0 l/ha) is done on standing plants of Sesbania which leads to not only control of broad leaf weeds but also supply of N up to 35 kg/ha.

**Conclusion**

Weed flora in paddy are dynamic in nature and varies with time and place. Weeds compete effectively with the crop plants mostly up to at 40-45 DAT and reduce grain yields ranging from 10 to 83 per cent. Chemical weed control is getting popularity, particularly in areas where labour is scarce and costly. Some of the herbicides either alone or their combinations at lower dose have been proved economically viable alternative to hand weeding in management of weeds in paddy field. However in the present era of integrated weed management use of all suitable management technique are utilized in such a compatible way so as to reduce weed population below economic threshold levels without deteriorating environment quality.

**References**

Datta SK and Khushi GS. 2002. Improving rice to meet food and nutritional needs: Biotechnological approaches. *Journal of Crop Production,* **6**: 229-247.

GOI 2012. Ministry of Finance, Government of India. *Economic Survey* 2011-12 pp A17-18.

Mukherjee M. 2006. Weed management strategy in rice-a review. *Agricultural Review*, 27**(4)**: 247-257.

Singh S, Singh G, Singh VP and Singh AP. 2005. Effect of establishment methods and weed management practices on weeds and rice in rice-wheat cropping system. *Indian Journal of Weed Science,* **37**: 51-57.