Gundhibug on leaf

Economics of off-farm trials showed that an additional return upto Rs. 12000/- per hectare can be obtained by adoption of IPM practices.

Gundhi bug damage

Now a days traditional rice cultivation has been abandoned due to introduction of high yielding varieties (HYV) in an effort to increase the productivity and income often ignoring the sustainable crop protection practices in every rice ecosystem including rainfed upland rice. Adoption of HYV, chemical fertilizer and pesticides and other advanced crop management practices profoundly influence pathogen and insect populations. Integrated pest management is, therefore, strongly linked to an integrated crop management practices for successful management of insects, diseases and weeds in upland rice.

Termite damage

Termite

Cynodon dactylon

Cyperus rotundus

Integrated Pest Management in Rainfed Upland Rice

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Integrated Pest Management in Rainfed Upland Rice

P. C. Rath

Rice is grown in vastly diversed conditions in India right from below the sea level in parts of Kerala to hilly tracts with an elevation of almost 3000m above mean sea level in Himachal Pradesh and in Jammu and Kashmir. In rainfed upland, it is grown with no standing water in the field. Total area under rainfed upland rice in the country is about 6.0 Mha, which accounts for 13.5% of total area under rice cultivation and contributing only 7% of the total production. It is located mainly in eastern zone i.e. Assam, Bihar, Chhattisgarh, eastern Uttar Pradesh, Jharkhand, Madhya Pradesh, Odisha, West Bengal and North East Hill Region. The rainfed upland ecosystem is drought prone.

Rainfed upland rice is generally mono-cropped in well drained soil in slopy, undulating or terraced land. The soil is shallow in depth with low water holding capacity. Soils is generally acidic. Farmer usually cultivates traditional rice varieties; apply low input; weed the crop once and get very low yield. The upland rice farmers generally belong to low socio-economic condition.

Physical and biological constraints for rainfed upland rice cultivation are numerous. Weeds are the most serious biological constraint accounting for about 20% loss in grain yield. Other pests (insects and diseases) accounts for about 15-20% additional losses. Beside weeds, termite, gundhi bug, stem borers, nematodes, blast and brown spot are the important biological constraints to the rainfed upland rice.

Rodents, nematodes and birds also sometimes cause very serious problem. Sustainability of the rice production system is under threat due to increasing use of chemical fertilizers and pesticides. The IPM, if adopted can help improve sustainability of the system.

White ear head

As per FAO definition, Integrated Pest Management (IPM) means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM is thus not only generation of technology but developing awareness among the farmers.

At present, IPM covers only about one per cent of 143 million hectares of cultivated area in the country. A little effort has been made to synthesize the location-specific IPM modules to take care of insect pests, diseases, weeds and other crop damaging organisms together. Validation of IPM in rice suggests that such efforts could help in reducing pesticide use and improve crop yield. Based on the information available, IPM strategy for rainfed upland have been developed and validated in farmers' field in Cuttack district.

YSB male

YSB female

YSB egg mass

Research at NRRI on IPM module for upland ecology during 2011 & 2012 in farmers' field revealed that seed treatment with Carbendazim 50 WP (Bavistin) @ 2gm/kg against blast and Chlorpyriphos 20EC (Hilban) @ 7ml/kg against termite, application of pre-emergence herbicide Pretilachlor 50 EC (Rifit) @ 1.5 liter/ha against weeds, use of trichocard (100,000 Trichogramma/ha) and pheromone trap (20 trap/ha) against yellow stem borer and need based application of Chlorpyriphos 20EC (Hilban) @ 1.25 litre/ha will effectively control the stem borer, termite, gundhi bug damage, blast and weeds. Due to IPM practice, on an average about 50% reduction of dead heart, white ear head, gundhi bug damage and termite damage was observed in off farm trials and the average grain yield increased over farmers practice plots was 60% during kharif 2010 & 2011 both in high yielding variety (Anjali) and local variety (Brown gora).

Dead heart

IPM module for rainfed upland rice:

Problems	IPM interventions in upland rice
Weeds	Application of pre-emergence herbicide Pretilachlor 50 EC (Rifit) @ 1.5 liter/ha two days after sowing followed by hand weeding at 30 days after germination.
Termite	Seed treatment with Chlorpyriphos 20EC (Hilban) @ 7ml/kg , need based application of Carbofuran 3G (Furadon) @ 33 kg/ha.
Blast	Seed treatment with (Bavistin) @ 2gm/kg and need based application of Carbendazim 50 WP (Bavistin) @ 2ml/lit at 8-10% leaf infection.
Brown spot	Need based application of Mancozeb 75 WP (Dithan M 45) @ 1.2kg/ha at 8-10% leaf infection.
Stem borer	Release of *Trichogramma japonicum* @ 100,000/ha (5 trichocards/ha) at 30 days after sowing, use of pheromone trap @ 20/ha for mass trapping, need based application of Chlorantraniliprole 18.5% SC (Coragen) @ 150 ml/ha.
Gundhi bug	Need based application of Chlorpyriphos 20EC (Hilban) @ 1.25 litre/ha
Insect pest tolerant high yielding varieties	Anjali or Vandana or Abhishek
Seed rate and sowing time	Sowing of 60 kg/ha latest by last week of June.
Healthy seeds	Healthy seeds can be obtained from mechanically separated seeds using 20% common salt solution which can manage sheath rot in varieties of 90-105 days duration.
N-fertilizer management	22 kg Urea as basal, 44 Kg Urea at 30 days after emergence (DAE) and 22 kg N at 45 days after emergence.

Rice blast
Pyricularia oryza

This module was found sustainable and recorded highest grain yield (2.85 t/ha) in high yielding variety (Anjali) as compare to schedule based protection practice and farmer's practice of pest management in both HYV and local variety. The benefit cost ratio for IPM Vs farmers' practice in Anjali was 1.7 and the benefit cost ratio for IPM in Anjali Vs farmers' practice in local variety was 2.1 during 2010. The benefit cost ratio for IPM Vs farmers' practice in Anjali was 1.6 and the benefit cost ratio for IPM in Anjali Vs farmers' practice in local variety was 2.6 during 2011.

By adoption of IPM in HYV Anjali, incremental return of Rs. 11976/- was received due to additional investment of Rs. 7064/- in the same variety. Whereas, an additional return of Rs. 15316/- was received in comparison to local variety Brown gora due to additional investment of Rs. 7214/-.

Blast lesions on leaves