



Research Article

EFFECT OF HERBICIDAL APPLICATION ON INCIDENCE OF INSECT PESTS AND NATURAL ENEMIES

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Abstract- The incidence / population of various insect pests and natural enemies were recorded at weekly interval on rice cultivar CSR 30 under transplanted condition with different herbicidal treatments during *Kharif* 2013 and 2014. The overall seasonal population of plant hoppers varied from 185.5 to 197.8 and 15.42 to 16.70 plant hoppers/10hills during 2013 and 2014, respectively. All the treatments were on par with each other. The seasonal mean incidence of stem borers varied from 3.93 to 4.82 and 4.67 to 5.49 per cent in different treatments during 2013 and 2014, respectively. There was no significant difference in the incidence of stem borer in different treatments during both the years. The incidence of rice leaf folder fluctuated during both the seasons with overall mean incidence of 5.98 to 6.51 per cent in 2013 and 3.87 to 4.17 per cent damaged leaves in 2014 and none of the herbicide neither increase nor decrease leaf folder incidence. There was no significant difference in the spiders population in different herbicidal treatments during 2013 and 2014. The average grain yield in different treatments was statistically at par with each other during both the years.

Keywords- Herbicides, Hoppers, Leaf Folder, Natural Enemies, Rice, Stem borer.

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Introduction

Rice (*Oryza sativa* L.) is a staple food for more than 60 per cent of the world's population. In India it is grown on an area of 39.16 million ha with total production of 85.59 million tones [2]. More than 100 species of insects are known to attack the rice crop. About 20-25 of these have reached the status of pest causing economic losses under farmers's field situations. Among them, plant hoppers, stem borers, leafhopper, leaf folder, gall midge, whorl maggot, rice hispa, gundhi bug, caseworm, armyworm, cutworm, and thrips are the most important in India and other countries [7].

The plant hoppers have posed a serious threat to rice production, causing 8–80 per cent yield losses under variable conditions of insect abundance, varieties, crop age, agronomic practices and insecticide usage [4,9,10]. The borers cause damage to rice throughout the crop growth period and the symptoms are common. The damage is manifested as 'dead heart' due to death of growing point in the vegetative phase and 'white ear' at reproductive stage [6]. The foliage feeders guild of insect pest is also important. The leaf folder, *Cnaphalocrocis medinalis* (Guenee) is a destructive pest occurs throughout the crop growth period from planting to harvest. The larvae of leaf folder fold the leaves and feed on the chlorophyll tissues leaving white parallel streaks running longitudinally on the leaf blade [1].

In the last decade use of pre-emergence and post emergence herbicides increased greatly in rice. The increasing reliance on herbicides has led to concern about their direct and indirect effects on herbivores and natural enemies. [13] reported significant stimulating effect of butachlor, metachlor, oxidiazon and bentazone on multiplication and feeding of brown planthopper. The changes in various farming practices such as crop establishment methods (direct-seeding and transplanting), variety, fertilizers and pesticides affect pest status [11,12]. So the effect of herbicides on insect pest may provides the basis for development of integrated pest management tactics. Therefore, keeping the above facts in view

the present investigation was conducted to provide novel information for herbicidal effect in pest reduction. If there, application reduces the incidence of pest they may also reduce the application of pesticides and input cost of farmers to raise the crop as are required to control the weeds in a particular crop.

Materials and Methods

Experimental Site:

In order to study the effect of various herbicides on various insect pest and their predators, the experiment was laid out in randomized block design with three replications in the plots measuring 5x4 m². Twenty five days old seedlings of rice cultivar CSR 30 of uniform vigour were transplanted 2 seedlings/hill at 20x15 cm spacing in second week of July during both the years and the crop was raised with recommended agronomic practices [3] at Chaudhary Charan Singh Haryana Agricultural University, Rice Research station, Kaul (29°51' N latitude, 76°41' E longitude) Haryana, India. The experiment constitutes following 10 treatments as detailed below.

Details of various treatments

S. No.	Name of herbicide	Formulation	Doses/ ha
T ₁	Butachlor	50 EC	3000 ml
T ₂	Anilophos	30 EC	1325 ml
T ₃	Pretilachlor	50 EC	2000 ml
T ₄	Butachlor + Almix	50 EC + 20 WP	3000 ml + 20 g
T ₅	Anilophos + Almix	30 EC + 20 WP	1325 ml + 20g
T ₆	Pretilachlor + Almix	50 EC + 20 WP	2000 ml + 20 g
T ₇	Butachlor + Bispyribac Sodium	50 EC + 10 SL	3000 ml + 250 ml
T ₈	Anilophos + Bispyribac Sodium	30 EC + 10 SL	1325 ml + 250 ml
T ₉	Pretilachlor + Bispyribac Sodium	50 EC + 10 SL	2000 ml + 250 ml
T ₁₀	Check (no herbicide)	---	---

The pre-emergence herbicides (butachlor, pretilachlor and anilophos) were applied 3 days after transplanting (after mixing with sand) and post-emergence herbicides almix and bispyribac sodium (T_4 to T_9) were sprayed 25 days after transplanting. Two hand weeding was done in check.

Observations

Population/ incidence of different insect pests and natural enemies was recorded from 10 randomly selected hills in each block at 7 days interval from 40-45 days after sowing till harvest.

Foliage feeders: (Leaffolder, whorl maggot, rice hispa, thrips and army worm): Total leaves and damaged leaves were recorded to compute per cent damaged leaves

$$\text{Per cent damaged leaves} = \frac{\text{Number of damaged leaves}}{\text{Total number of leaves}} \times 100$$

Borers: Total tillers and dead hearts at vegetative stage and white ears at reproductive stage were counted to compute per cent dead hearts and white ears as under

$$\text{Per cent dead hearts} = \frac{\text{Number of dead hearts counted}}{\text{Total number of tillers observed}} \times 100$$

$$\text{Per cent white ears} = \frac{\text{Number of white ears}}{\text{Total productive tillers}} \times 100$$

Sucking insects: Population of brown plant hopper, white backed plant hopper and gudhi bug was recorded.

Natural enemies: Population of spiders and mirid bugs was recorded.

The population of plant hoppers along with predators was recorded in the forenoon visually and by tapping the plant by hand from the base of the plant to the top in to a 30x22.5x5 cm white enamel tray containing a little water. The tray was cleaned every time before next observation.

Yield: Grain yield of the crop was recorded at harvest from a small plot of 5mx4m in each block/replicate.

Result and Discussion

The herbicides may have direct or indirect effect on insect population and natural enemies which in turn influence degree of damage to the crop. The herbicides commonly used by the farmers and recommended by CCS Haryana Agricultural University, Hisar were studied for their effect and the results are discussed below.

Effect on plant hoppers, stem borers and rice leaf folder incidence

Effect of herbicidal application on plant hopper revealed that the overall population in the season varied from 185.5 to 197.8 and 15.42 to 16.70 plant hoppers/10hills during 2013 and 2014, respectively. No significant difference was observed among the different herbicide treatments at any period of observation [Fig-1]. Likewise, mean seasonal incidence of stem borers varied from 3.93 to 4.41 per cent the different herbicides treatments showed no difference in infestation among the treatments at any interval during 2013. Almost similar trend of incidence (4.67 to 5.91 per cent) was observed during 2014 [Fig-2]. The overall damage caused by leaf folder varied from 5.98 to 6.51 per cent damaged leaves in different treatments. The difference among the treatments were not significant against this pest also [Fig-3]. It is evident from the data that various herbicides when applied singly or in combination did not influence the incidence of planthoppers, stem borers and leaf folder. It can be inferred from the present findings that the herbicide butachlor, anilophos, pretilachlor alone and in combination with almix and bispyribac sodium neither favoured nor suppressed any of the insect.

The results of herbicidal application of insect pests are in accordance with [7] who

reported the non significant influence of weed control treatments pendimethalin alone and in combination with bispyribac sodium and azimsulfuron. The present study is in contrast with [7] who evaluated eleven herbicides and reported that butachlor, metachlor, oxidiazon and bentazone could significantly stimulate multiplication and feeding of brown plant hopper. This variability may be due to difference in herbicidal dose, variety and climate. The studies conducted by [5] revealed that incidence of stem borer increased in plots treated with 2,4-D as compared to untreated plots not in line with present investigation. These finding cannot be compared with present study as the chemical is different and different herbicides may have different effect on the physiology of plant

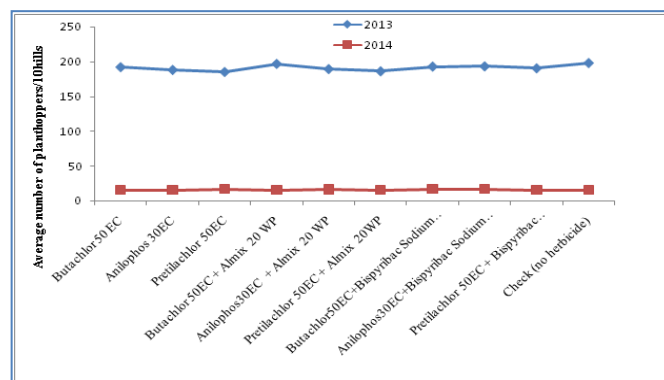


Fig-1 Mean seasonal population of plant hoppers in herbicide and check treatments during Kharif 2013 and 2014

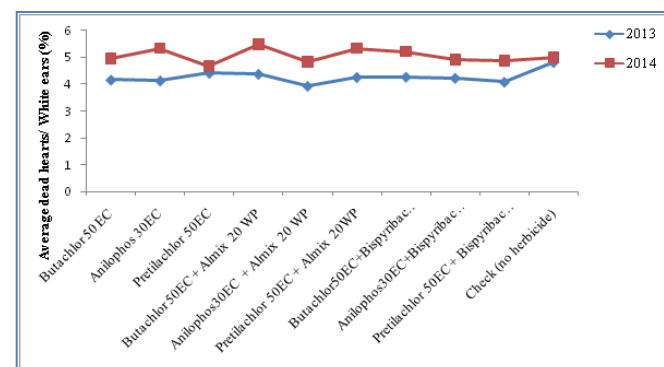


Fig-2 Mean seasonal incidence of stem borers in herbicide and check treatments during Kharif 2013 and 2014

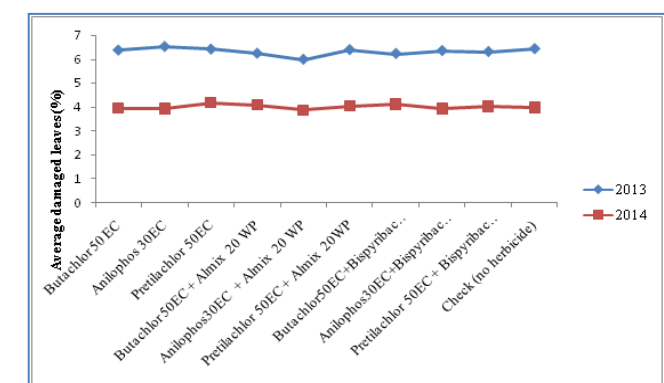


Fig-3 Mean seasonal incidence of rice leaf folder in herbicide and check treatments during Kharif 2013 and 2014

Effect on population of spiders, mirid bugs and crop grain yield

The herbicides may also influence the population of natural enemies through their direct toxic effect or through the host they prey upon. The overall mean population density of spiders varied from 21.8 to 23.4/10hills among different treatments in comparison with 23.2/10hills during 2013 [Fig-4]. The population did not differ significantly among the treatments at any period of observation. The population of

spiders was low during 2014 compared to previous year but the trend was similar. The seasonal counts of mirid bugs ranged from 23.5 to 25.6 mirid bugs/10 hills during 2013 and 13.7 to 15.6/10hills during 2014 in different treatments of the experiment [Fig-5]. As with the spiders the herbicides have not influenced the population of mirid bugs. It can be inferred from the results that the herbicides are safe to both spiders and mirid bugs. The highest grain yield (35-37q/ha) was obtained in herbicidal treatments and lowest yield (34.3q/ha) was recorded in check during 2013. The grain yield ranged from 35.9 to 39.5q/ha among different treatments including check during 2014. However, was on par with the yield in other treatments. Non significant difference among the treatments may be due to similar level of infestation of different insect pest in different herbicide treatments [Fig-6]. These findings are in agreement with observations recorded by [7] who recorded non significant effect of herbicides on various pests of rice.

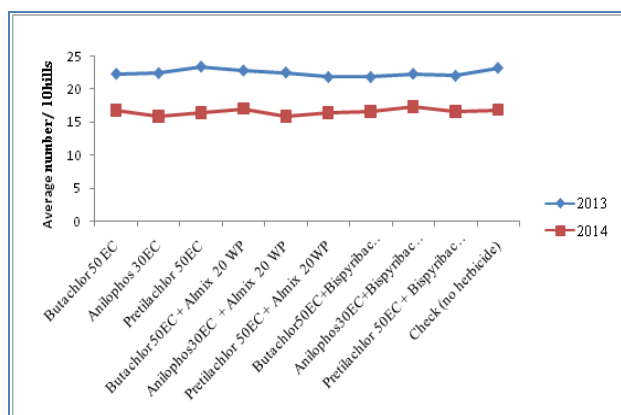


Fig-4 Mean seasonal population of spiders in herbicide and check treatments during Kharif 2013 and 2014

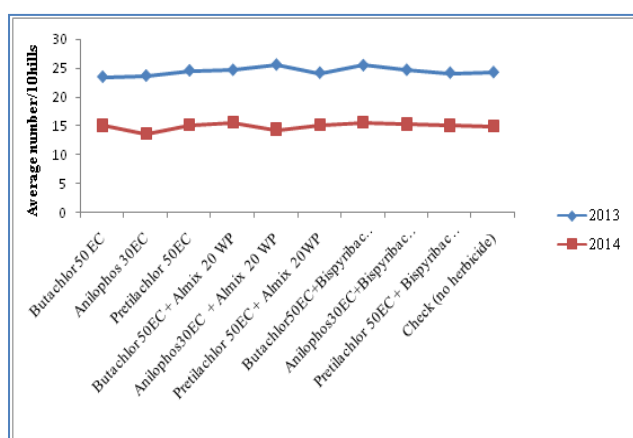


Fig-5 Mean seasonal population of mirid bugs in herbicide and check treatments during Kharif 2013 and 2014

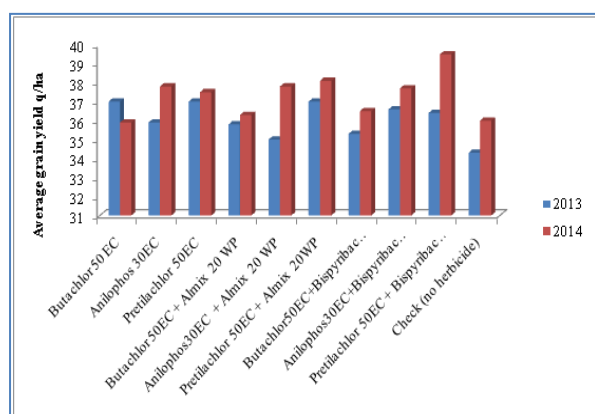


Fig-6 Grain yield fluctuation in herbicide and check treatments during Kharif 2013 and 2014

Table-1 Effect of herbicidal application on rice grain yield during Kharif 2013 and 2014

Treatments	Yield q/ha	
	2013	2014
Butachlor	37.0	35.9
Anilophos	35.9	37.8
Pretilachlor	37.0	37.5
Butachlor + Almix	35.8	36.3
Anilophos + Almix	35.0	37.8
Pretilachlor + Almix	37.0	38.1
Butachlor + Bispyribac Sodium	35.3	36.5
Anilophos + Bispyribac Sodium	36.6	37.7
Pretilachlor + Bispyribac Sodium	36.4	39.5
Check (no herbicide)	34.3	36.0
SE(m) ±	1.12	1.88
CD (P=0.05)	NS	NS

Conclusion

Observations on the overall seasonal population of plant hoppers showed that all the treatments were on par with each other. Similarly, there was no significant difference in the incidence of stem borer in different treatments during both the years. The incidence of rice leaf folder fluctuated during both the seasons and none of the herbicide neither increase nor decrease leaf folder incidence. The population of spiders appeared in 33rd week i.e. from August and remained throughout the crop seasons during both the years and differed non significantly. The overall mean seasonal population varied from 21.8 to 23.4 spiders/ 10hills among different treatments in comparison with check with 23.2 spiders/ 10hills during 2013. In 2014, the overall mean population was 15.8 to 17.3/10hills in different treatments as compared to 16.8 spiders/10hills in check. Population of mirid bugs started building up in 38th week with mean population of 23.5 to 25.6 /10 hills in all the treatments during 2013 and in 2014 the overall population ranged from 13.7 to 15.6/10 hills which were statistically at par with each other during both the years. The grain yield among different herbicidal treatments and check was differed non significantly.

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Author Contributions

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Conflict of Interest: None declared

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