

Determination of rainbow efficacy as post emergence herbicide in lowland rice

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ABSTRACT: A Randomised Complete Block Design experiment was carried out in three consecutive years (2005, 2006 and 2007) at the experimental site of National Cereals Research Institute, Badeggi, to evaluate the efficacy of Rainbow as a post emergence herbicide in lowland rice. Rainbow has penoxsulam as its active ingredient. FARO 52 was the test crop and the rate of Rainbow used were 1.0, 1.25, 1.50l/ha compared with a check chemical Orizoplus^R at 5l/ha. Orizoplus^R is made up of Propanil and 2, 4 – D Amine. Two hand weeding at 21 and 42 days after transplanting and weedy plot were also included as part of the treatments in a plot size of 5m x 10m and three replicates. It was observed that Rainbow was not phytotoxic to rice when applied on rice field indicating that it can be safely used in rice field without causing injury to the rice plant. The three years' pooled result of the trial showed that application of Rainbow at 1.25 – 1.50l/ha is good for weed control in lowland rice field which will also result into higher yield.

Introduction

Farmers need to combat the nuisance cause by weeds in crop field as weeds compete with crop for soil nutrients, water and light thereby depriving crops of limited essential resources and reduce yields (1). In fact weed is one of the major constraints in crop production (2) and it is considered to be a serious pest.

The use of hand weeding is the common practice of controlling weeds among peasant farmers. Two hand weeding have been recommended for many annual crops, including rice which is to be weeded at 3 and 6 weeks after sowing (3). However, the use of hand weeding or hoe weeding in the control of weeds by most smallholder farmers in developing countries is known to be time-consuming and labour intensive. It can take more than 50% of the farmer's labour input into crop production (4). Many times also, hand weeding becomes cost prohibitive in many areas because of the gradually shrinking labour pool (5)

The alternative use of herbicide is faster, effective and also suitable for both small scale and commercial farming. It is a good alternative to hand weeding if properly handled within the context of Integrated Weed Management practices. Many Agrochemical companies do manufacture new products that needed to be tested and the efficacy ascertained before being recommended for use. The objective of this trial is to evaluate the efficacy of Rainbow as post emergence herbicide for weed control in lowland rice.

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Materials and Methods

A Randomised Complete Block Design experiment was carried out in three consecutive years (2005, 2006 and 2007) at the experimental site of National Cereals Research Institute, Badeggi, located at Lat. 09° 45'N; Long 06° 7'E, ALT 50.57 MSL to evaluate the efficacy of Rainbow as a post emergence herbicide in lowland rice. Rainbow has penoxsulam as its active ingredient. FARO 52 was the test crop and the rate of Rainbow used were 1.0, 1.25, 1.50l/ha compared with a check chemical Orizopulus^R at 5l/ha with 200 litres of water per hectare. Orizopulus^R is made up of Propanil and 2, 4 – D Amine. Two hand weeding at 21 and 42 days after transplanting and weedy plot were also included as part of the treatments in a plot size of 5m x 10m and three replicates. Transplanting of 21 day-old seedlings was done on 15 August, 2005; 21 August, 2006 and 13 September 2007 respectively at a spacing of 20cm x 20cm and two seedlings per hill.

The herbicides were applied post emergence at 14 days after transplanting of rice. Fertilizer application was applied basal at 40kgN/ha, 40kgP₂O₅/ha and 40kgK₂O/ha using NPK 15:15:15 fertilizer source at two weeks after transplanting. Top dressing using Urea 46% was done at six weeks after transplanting at 40KgN/ha. Collected data include: prevalent weed species at the first flush before herbicide application; phytotoxicity score at 1, 2 and 3 weeks after herbicide application; weed control rating at 1, 2 and 3 weeks after herbicide application; weed cover score at 1, 2 and 3 weeks after herbicide application; plant height at maturity; panicle number/hill at maturity and grain yield. The data for the three years were pooled and combine analysis of variance was carried out using IRRISTAT analytical software and where F-ratio was significant, means were separated using Least Significant Difference.

Results and Discussion

Weed occurrence

All the three categories of weeds (grasses, broadleaved and sedges) were present at the experimental site (Table 1). Within the grasses, *Echinochloa stagnina* Beauv was most prominent followed by *Leersia hexandra* (Sw) while in the broadleaved weed category, *Ipomea aquatica* Forsk appeared more than *Aeschynomene indica* L. *Nymphae lotus* Linn. and *Eichhornia natans* (P. Beauv) Solms-laub were similar in occurrence. Three sedges prominently occurred in the three years of experimentation. They are *Cyperus difformis* L, *Cyperus esculentus* Linn and *Klinga pumila* Michx.

Phytotoxicity

Rainbow was not phytotoxic to rice when applied on rice field as there was no sign of any phytotoxicity on rice as a result of the herbicide application (Table 2) indicating that it can be safely used in rice field without causing injury to the rice plant.

Weed control rating

Significant difference occurred in the weed control rating among the various rates of Rainbow used in each respective week of application (Table 2). The percentage weed control rating increased as the rate of application increased. Although the percentage weed control increased as the rate of application increased, the applied rate of 1.25 and 1.5l/ha of Rainbow did not differ significantly. The weed control rating was lower at 1.0l/ha application of Rainbow which was also significantly lower than the observed value for Orizopulus^R at 5l/ha. Despite the differences in percentage weed control rating observed, the values in both the test chemical (Rainbow) and the check chemical Orizopulus^R were very close and not significant at 1.25 and 1.50l/ha of Rainbow. This indicates that Rainbow at 1.25 and 1.5l/ha will control weeds similarly with the check chemical Orizopulus^R at 5l/ha. There was high value percentage weed control rating of Rainbow and Orizopulus^R indicating that Rainbow can control weeds effectively in lowland rice field.

Table 1: Weed occurrence status at the experimental site during the first flush before herbicide application in the 3 years of experimentation at Badeggi

Weed species	Status of occurrence		
	2005	2006	2007
Grasses			
<i>Cynodon dactylon</i> (Linn) pers	-	++	+++
<i>Leersia hexandra</i> (Sw)	++	++	++
<i>Echinochloa stagnina</i> Beauv	+++	+++	+++
<i>Imperata cylindrical</i> var <i>Africana</i> C.E. Hubbard	-	+	+
<i>Paspalum vaginatum</i>	+	-	-
Broadleaves			
<i>Aeschynomene indica</i> L	+	+	+
<i>Ipomea aquatica</i> Forsk	++	++	+
<i>Nymphae lotus</i> Linn	+	+	++
<i>Eichhornia natans</i> (P. Beauv) Solms-laub	+	++	+
Sedges			
<i>Fimbrostylis difforalis</i> Gaudet	-	+	+
<i>Klinga pumila</i> Michx	++	++	++
<i>Cyperus haspan</i>	++	-	-
<i>Cyperus difformis</i> L	++	++	++
<i>Cyperus esculentus</i> Linn	++	++	++

+ = low; ++ = moderate; +++ = high

Weed cover score

Weedy check plot had significantly highest percentage weed cover score in each respective week after herbicide application (Table 3). The percentage weed cover score was not however significantly different among the herbicide applied plot except at one week after application (Table 3). The 2 Hand weeding plot was also comparable to the herbicide plots in having lower weed occurrence showing that hand weeding can similarly control weeds in lowland rice.

Plant height at maturity

There was significant difference in the plant height of rice at maturity (Table 3). Weedy check plot had shorter significant rice plant height of 109.8cm at maturity (Table 3). The tallest rice plant height of 120.0cm was obtained in Orizoplus^R applied plot but was not significantly different from the rice plant height obtained in the rest herbicide treated plots. It showed that presence of weeds can reduce plant growth.

Panicle no/hill at maturity

Apart from the weedy check plot that had significantly lower value (Table 3), all other treatments were not significantly different in panicle no/hill and thus indicating that Rainbow application does not affect the panicle no/hill negatively.

Grain yield

Highest grain yield of 2850.1kg/ha was obtained at 1.25l/ha of Rainbow application (Table 3). Weedy check plot gave significantly lower grain yield of 1078.3kg/ha. The grain yield obtained in the various rates of Rainbow used and that of check chemical Orizoplus^R and as well as the 2 hand weeding plots did not show any significant difference. It was observed that application of Rainbow between 1.25 – 1.50l/ha in lowland rice field will control weeds and give high grain yield.

Table 2: Three years' combined mean effect of Rainbow on phytotoxicity on rice and weed control rating in rice field.

Treatment	Phytotoxicity score			% weed control rating		
	Weeks after application			1	2	3
1	Rainbow @ 1.0l/ha	0	0	0	7.3 ^b	63.3 ^b
2	Rainbow @ 1.25l/ha	0	0	0	9.1 ^{ab}	72.2 ^{ab}
3	Rainbow @ 1.50l/ha	0	0	0	16.9 ^a	76.6 ^a
4	Orizoplus ^R @ 5l/ha	0	0	0	17.2 ^a	77.8 ^a
5	2 H/W @ 21 & 42 DAT -	-	-	-	0.0 ^b	73.9 ^a
6	Weedy check -	-	-	-	0.0 ^b	0.0 ^c
SE±	-	-	-	-	2.6	3.1
CV%	-	-	-	-	54.0	8.8

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

DAT = Days after transplanting; H/W = Hand weeding

Phytotoxicity score: 0 – 10 where 0 = no phytotoxicity and 10 = complete crop kill.

Table 3: Three years' combined mean effects of Rainbow on weed cover score, plant height, panicle number and grain yield .

		% Weed cover score					
		Weeks after application			Plant height	Panicle number	Grain yield
Treatment		1	2	3	at maturity, cm	per hill	kg/ha
1.	Rainbow @ 1.0l/ha	19.8 ^b	15.5 ^b	14.8 ^b	118.8 ^a	19.4 ^a	2380.6 ^a
2.	Rainbow @ 1.25l/ha	19.6 ^b	14.4 ^b	14.8 ^b	118.8 ^a	20.7 ^a	2850.1 ^a
3.	Rainbow @ 1.50l/ha	16.6 ^c	12.3 ^b	12.8 ^b	117.5 ^a	20.1 ^a	2835.2 ^a
4.	Orizoplus ^R @ 5l/ha	14.6 ^c	11.7 ^b	12.2 ^b	120.0 ^a	19.8 ^a	2735.9 ^a
5.	2 H/W @ 21 & 42 DAT	24.8 ^a	11.3 ^b	13.5 ^b	116.6 ^{ab}	20.6 ^a	2718.0 ^a
6.	Weedy check	24.8 ^a	41.6 ^a	42.8 ^a	109.8 ^b	16.3 ^b	1078.3 ^b
SE±		1.0	1.9	2.6	2.2	0.6	227.1
CV%		8.4	18.9	24.5	3.3	5.4	16.2

Figures in the same column followed by the same letter (s) are not significantly different at P = 0.05 of LSD

DAT = Days after transplanting; H/W = Hand weeding

Conclusion and recommendation

The trial has been carried out for three consecutive years (2005, 2006, and 2007) and hence recommendation on its performance can be ascertained. The three years' combined analysis indicated that Rainbow is a herbicide that is not toxic to rice when applied thereby not inflicting injury to the rice plant. It also has the ability to control weeds in the lowland rice field and consequently bring about good grain yield. It is therefore recommended that Rainbow could be safely used as post-emergence herbicide in lowland rice at the rate of 1.25 – 1.50l/ha. Also the use of low volume of water (200l/ha) will reduce cost of input application.

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