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Evaluation of herbicides for weed control in three varieties of upland rice (*oryza sativa* L.) in the Nigerian Savannah

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Abstract

The effect of herbicides for weed control in three upland rice varieties was evaluated in the Nigerian savannah. Among the herbicides evaluated, pretilachlor + dimethametryne at 2.5 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i/ha perfomed well as they effectively controlled weeds and resulted in better growth and grain yield that was comparable to the hoe-weeded control.

Among the rice varieties evaluated, WAB 56–50 and FARO 40 performed better than FARO 38 as they resulted in better growth and yield.

Keywords: Herbicides; Rice; Varieties; Weeds; Crop

1. Introduction

Rice (*oryza sativa* L.) is the only cultivated cereal crop adapted to growing in both flooded- and non flooded conditions and it is the staple food for more than 90% of the world's population (Rothschild, 1995). Most of the rice produced in Nigeria is grown under upland condition.

The production of upland rice in Nigeria is limited by weeds especially when compared with lowland rice. Another factor that limits the crop, is the cultivation of low-yielding varieties. The average yield reduction from uncontrolled weed growth in upland rice fields is given as 80–100% loss in potential grain yield of the crop (Akobundu, 1987).

Farmers in Nigeria, still rely predominantly on hoe-weeding, which is the traditional method of weed control in upland rice. This manual method of weeding is expensive, labor intensive and time consuming. For instance, an average of 200–418 man hours are require to weed 1 ha of upland rice at Samaru (Lagoke and Chaudhary, 1982). This necessitates the evaluation of an alternative weed control method that is more effective and less labor requiring that can serve as a substitute to manual hoe weeding.

The use of various herbicides such as propanil at 3.0 kg a.i./ha, dimethametryne at 1.5 kg a.i./ha, cinosulfuron at 0.04 kg a.i./ha and oxadiazon at 1.0 kg a.i./ha (Adekpe, 1998; Adeosun, 1994) in improved cultivars of upland rice, has been reported to show more promise than manual hoe-weeding, since they reduced labor requirement and increased grain yield in rice production (Adekpe, 1998).

This work was therefore initiated with the objective of evaluating the selectively and performance of some pre-emergence and post-emergence herbicides for weed control in three upland rice varieties at Samaru, in northern Guinea savannah of Nigeria.

2. Materials and methods

Two field trials were conducted during the wet seasons of 2002 and 2003, to evaluate some pre-emergence and post-emergence herbicides for weeds control in upland rice at Samaru (11°11′N; 07°38′E) in the northern Guinea savanna of Nigeria.

The soil was a sandy loam having 5.4 pH, 0.02% organic carbon, 0.180% total nitrogen and 7.5 Cmol/kg of soil cation—exchange capacity.

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Table 1
The names of herbicides used during the experiment

Chemical name	Dose (kg a.i/ha)	Trade name
Pre-emergence		
Oxadiazon	1.0	Ronstar 250 EC
Oxadiazon	1.25	Ronstar 250 EC
Cinosulfuron	0.05	Set off 20 WG
Cinosulfbron	0.075	Set off 20 WG
Piperophos + propanil	1.5	Rilof S80 g/1
Prosulfuron	0.05	CGA152005 60 WG
Pretilachlor + dimethametryne	2.5	Rifit extra 500EC
Post-emergence		
2,4-D	2.5	Fernoxone 80 SP
Bentazon	1.92	Basagran 450 EC
Piperophos + cinosulfuron	1.5	Pipset 35 WP
Hoe weeded control	—	—
Weedy check	—	—
Rice varieties (V)		*Seed rate (kg/ha)*
FARO 40		62
WAB 56-50		62
FARO 38		62

The total rainfall received during the cropping seasons was 1007.6 and 1135.4 mm in 2002 and 2003, respectively.

The rice seeds (Var. FARO 40 WAB 56-50 and FARO 38) were sown on the flat by drilling at an inter-row spacing of 25 cm and at a seed rate of 62 kg/ha on the 18th and 20th June of 2002 and 2003, respectively.

Split application of 70 kg K/ha was done at 3 and 6 weeks after sowing whereas phosphorous at 12.9 kg K/ha was broadcast at ploughing using Urea, single superphosphate and muriate of potash were used as sources of nitrogen, phosphorous and potassium. In both the years, gross plot size was 27.5 m^2, whereas the net plot size was 13.5 m^2.

The experiment consisted of various doses of pre-emergence and post-emergence herbicides, a hoe-weeded control and a weedy check making a total of 12 main plot treatments, whereas the sub-plot treatments were made up of three upland rice varieties (laid in sub-plots) as indicated in Table 1. Both the main plot treatments and the sub-plot treatments were laid out in a split-plot design in three replications. All herbicides treatment were applied in 250 L of water per hectare, using the conventional CP3 knapsack sprayer at about 2.1 kg cm^2 pressure.

The data collected were, crop vigor score, crop injury score, weed cover score, weed dry weight and grain yield of rice. Data were subjected to analysis of variance and the treatment means were separated by Duncan's multiple range test.

3. Result

3.1. Effect of weed control treatments on growth of the upland rice varieties

The results in both 2002 and 2003 (Table 2) show that the weedy check treatment reduced vigor score compared to all other weed control treatments while, oxadiazon at 1.0 kg a.i./ha reduced crop vigor score more than 2,4-D at 2.5 kg a.i./ha in 2002.

Among the rice varieties evaluated, WAB 56-50 had higher vigor score than FARO 40 in 2002.

Similarly, the weedy check had higher crop injury score compared with all other weed control treatments in both the years (Table 2) whereas application of cinosulfuron at 0.7 5 kg a.i./ha and 2,4-D at 2.5 kg a.i./ha increased crop injury score compared to all other weed control treatments in 2003.

Among the rice varieties evaluated, FARO 40 suffered more injury due to herbicide application, followed by WAB 56-50 and FARO38 in 2002.

3.2. Effect of weed control treatments and varietal differences on weeds in upland rice

In both 2002 and 2003 (Table 3), all the herbicide treatments and the hoe-weeded control reduced weed cover and weed dry weight compared to the weedy check, but application of pretilachlor + dimethametryne at 2.5 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i./ha reduced weed cover score compared to oxadiazon at 1.0 kg a.i./ha, prosulfuron at 0.05 kg a.i./ha and the hoe-weeded control in 2002. The application of pretilachlor + dimethametryne at 2.5 kg a.i./ha, piperophos + cinosulfuron at 1.5 kg a.i./ha and fernoxone at 2.5 kg a.i./ha depressed weed weight compared to all other weed treatments in 2003.

Among the rice varieties evaluated, FARO 40 and WAB 56-50 depressed weed cover score and weed weight than FARO 38 in 2002 (Table 3).

3.3. Effect of weed control treatments on yield component and yield of three varieties of upland rice

This result (Table 4) shows that, application of pretilachlor + dimethametryne at 2.5 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i./ha resulted in longer panicles of rice than all other herbicides treatments in both 2002 and 2003 and were compared to the hoe-weeded control in 2002. The weedy check however, had the shortest panicles of rice compared to all other weed control treatments in both the years of the experiment.

Among the rice varieties evaluated, FARO 40 and WAB 56-50 had longer panicles than FARO 38.

The interaction between weed control treatments and the rice varieties on the length of panicle of rice was significant in 2003 (Table 4).

In 2002, application of cinosulfuron at 0.05 kg a.i./ha produced high grain yield of rice comparable to pretilachlor + dimethametryne at 2.5 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i./ha and the hoe-weeded control. These treatments also gave higher grain yield than the weedy check.

Similarly, in 2003 application of the same pretilachlor + dimethametryne at 2.5 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i./ha increased grain yield compared