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EFFECT OF WEED CONTROL METHODS AND SEEDLING GROWTH STAGESON THE GROWTHOF TRANSPLANTED RICE(*Oryza sativa* L.) IN DUTSE, JIGAWA STATE

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ABSTRACT

The experiments were carried out in 2020 and 2021 rainy seasons to determine the performance of rice as influenced by seedling age and weed control treatments. The treatments consists of three seedling age (14, 21 and 28 day old seedling) and four weed control methods (hoe weeding, pre emergence application of gramozone (200g/L of paraquat/ha), pre and post emergence of gramozone (200g/L of paraquat/ha) and premix of propanil360g/L + 2,4_D 200g/L) and weedy check). The treatments were laid out in split-plot in a Randomized Complete Block Design (RCBD) and were replicated three times. The results revealed that the plots weeded twice and those treated with pre and post emergence application of gramozone and propanil respectively resulted in taller plant height, large leaf area, and more growth rate than the others weed control methods while weedy check gave the least value. The effect of seedling age on the rice growth revealed that rice transplanted under 14 days old seedling gave tallest plant height, high value of growth rate, relative growth rate and net assimilation value compared to the other methods while 28 days old seedling resulted in the least value of the parameters than others methods. Therefore, it can be concluded that rice farmers in the Sudan savanna zone of Nigeria can adopt pre and post emergence application of gramozone and propanil with transplanting 14 days old seedling since the combination of these treatments gave better weed control and growth of paddy rice.

Key words: Rice, plant height, leaf area, transplanting and herbicide

INTRODUCTION

Rice (*Oryza sativa*) is the most important cereal crop in the developing world and is the staple food of over half the world's population. Rice is the world's most important staple food crop for more than half of the world's population (Kumar and Ladha, 2011). The world's total rice area is 167 million ha and production is about 782 million tons with productivity of 4.67 Mt ha^{-1}. The productivity of rice in Southeast Asia is 4.41 tons ha^{-1} and China is the largest producer (FAOSTAT, 2017). It is generally considered a semi-aquatic annual grass plant. About 20 species of the genus Oryza are recognized, but nearly all cultivated rice is *Oryza sativa* L.

A small amount of *Oryzaglaberrima*, a perennial species, is grown in Africa. So-called "wild rice" (*Zizaniaaquatica*), grown in the Great Lakes region of the United States, is more closely related to oats than to rice. . Weeds pose major problem in rice production, by diminishing the quantity as well as quality (Rajkhowa*et al.*, 2007). Hence, the weed management plays an important role in increasing productivity of rice. Hoe weeding is an effective and the most common method to control weeds. However, it is laborious and tedious in rice growing areas due to increase in labour cost and non-availability of labour during peak periods of other agricultural operations. The use of herbicides offers scope for economical control of weeds right from the beginning. Recent trend of herbicide use is to find out, an effective weed control measure by using low dose and highly efficient herbicides which will not only reduce the total volume of herbicide/unit area, but also the application becomes easier and economical to the farmer (Subramanyam *et al*., 2007).

Seedling age at the time of transplanting is an important factor in rice production and regulating its growth as it primarily contributes to increase number of productive tillers, panicle length, filled grains $panicle^{-1}$ and 1000-grain weight, ultimately resulted in increased grain yield of rice (Ginigaddara and Ranamukhaarachchi, 2011; Kewat*et al*. (2002) and Krishna *et al*. (2008) reported that young seedling at age of 21 days old produced higher number of tillers, which contributed to higher grain yield more than 28 days old seedlings. Abou-Khalifa (2005) reported that seedling age of 25 days produced the highest valueof number of panicles m^{-2}, 1000-grain weight, panicle weight, number of filled grains panicle-1 and grain yield.

MATERIALS AND METHODS

The experiment was carried out during the 2020 and 2021 raining season in the Faculty of Agriculture Research Farm, Federal University Dutse(Lat 11°46'39" N, Long 9°20'3" E). The experiment consisted of four different weed control treatments (hoe weeding at 3 and 6 weeks, pre emergence application of gramozone (200g/L of paraquat/ha), pre and post emergence of gramozone (200g/L of paraquat/ha) and premix of (propanil 360g/L + 2,4-D 200g/L) and seedling growth stages of rice (14, 21 and 28 DAS).The seedling was raised close to the field by mixing adequate soil and manure for proper seedling development and tranplanted according to the experimental design. The treatments were laid out i in a Randomize Complete Block Design (RCBD) with three replications.

Herbicides were applied using a knapsack sprayer CP3 knapsack sprayer fitted with a green deflector nozzle, at a pressure of 2.1kg/cm^2 to deliver spray liquid volume of 180L/ha at 2WAT

The application of fertilizer was done using NPK 15:10:10 at the recommended dose of Nitrogen 100kg/ha, Phosphorus 60kg/ha and Patasium 60kg/k in two splits. Weed control was carried out based on treatments designed for specific plot.Faro 44 rice variety was used and seedling were transplanted at 25cm by 25cm Harvesting was done when the crop reached physiological maturity. Faro 44 was used Nursery bed section was cleared from grasses, tilled and levelled properly to assure efficient water drainage. The bed was irrigated for 3 days prior to transplanting of seedlings. The tools used for clearing and tilling of the soil are; cutlass, rake and a hoe.

Data collected included plant height, number of tiller, length of panicle, leaf area index (LAI) taken from three tagged plants per each subplot with the help of a LAI digital meter and calculated using the formula suggested by Watson (1958); LAI = L x W x N x P x 0.72/A,
Data analysis was done using GENTSAT statistical package 14th edition. Means were compared using DMRT (Gomez and Gomez, 1984)at 5% significance level

RESULTS

Plant height:

Effect of weed control methods and age of seedling on plant height was significant($p< 0.05$)shown in (table 1). In both seasons, at all the samplings periods, hoe weeding control gave the tallest plants compared to other weed control while the weedy check had the shortest. The effect of seedling age on plant height was significant at all the sampling, 14 days old seedling had statistically similar plant height with 21 days old while 28 days old had the shortest plant.The interaction between the weed control treatments and seedling age was not significant.

Leaf Area Index:

Effect of weed control methods and seedling age was significant on leaf area index of rice in both seasons (Table 2).Hoe weeding at 3and 6WAT gave the highest value of leaf area index at all sampling periods follow by application Gramozone + Premix (propanil + 2,4-D) while weedy checkgave the lowest value of leaf area index .Among seedling age, 14 days old seedling resulted in higher value of leaf area index at all sampling periods while 28 days old seedling had the leastvalue at all sampling periods.The interaction between the weed control methods and seedling age on leaf area index was not significant at all sampling periods.

Number of tiller

Effect of weed control methods and seedling age was significant on the number of tiller in both seasons (Table 3).Hoe weeding at 3and 6 weeks after transplanting resulted in the highest of number of tiller at all sampling period while weedy check had the lowest number. Among seedling age, 14 days old seedling was recorded with the highest tiller number at all sampling periods while 28 days old seedling hadthe lowest. The interaction between the weed control methods and seedling age on tiller number were not significant at all the sampling periods.

Daysto 50% flowering

Effect of weed control method and age of seedling on day to 50% flowering of ricewas significant (table 4).Hoe weeding control at 3 and 6 WAT reached50% flowering earlier than the other treatments and weedy check resulted in longest days to 50% flowering.The effect of seedling age on 50% flowering was significant, the older seedling reaches 50% flowering earlier than the younger seedlings.

The interaction between weed control method and seedling age on 50% day to flowering was highly significant in 2020 (table 5). Combination of Gramazolepre emergence application and 14 day old seedling had the longest day while Gramazole + Propanil at pre and post emergence application respectively in combination of 28 day old seedling had the shortest day to 50% flowering.

DISCUSSION

The result of the study showed that the effective control of the weed was observed among the weed control methods adopted. The application of pre and post emergence gramozone followed by premix of

propanil plus 2,4-D resulted in better weed control and improvement in growth characters by the rice. This might be due to available of the growth resources and space as a result of effective weed control through the growing periods and high spectrum response of the herbicides that secured free weed condition for the rice growth and development. Similar finding was reported by Danmaigoro and Umar 2018., who's reported a free weed regime was observed when mixture herbicides was used on transplanted rice. The poor plant growth was observed in weedy check plots in the experiment due to high weed composition. This result in line with the finding of (Johnson et al.,1998 and Danmaigoro*et al*.(2015) who observed that the major impediment in the cultivation of rice is heavy weeds infestation that compete with the crop to such extent that it could get rice completely smothered. Similar study carried out by (Akbar *et al*. 2011 and Danmaigoro *et al*.2018), also show higher plant height for rice under hoe weeding treatment than uncheck plots. Mean tiller count varied among rice during experiment with the highest tiller count observed under herbicide supplication while weedy check plots recorded the lowest tiller count. , who reported that effective tillers increased with proper weed management, hence yield of rice.Ismaila*et al*. (2012) also recommended three times hoe weeding for proper weed suppression and yield increase in rice fields. In this study, it was observed that different transplanting dates significantly influenced the plant growth and yieldofrice. Plant dry matter production is the combined effect of other factors such as plant height, number of tillers produced, leaf area index and other biomass-related factors. The results also showed that transplanting of older seedling resulted in reduced growth and yield parameters while the plots that received young seedling had better growth and yield. This results is similar findings of Danmaigoro and Umar 2018.

Higher crop growth rate recorded from the hoe weeding and herbicide treated plots than other control methods as shown in the results, this may be due to the higher LAI value of the plots and LAI is influenced by high number of photosynthesis assimilates production by the (leaves). Danmaigoro and Umar 2018 reported high yield of rice due to free weed regime as a result of weed management and fertilization.

The interaction effect of seedling age and weed management was more pronounced due to their enhanced complementary effect. . Therefore, it can be concluded that rice farmers in the Sudan savanna zone of Nigeria can adopt pre and post emergence application of gramozone followed by premix of propanil plus 2,4-D at seedling growth stage of 14 days old seedling since the combination of these treatments gave better weed control and growth of paddy rice

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Table 1:Effect of Weed Control Methods and Seedling Growth StageonPlant Height of Rice at Dutse in 2020 and 2021 Rainy Seasons

Treatments		Plant height							
		2020				2021			
	Rate/ha	3WAT	6WAT	9WAT	12WAT	3WAT	6WAT	9WAT	12WAT
Weed control methods									
Gramozone + Premix (propanil + 2,4-D)	200g/l paraquat + 360g/l propanil + 200g/l 2-4D	24.63b	36.48b	39.39b	43.72b	23.31b	36.89b	43.09b	52.61b
Gramozone	200g/l paraquat	22.13bc	31.11c	36.44b	39.93c	19.56c	34.36b	39.77c	49.33bc
Hoe weeding at 3 and 6 WAT		31.60a	48.66a	54.80a	57.23a	27.97a	43.91a	59.19a	62.28a
Weedy check		19.07c	25.29d	30.32c	33.30d	18.73c	31.24c	38.18c	47.90c
SE±		1.680	1.126	1.832	1.086	0.645	0.982	0.655	1.231
Seedling GrowthStage									
14 days old	25kg	26.87a	39.13a	44.46a	48.27a	27.29a	43.28a	50.38a	57.69a
21 days old	25kg	25.33a	36.59a	39.98ab	42.69b	22.09b	35.28b	44.48b	51.76b
28 days old	25kg	20.88b	30.42b	36.28b	39.68c	17.79c	31.24c	40.32c	49.64b
SE±		1.455	0.975	1.586	0.941	0.559	0.850	0.567	1.066
Interaction									
Weed controlxSeedling Growth Stage		NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter are not significantly different at 5% level of probability using DMRT.

Table 2:Effect of Weed Control Methods and Seedling Growth Stageon the Leaf Area Index of Rice at Dutse in 2020 and 2021 Rainy Seasons

Treatments		Leaf Area Index							
		2020				2021			
	Rate/ha	3WAT	6WAT	9WAT	12WAT	3WAT	6WAT	9WAT	12WAT
Weed control methods									
Gramozone + propanil	200g/l paraquat + 360g/l propanil + 200g/l 2-4D	18.58b	24.69b	25.32b	28.56b	14.12b	24.39b	26.47b	23.73b
Gramozone	200g/l paraquat	16.41c	20.11c	21.73c	25.00c	12.12c	21.58c	25.64bc	21.44bc
Hoe weeding at 3 and 6 WAT		25.17a	36.06a	35.26a	43.56a	21.22a	31.58a	40.94a	36.61a
Weedy check		12.90d	15.52d	17.89d	20.87d	9.62d	20.50c	21.94c	18.99c
SE±		0.304	0.411	0.682	0.564	0.209	0.487	1.389	1.211
Seedling Growth Stage									
14 days old	25kg	20.28a	27.04a	27.89a	32.67a	16.54a	43.28a	32.28a	28.84a
21 days old	25kg	19.26b	24.18b	24.97b	29.33b	14.23b	23.96b	28.38b	24.98b
28 days old	25kg	15.25c	21.06c	22.28c	26.48c	12.04c	22.17c	25.48c	21.76c
SE±		0.263	0.356	0.591	0.489	0.181	0.422	1.202	1.048
Interaction									
Weed controlxplanting method		NS	NS	NS	NS	NS	NS	NS	NS

Means followed by the same letter are not significantly different at 5% level of probability using DMRT.

Table 3: Effect of Weed Control Methods and Seedling Growth StageonNumber of Tillers (per hill) of rRice at Dutse in 2020 and 2021 Rainy Seasons

Treatments		Number of tillers(per hill)					
		2020			2021		
	Rate/ha	6WAT	9WAT	12WAT	6WAT	9WAT	12WAT
Weed Control Methods							
Gramozone + Premix (propanil + 2,4-D)	200g/l paraquat + 360g/l propanil + 200g/l 2-4D	28.11b	43.78b	43.1b	16.00b	25.89b	35.56b
Gramozone	200g/l paraquat	24.67b	28.78c	31.4c	13.06c	23.45c	33.78bc
Hoe weeding at 3 and 6 WAT		41.00a	52.11a	58.8a	25.89a	36.44a	43.89a
Weedy check		20.87d	25.33d	26.8c	10.39d	18.78d	27.22c
SE±		0.817	0.938	2.16	0.645	0.983	1.151
Seedling Growth Stage							
14 days old	25kg	31.58a	41.83a	47.2a	16.54a	43.28a	32.28a
21 days old	25kg	28.75b	37.25b	40.6b	14.23b	23.96b	28.38b
28 days old	25kg	25.65c	33.42c	32.2c	12.04c	22.17c	25.48c
SE±		0.707	0.812	1.87	0.181	0.422	1.20
Interaction							
Weed control*planting method		NS	NS	NS	NS	NS	NS

Means followed by the same letter are not significantly different at 5% level of probability using DMRT

Table 4: The effect of weed control treatments and seedling age on days to 50% flowering of rice at Dutse in 2020 and 2021 rainy seasons

TREATMENT		Days to 50% flowering	
	Rate/ha	2020	2021
Weed control methods			
Gramzone + propanil	200g/l paraquat + 360g/l propanil + 200g/l 2-4D	76.78b	84.11b
Gramozone	200g/l paraquat	79.00b	83.89b
Hoe weeding at 3 and 6 WAT		68.89c	75.48c
Weedy check		85.28a	85.94a
SE±		1.282	0.514
Seedling Growth Stage			
14 days old	25kg	72.96c	80.69c
21 days old	25kg	78.92a	83.75b
28 days old	25kg	76.58b	86.38a
SE±		1.110	0.445
Interaction			
Weed controlxSeedling Growth Stage		NS	**

Means followed by the same letter are not significantly different at 5% level of probability using DMRT.

Table 5.Interaction effect between weed control methods and seedling ageon 50% day to flowering of rice.

Treatments	Seedling age		
	14 days old	**21 days old**	**28 days old**
Weed control			
Gramazole + Propanil	87.67ab	85.67b	79.00d
Gramazole	88.67a	81.67cd	81.33cd
Hoe weeding @ 3 and 6 WAT	82.43c	80.00cd	79.00d
Weedy check	88.00ab	87.67ab	82.17c
SE±		0.890	

In a column, values having the same letters do not differ significantly whereas values with dissimilar letter differ significantly using Duncan's Multiple Range Test at 5% level of significance. Note: SA (seedling age), WC (weed control) and WAT (week after transplanting).

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