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Influence of seed rates on weed management and grain yield in a drill-sowing method of Acha, *Digitaria exilis*, Kippis Stapf in the Sudan Savanna zone of Nigeria

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ABSTRACT: A randomized Complete Block design experiment with three replicates was carried out in 2001 and 2002 on Acha at the experimental site of the National Cereals Research Institute, Rice Research Station, Birnin Kebbi located at Lat. 12°32'N; Long. 04°12'E Alt 200MSL in the Sudan Savanna zone of Nigeria. Six seed rates (10, 15, 20, 25, 30 and 35kg/ha) were evaluated at a drill spacing of 20 cm apart using Ex-Sum accession of Acha. The recommended broadcast seed rate of 25kg/ha was included as check treatment. The aim was to determine the appropriate seed rate in drill-sowing of Acha for good weed management and optimum grain yield. Weeds were observed to be suppressed to comparably low level at 30kg/ha seed rate. Optimum yield and net benefit also indicated a wise decision for Acha to be drill-sown at 30kg/ha seed rate.

Key words: Seed rate; Weed management; Drill-sowing.

Introduction

Acha, *Digitaria exilis*, Kippis Stapf can be broadcast-seeded or drill-sown similar to that of upland rice, Oryza sativa L. The different methods of sowing gave different seed rate requirement. While sowing can be of 100kg/ha for broadcast rice, that of drilled rice can be between 70 – 90 kg seed/ha at a row spacing of 15 – 20 cm (Pillai, 1981). Though the optimum seed rate in broadcast method of sowing of Acha has been determined to be 25kg seed/ha. (Bakare, 2000), that of drilled method of sowing has not been verified yet.

The difficulty involved in weed control under broadcast sowing than drilled sowing made drilled sowing more popular in upland rice production than broadcast sowing (Pillai, 1982). However in Acha, the influence of row spacing on crop-weed relationship has not been investigated and the judicious manipulations of this factor could be a highly effective component of integrated weed management (Baker and Terry, 1991).

When seeds are broadcast, the feasibility of mechanical weed control is eliminated and hand pulling is resorted to, especially in Acha production where no suitable selective herbicide has been identified (Yayock *et al*, 1988). Hand pullings in such circumstances are more injurious to the crop, since the random presence of weeds will not allow labourers to move around the field without stepping on seedlings, thereby

causing injury to crop seedling. Also, the simultaneous germination of weed and crops make identification of Acha from grass seedlings very difficult because of the similarities in plant type.

Drilling of Acha seeds in rows would permit easy weeding, hence, Purseglove (1975) and Mercado (1979) suggested that there has to be shift from broadcast seeding to drilled seeding. Unfortunately, agronomic experiments on Acha were scanty (National Research Council, 1996). This experiment was therefore carried out with the objective to determine the appropriate seed rate in drilled sowing of Acha for good weed management and optimum grain yield.

Material and Methods

A randomized Complete Block design experiment with three replicates was carried out in 2001 and 2002 on Acha at the experimental site of the National Cereals Research Institute, Rice Research Station, Birnin Kebbi located at Lat. 12^{o}32'N; Long. 04^{o}12'E Alt. 200 MSL in the Sudan savanna zone of Nigeria. Six seed rates (10, 15, 20, 25, 30 and 35 kg/ha) were evaluated at a drill spacing of 20 cm apart using Ex-Sum accession of Acha. The recommended broadcast seed rate of 25kg/ha was included as check treatment. The aim was to determine the appropriate seed rate in drill-sowing of Acha for good weed management and optimum grain yield.

Land preparation was by ploughing and harrowing on 3 and 7 June, 2001 and 5 and 7 June, 2002 respectively. Sowing of the various seed rates was carried out on 8 June in each respective year. Basal fertilizer was applied at 2 weeks after sowing (WAS) at the rate of 15kgN/ha; 30kg P_2O_5/ha and 30kg K_2O/ha using single fertilizer source of Urea 46%; Single Superphosphate 18% and Muriate of Potash 60% respectively. Top dressing with 15kg N/ha using Urea 46% was carried out at 6 WAS.

Hand weeding was carried out at 4 and 8 WAS. Common weeds in the experimental area were identified at the first flush. Dry weed weight was determined by throwing a 1-m quadrat in a plot, twice to collect weed fresh samples within the quadrat before weeding at 4 and 8 WAS. The collected weed samples were put in envelopes and were Oven-dried at 70^{o}C for 4 days when constant weed weight have been obtained. The average weight of the two samples within a plot was determined. Other data taken were no. of productive tillers/plant, plant height at maturity, grain yield at 14% moisture content and net benefit. Calculation of the net benefit was made by subtracting production cost from gross benefit. Field price was used in the calculation.

Analysis of variance was carried out on the data collected with MSTATC Software and the means obtained were compared using New Duncan Multiple Range Test.

Results and Discussion

The common weeds in the experimental site were: *Cleome viscose* L; *Boerhavia erecta* Linn; *Commelina benghalensis* L and *Digitaria horizontalis* Willd.

Dry weed weight

Significant difference occurred in the dry weed weight in both years at 4 and 8 WAS (Table 1). The seed rates between 10 – 20kg/ha had higher dry weed weight than those of 25 – 30kg/ha as well as that of the broadcast check in both 2001 and 2002 at 4 and 8 WAS.

This indicated that seed rate within the range of 25 – 35kg/ha controlled weeds better than the lower seed rates. This may probably be due to higher density of the crop in higher seed rates than the lower seed rates.

Table 1: Effect of seed rates on dry weed weight at 4 and 8 WAS of Acha in 2001 and 2002.

Seed rate (kg/ha)	Dry weed weight (kg/ha)			
	4 WAS		8 WAS	
	2001	2002	2001	2002
10	62.7[a]	61.0[a]	480.2[a]	456.3[a]
15	62.3[a]	61.7[a]	450.5[ab]	444.3[a]
20	60.1[a]	61.7[a]	430.8[ab]	417.3[a]
25	53.8[b]	57.3[ab]	415.3[b]	363.0[b]
30	54.5[b]	52.3[b]	419.0[b]	308.7[c]
35	54.1[b]	53.0[b]	408.7[b]	310.0[c]
Broadcast check	53.2[b]	57.0[ab]	411.5[b]	311.7[c]
SE ±	2.0	2.2	25.6	19.5
CV%	6.0	4.8	10.2	6.4

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

Productive tillers

There was no significant difference in the no. of productive tillers/plant in the various seed rates in both 2001 and 2002 (Table 2). Highest no. of productive tillers/plant was 31 in 2001 while the lowest was 30. In 2002, the highest no. of productive tillers/plant was 28 which occurred at seed rate of 30kg/ha while the lowest (24) productive tillers/plant was observed at 10kg/ha seed rate.

Plant height at maturity

Height at maturity also indicated no significant difference in the various seed rates (Table 2). Seed rate therefore has no influence on the height of Acha at maturity.

Grain yield

Significant difference occurred among the seed rates in the grain yield for both 2001 and 2002 (Table 3). Grain yield in 25 and 30kg/ha were significantly higher than grain yield obtained in 10 – 20kg/ha seed rate in 2001. Similarly in 2002, grain yield in 30kg/ha seed rate was significantly higher than grain yield obtained in 10 – 20kg/ha seed rate as well as the broadcast check. Highest grain yield of 725kg/ha and 750kg/ha were obtained at 30kg/ha seed rate in 2001 and 2002 respectively.

Grain yield obtained at 35kg/ha seed rate was lower than grain yield obtained at 30kg/ha seed rate in both 2001 and 2002. This indicated that, above 30kg/ha seed rate, grain yield declines. The grain yield of 30kg/ha seed rate was also higher than the broadcast check in both years.

Net benefit

The result of net benefit gave similar trend with that of grain yield. Net benefit obtained at 30kg/ha seed rate had highest significant figure in both years (Table 3). Okuneye (1985) stated that, "if agriculture is considered as a business that gives income to the farmer, the cost and return of agricultural activities should

be considered to guide the farmer on the economics of his production activities". While net benefit increased from 10 to 30kg/ha seed rate, declines occurred at 35kg/ha seed rate. The net benefit of 30kg/ha seed rate was also higher than the broadcast check. Drill-sowing at 30kg/ha seed rate was therefore more profitable than other seed rates.

Table 2: Effect of seed rates on productive tillers and plant height at maturity in Acha in 2001 and 2002

Seed rate (kg/ha)	No of productive tillers/plant		Height at maturity (cm)	
	2001	2002	2001	2002
10	31[a]	24[a]	75.4[a]	75.3[a]
15	31[a]	27[a]	73.5[a]	76.0[a]
20	30[a]	27[a]	72.3[a]	73.7[a]
25	31[a]	24[a]	73.2[a]	76.3[a]
30	31[a]	28[a]	74.5[a]	75.7[a]
35	30[a]	25[a]	75.5[a]	73.3[a]
Broadcast check	30[a]	26[a]	75.3[a]	79.0[a]
SE ±	2	3	2.2	2.0
CV%	14	16	5.0	3.0

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

Table 3: Effect of seed rates on grain yield and net benefit of Acha in 2001 and 2002

Seed rate (kg/ha)	Grain yield (kg/ha)		Net benefit (N/ha)	
	2001	2002	2001	2002
10	580.5[b]	472.2[b]	29,364[b]	25,282[bc]
15	595.5[b]	444.5[b]	29,428[b]	23,218[c]
20	633.5[b]	486.1[b]	30,200[b]	25,068[bc]
25	688.5[a]	666.7[ab]	36,475[ab]	35,600[ab]
30	725.0[a]	750.0[a]	38,000[a]	40,348[a]
35	675.5[ab]	694.4[ab]	33,417[ab]	36,616[ab]
Broadcast check	674.0[ab]	569.4[b]	33,910[ab]	31,666[b]
SE ±	54.6	61.2	3579	3674
CV%	23.0	12.9	20	15

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

Conclusion

The optimum yield and net benefit obtained at drill-sowing of 30kg/ha seed rate indicated a wise decision for Acha to be drill-sown at 30kg/ha seed rate. Weeds were also suppressed to comparably lower level at 30kg/ha seed rate.

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