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Management of Spear Grass (*Imperata cylindrica* L) Using Different Methods of Weed Control

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A study was conducted in 2008 at the Research /Training Farm of the Department of Agronomy, Delta State University, Asaba Campus, Nigeria with the objective of identifying the best method to control spear grass weeds at a reduced and affordable cost. The treatments included spear grass + 2 hand weeding, spear grass + Bahama, spear grass + Glyphosphate and spear grass integrated with 2 hand weeding, Bahama and glyphosphate. The experiment was laid out in a randomized complete block design and replicated three times. The results showed that Bahama had more superior contents of chemical nutrients including nickel and copper. The roots of Bahama also had more profuse rhizomatous roots which enabled it to colonize and suppressed the growth of spear grass hence more effective biological control at reduced cost as its height and weight significantly reduce (P≥0.05) when compared to the other treatments. Spear grass + glyphosphate also had appreciable control of spear grass. It is therefore recommended that Bahama as a biological control measure be used for the effective management of spear grass infested areas like Anwai area of Delta State.

Key words: Spear grass, Bahama grass, biological control, hand weeding.

INTRODUCTION

Spear grass is a rhizomatous perennial grass belonging to the family Panicoideae and tribe Andropogoneae. Widely grown in the tropics but constitutes a serious problem in South Eastern Asia, parts of the United States of America and most parts of West Africa including Nigeria (Garrity *et al*., 1997). The grass infests land, competing with crops; injure humans and highly fire resistant (Chikoye *et al*., 2000). Crop production in Nigeria has not reached its maximum potential due in part to the problems associated with spear grass infestation (Akobundu, 2000). In the same vein, Bahama grass (*Cynodon dactylon* L) belonging to the sub-family Chloridoideae and tribe Chlorideae is a common weed found in West African Countries. These weed species have negative effects on plant growth development and yields hence, accounts for food insecurity in many African Countries Weed control measures include cultural (hand weeding), mechanical (slashing, mowing (Akobundu, 2000), chemical (use of herbicides (Akobundu, 2000), biological (using cover crops, predators (Okonmah, 2004) and integrated methods (combination of two or more of the above methods e.g. biological and chemical (Okonmah, 2004). If food insecurity is to be tackled, the weeds must be vigorously eradicated for the proper development of crops using various methods to achieve optimum yields. It is against this background that a study as this has been embarked upon with the main objective of identifying the best method to control spear grass weed at a reduced cost with a view to increasing yield of agricultural crops and reducing poverty level of the rural populace.

MATERIALS AND METHODS

Study location

The study was conducted in 2008 at the Research/Training farm of the Department of Agronomy, Delta State University at latitude 6^0 14'N and longitude 6^0 49'E (Delta State University Asaba Meteorological Station, 2008).

Land preparation

A land containing a colony of spear grass was marked out and the area was 14 x 19m. The grown spear grasses were slashed to the ground level to allow for fresh growth and for proper introduction of the various treatments. The plot size was 4 x 4m and each was demarcated by a meter apart. The experiment was laid out in a randomized complete block design and replicated three times using four treatments as.

(a) Spear grass + 2 hand weeding
(b) Spear grass + Bahama grass
(c) Spear grass + Glyphosphate
(d) Spear grass + 2 hand weeding, Bahama grass + Glyphosphate

Data collected were spear grass plant height, spear grass weight, soil physio-chemical, chemical composition of spear grass and Bahama grass, Length of Bahama grass and leaf numbers of spear grass were taken fortnightly. Plant height was determined by measuring the height of the grass from the soil level to the terminal bud using a measuring tape fortnightly until 10 weeks of age. Plant weight of spear grass was determined by using weighing balance.

Soil analysis

Composite soil sample was collected from 0 – 20cm depth with augur prior to treatment application. The samples were air-dried in a room temperature of 25 – 27^0C for four days and then passed through a 2mm mesh sieve and neatly packed in a properly labeled air-tight polythene bags for physio-chemical analysis at the National Institute for Oil Research (NIFOR) near Benin-City, Edo State. Particle size distribution of the soil samples was determined by hydrometer method using calgon solution as dispersed agent. Organic carbon was by the modified wet oxidation method and converted to organic matter. Total nitrogen was by micro-Kjeldahl digestion and distillation method. The soil pH was measured with a pH meter in a 1:1 soil/water ratio suspension. Exchangeable cations were extracted with 0.1N Ammonium acetate at pH 7.00 while Na^+ and K^+ were measured by EDTA titration. Available phosphorus was determined by Bray No 1 acid fluoride solution while cation exchange capacity (CEC) was determined by Ammonium acetate technique.

Plant tissue analysis

The two experimental materials: spear grass and Bahama grass were carefully collected by uprooting. The roots were carefully dusted

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to remove soil particles, placed in different envelopes before oven – drying. The plant tissues were dried at a minimum temperature of 65^{0}C for 8 hours: The plant materials were later ground with an agate mortar to achieve fine grinding; 1.0g of each of the ground materials was weighed into a conical flask for wet ashing which involved decomposition of the plant tissue in a mixture of strong acids comprising nitric, sulphuric and perchloric of 50^{0}C in a furnace for 4 hours until grey coloured indicating that complete ashing has been achieved. After ashing, Na and K were determined by flame photometer. The heavy metals: Mg, Fe, Ni, Zn and C by atomic absorption spectrophotometer (AAS), phosphorus by calorimeter method. Total exchangeable bases (TEB) were calculated by adding the values of all the exchangeable cations (Ca, Mg, Na and K). Effective cation exchangeable capacity (ECEC) was calculated by adding the values of the TEB and total base saturation (BS) was calculated by dividing the values of TEB by the ECEC and multiplying by 100. All the data collected were subjected to analysis of variance while the significant means were separated with the least significant difference using SAS (2005).

RESULTS AND DISCUSSION

Table 1 shows the soil physio-chemical properties before the experiment. The soil is sandy loam in texture with characteristics of 84.60% sand, 6.92% silt and 8.48% clay. The pH 6.2 indicated that the experimental site is slightly acidic. Both the organic matter (2.64 gkg^{-1}) and total nitrogen (0.9 gkg^{-1}) are relatively low (Table 1). The plant height (cm) of spear grass as influenced by the various treatments is presented in Table 2. The result indicated that the plant height of spear grass increased with time. The plant height value of spear grass + 2 hand weeding showed significant difference ($P<0.05$) when compared with the values obtained for the other treatments (Table 2). The weight of spear grass that had 2 hands weeding significantly differed from other treatments those of other treatments: spear grass + Bahama grass, spear grass + Glyphosphate and spear grass integrated with 2 hand weeding Bahama grass and glyphosphate (Table 3). Similarly, the weight of the test plant increased with time (Table 3).

The length of bahama grass (cm) is presented in Table 5. From the results of chemical composition of spear grass and Bahama at harvest is presented in Table 4, it is evident that Bahama grass showed superior contents of chemical nutrients. For example, while 1.10 gkg^{-1} was obtained for Bahama grass nitrogen, 0.08 gkg^{-1} was recorded for spear grass. Bahama also had nickel and copper. Besides, research on the effects of nickel and heavy metals found in Bahama grass showed that high concentration of nickel on sandy soil can clearly damage plants (Agbogidi *et al.*, 2007; Sobolev and Megonia, 2008). Nickel can also reduce the growth rate of algae which could result in the diminishing growth of spear grass as observed in Table 1. There were however, various values obtained for cations (Ca^{2+}, Mg^{2t}, K^+ and Na^+) measured in the two plant species. The observed 6.20 value of the pH of the soil indicates that the soil is slightly acidic and this can be attributed to the high rainfall prevalent in the area leading to excessive leaching of the basic cations from the surface area of the soil. The low organic content and total nitrogen could be attributed to the effects of soil erosion leaching and bush burning predominant in the study area. Similarly, the low exchangeable cations may be due to the low clay activity and low organic content of the soil. The CEC was average (15.20 cmo/kg-1) while the base saturation indicates that the study area has low fertility status which may be due to the long usage of the area for serious cropping without replenishing the lost nutrients through fertilizer application. The results of the pre-planting soil analysis agree with the findings of Enwezor (2005) and Egbuchua (2007).

Table 1. Physiochemical properties of soil before experiment

Soil properties	Values
Sand	84.60
Silt	6.92
Clay	8.48
pH (H_20)	6.20
Organic matter gkg^{-1}	2.64
Total N	0.9
Available P (mgkg^{-1})	8.27
Exchangeable cation (cmo/kg^{-1})	
Ca	1.30
Mg	1.16
K	0.21
Na	0.43
CEC (cmo/kg^{-1})	15.20
% BS	20.4

Table 2. Plant height (cm) of spear grass as influenced by the various treatments

	Weeks after planting (WAP)				
Treatments	2	4	6	8	10
SG + 2 hand weeding	30.07	56.8	43.9	44.6	73.38
SG + Bahama	19.51	32.2	35.2	44.2	52.37
SG + Glyphosphate	24.42	11.6	41.7	54.1	57.51
SG + Glyphosphate Bahama + 2 hand weeding	29.13	38.4	41.2	48.6	55.95
$LSD_{0.05}$	14.01	37.5	9.68	10.41	42.07

SG = Spear Grass

Table 3. Weight (gm) of spear grass as affected by the various treatments

	Weeks after planting (WAP)				
Treatments	2	4	6	8	10
SG + 2 hand weeding	21.57	4.11	11.74	18.28	19.00
SG + Bahama grass	18.97	1.20	9.97	11.78	13.65
SG + Glyphosphate	20.68	1.10	10.76	13.88	14.63
SG + Glyphosphate Bahama + 2 hand weeding	21.30	3.99	12.68	17.50	17.60
$LSD_{0.05}$	2.28	0.72	0.88	1.27	0.10

SG = Spear Grass

Table 4. Chemical composition of spear grass and bahama grass at harvest

Parameters	Spear grass	Bahama grass
Total N (gkg^{-1})	0.08	1.10
Total P (mgkg^{-1})	4.50	9.84
Total C (gkg^{-1})	1.25	0.95
Exchangeable Cations		
Ca^{2+}	1.10	1.70
Mg^{2+}	0.56	0.76
K^+	2.40	3.41
Na^+	0.07	0.07
Heavy metals		
Pb	Nil	Nil
Cu	0.21	2.87
Zn	5.23	5.23
Cd	Nil	Nil
Mn	0.88	0.79
Fe	3.25	1.45
Cr	1.38	0.40
N_1	Nil	0.88
C:N	15.63	0.86

Table 5. Length of Bahama Grass (cm) at 2, 4, 6, 8 and 12 weeks after planting

Treatment length of Bahama Grass	Weeks After Planting					
	7.33	15.15	19.13	21.33	24.57	34.00

The increased plant height and weight of spear grass with time is expected as a feature of crops and living organisms. Bahama grass had more nitrogen when compared to spear grass (Table 4). From the values obtained in the two plants, the two weed species showed that they fall within the tolerable levels. This indicates that they may not hinder or obstruct the uptake of other nutrients in the soil. The

special growth pattern and the root system of Bahama grass where it spreads everywhere demonstrated ability for biological weed control. This could have adversely affected the spear grass by suppressing its growth hence more effective among the treatments adopted. This observation is in harmony with earlier reports by Okonmah (1988), Okonmah (2004), Chikoye *et al*. (2000) and Chikoye *et al.* (2004). There was also, an appreciable effect in the control of spear grass treated with glyphosphate when compared with those with 2 hand weeding and a combination of 2 hand weeding, glyphosphate, and Bahama. This finding agrees with that of Terry *et al.* 1997; Okonmah *et al.* (2005) who reported that Egusi/melon significantly suppress weed in maize cassava mixed cropping. The spear grass plus Bahama is observed as the most effective control measure to spear grass weed at reduced and affordable cost followed by spear grass plus glyphosphate hence spear grass plus Bahama is recommended to farmers in Anwai area of Delta State, Nigeria. Further research is required on the effect of nickel found in Bahama grass against spear grass.

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