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Research

Evaluation of the Influence of Weeds and Weediness on the Growth and Yield of *Celosia argentea*

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Abstract

This work focused on the investigation and evaluation of the effects of weeds on the agronomy of Celosia argentea at various weed densities. Five levels of crop – weed competition were introduced into a 20 X 10 m^2 C. argentea plot comprising: 100% weediness (No weeding all through the period), 75% weediness (Weeding on the first 2 weeks only), 50% weediness (Weeding on the first 4 weeks), 25% weediness (Weeding for 6 weeks) and 0% weediness (Weeding all through the period) in a randomized complete block design (RCBD) with three replications. The experiment was conducted for 8 weeks; during which data were collected on the agronomic and yield variables of the crop. These variables were subjected to analysis of variance and the significant means were separated using Duncan's multiple range tests. There was obvious competition between the crop and the weeds growing on the plots, evident by reduced agronomic and yield performance of the crop under plots of higher weed incidence. The duration of competition also contributed to significant decline in crop performance as weed density induced significant reduction in plant population and plant height. The results point to the direction that optimum agronomic and yield performance of the crop is obtained where there is reduced incidence of weeds and better management of weed population.

Introduction

Celosia argentea L. is an important potherb in Nigeria. Its cultivation spans both the rainy and the dry seasons. It is an erect annual, 0.4-2.0 m tall, simple or branched; stem strongly ridged, green and often tinged red plant. Leaves are linear to linear lanceolate, glabrous, alternate, 20-180 mm long, 8-65 mm wide, with smaller leaves above, lower leaves with petioles (<18 mm) to sessile above. Its spikes are terminal and simple, 25-200 mm long, 10-22 mm across, conical at first and later cylindrical, continuous with dense flowers, silvery-white to pink. Fruits of this plant are dehiscent, 5.5 mm across with up to 9 seeds, glossy black, 1.3-1.5 mm long and slightly reticulate (Singh and Bajpai, 1994). Because of the inclusion of *C. argentea* as a major source of vitamins and minerals in local diets, it is important to discourage influences of inter and intra-row weeds on its growth.

Weeds are known to compete with crop plants for water, nutrients, space and solar radiations by influencing crop growth and

reduction of yield up to 20 to 50% (Kushwaha *et al*., 2002). Kushwaha *et al*. (2002) and Singh and Singh (1984) reported that weeds caused an appreciable reduction in density, dry weight and depletion of nutrients. These authors stressed that since single method is not able to control all weeds up to desired level, therefore, integration of chemical and mechanical methods might be an answer to achieve greater weed control efficiency, which in turn, may increase over-all benefit of crop production.

Singh and Bajpai (1994) also studied the influence of crop geometry and weed control on yields of rainfed soyabean, in areas where this crop was intercropped with C. *argentea*. Sowing at a row spacing of 30 cm resulted in the lowest weed density and highest seed yield, whereas hand-weeding and fluchloralin application gave significantly higher seed yield and reduced weed density over the weedy control plots. Maintenance of optimum plant density is one of the most important crop husbandry practices, which is responsible for the Abeokuta, Ogun state; which after initial cleaning was drilled on rows separated by about 50cm inter-row distance. The planting was done towards late raining season of September/October 2013 using a seed rate of about 300 grammes per plot. The design used was randomized complete block design (RCBD) with three replications. The experiment was conducted for 8 weeks; during which data were collected on the agronomic and yield variables of the crop. amount of radiation intercepted per unit area and significantly reduces the weed growth by reducing the availability of growth resources to the weeds (Nagamani *et al*., 2011).

This work was therefore designed to monitor and evaluate the competitive effects and influence of weeds on the agronomic and yield performances of *Celosia argentea* and also analyze the physiological basis for the performance of this crop under such condition.

Materials and methods

A 20 X 10 m^2 size plot was divided into five sub plots (plate 1); and five levels of crop – weed competition was introduced to the sub-plots as: 100% weediness (No weeding all through the period), 75% weediness (Weeding on the first 2 weeks only), 50% weediness (Weeding on the first 4 weeks), 25% weediness (Weeding for 6 weeks) and 0% weediness (Weeding all through the period). A local variety of *Celosia argentea* was sourced from the open market in The agronomic variables included: number of plant per plot, plant height and leaf colour; while plant weight at harvest and total dry matter constituted the yield data. These variables were subjected to analysis of variance, using Statistical Analysis Software, SAS version 8.1 (SAS, 1999) in order to determine if the treatments were significant on the variables; after which the significant means were separated using Duncan's multiple range tests.

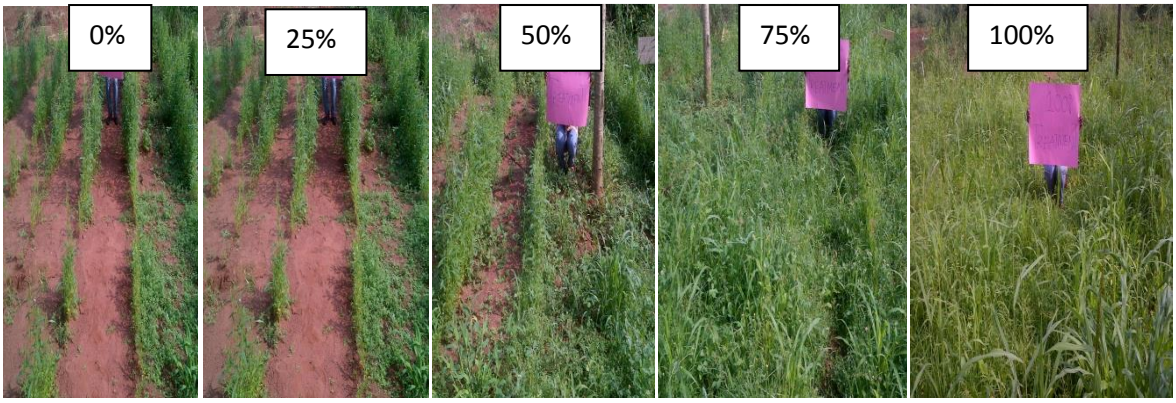

Plate 1. *Celosia agentea* plots under different weed density treatments.

Results and Discussion

Mean squares of agronomic and yield characters of *Celosia agentea* under intra and inter-specific weed influence are shown in table 1. The treatments were highly significant on all the variables evaluated; and this was also the same for the time period of evaluation. Interaction of treatment and time was however not significant only for number of plant per plot but highly significant for other variables. Replication was not significant also in all the variables except in number of plant per plot ($p \leq 0.01$, table 1). Table 2 shows means of agronomic and yield characters of *Celosia argentea* evaluated under five levels of weed treatment. All the weed treatments/levels (%) were significantly different for all the agronomic and yield variables. Means of all the agronomic variables evaluated showed considerable differences across the time periods, except for number of plant per plot where there was no difference in results from the fourth to the eight week of evaluation (Table 3). There were significant variations in the population of *Celosia argentea* observed in all the plots at harvest (fig. 1); with 0% plot recording the highest plant population (10,803) and 100% which has most severe weed influence recording lowest (660 plant stands). Differences in plant height (average values) at harvest is also presented in fig. 2. There was significant decrease in height of the crop from 25% to 100% treatment; with exception of 0% plot which recorded somewhat reduced plant height (106cm).

There was obvious competition between the crop and the weeds growing on the plots. The duration of competition probably contributed to the competitive effects as weed density and duration of association induced significant reduction in plant population and plant height. Ogunyemi *et al.* (2002) showed similar reduction in crop performance when *Solanum nigrum* grew in association with *Amaranthus cruentus.* Ogunyemi *et al.* (2000) also obtained similar results in the study of the competitive interaction between *Amaranthus spinosus* and *Glycine max*. However, most weed studies have always gone beyond evaluating the influence of weeds on crop but investigating the best weed management practices in different cropping situations; which this work was not extended to. One

of such works carried out by Pradhan *et al*. (2010) and Nagamani *et al*. (2011) pointed out that adoption of a good planting pattern for specific crops and increase in crop density per unit area will discourage weed growth and encourage higher net returns and benefit : cost ratio.

Conclusion

Competitive effect of weeds on *Celosia argentea* has relative agronomic impacts, which could in most cases also translate to overall yield reduction in the crop. The agronomic and yield quality of *Celosia argentea* was best under maximum weed reduction through periodic weed-free checks and plot sanitation. A well-developed, better planned effective weed management practice is therefore necessary to minimize weed problems and maximize crop performance, especially in humid tropical soils of south-western Nigeria. The latter we hope to achieve in future works.

Acknowledgements

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Table 1. Mean squares of Agronomic and yield characters of *Celosia agentea* under intra and inter-specific weed influence.

Source	Df	No of plant per plot	Plant height	Leaf colour	Plant weight	Toltal dry matter
Trt	4	44814776.1**	2648.86**	5.02**	668507.50**	515956.25**
Time	7	916583.1**	5611.83**	5.28**	8253007.50**	5633333.33**
Trt *time	28	133723.3ns	200.95**	1.16**	668507.50**	515956.25**
Rep	2	635416.2**	21.32ns	0.03ns	30152.50ns	21250.83ns
Error	78	85770.4	64.02	0.02	99675.58	98746.56
Total	119					
Cv (%)		22.8	33.7	5.6	120.4	145.0

Key: trt= levels of weed treatment, rep=replications, df= degree of freedom, *=significant at 5% level of probability, **= significant at 1% level of probability, ns= not significant, cv= coefficient of variation.

Table 2. Means of agronomic and yield characters of *Celosia agentea* evaluated under five levels of weed treatment.

Levels (%) of weed treatment	**no. of plant per plot**	**plant height**	**leaf colour**	**plant weed per plot**	**total dry matter**
0	3392.63a	13.73c	2.38b	422.92a	363.33a
25	1927.29b	40.78a	3.00a	425.00a	352.08a
50	554.79c	24.89b	2.21c	275.00ab	232.08ab
75	346.17d	22.53b	2.13d	129.17bc	96.67bc
100	189.58d	16.79c	1.75e	59.17c	39.17c

Key: Means with the same letter are not significantly different along the column.

Table 3. Means of agronomic and yield characters of *Celosia agentea* under weed influences for eight weeks.

Time (weeks)	no. of plant per plot	plant height	leaf colour	plant weight per plot	total dry matter
1	726.7c	0.14of	1.20e	-	-
2	1122.3b	4.571ef	3.00a	-	-
3	1321.2ab	9.398e	3.00a	-	-
4	1437.9a	16.927d	2.60b	-	-
5	1425.6a	25.063c	2.27c	-	-
6	1406.8a	35.752b	2.27c	-	-
7	1408.0a	46.297a	2.00d	-	-
8	1408.2a	51.802a	2.00d	2098.0	1733.3

Key: Means with the same letter are not significantly different along the column.

n.b. Data were collected only in the eight week for plant weight per plot and total dry matter (at harvest).

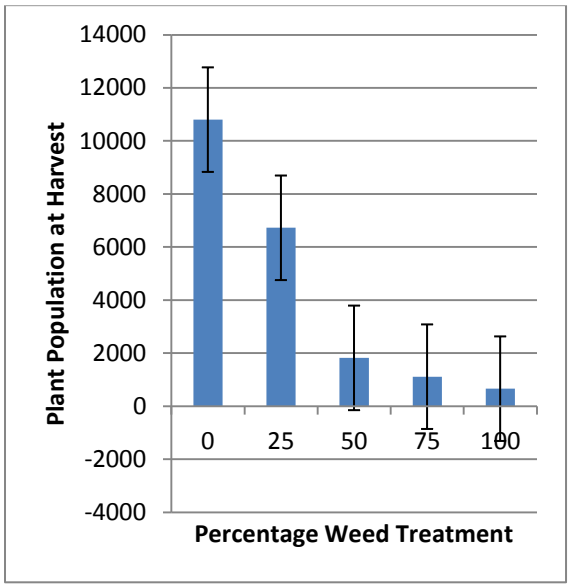

Fig. 1. Population of *Celosia agentea* on each plot at harvest.

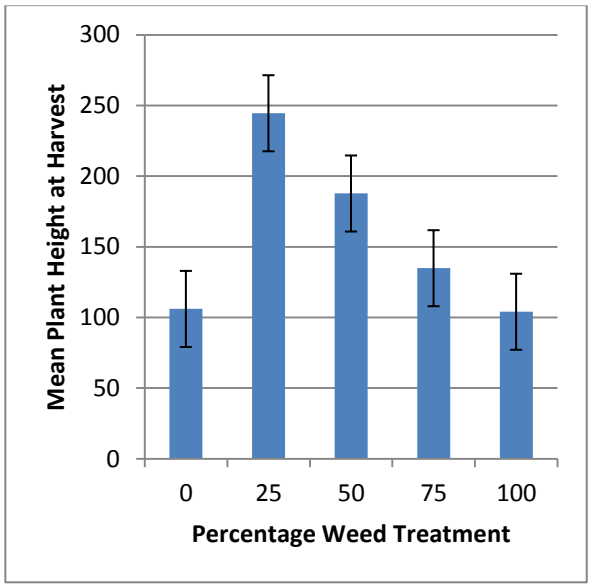

Fig. 2. Mean height of *Celosia agentea* on each plot at harvest.