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**EFFECT OF WEED DENSITY (*EUPHORBIA HETEROPHYLLA*)
ON THE PERFORMANCE OF POPCORN MAIZE
(*ZEA MAYS* VAR. *EVERTA*)**

UČINAK BROJA JEDINKI KOROVNE VRSTE (*EUPHORBIA
HETEROPHYLLA*) NA RAST I KOMPONENTE PRINOSA
KUKURUZA KOKIČARA (*ZEA MAYS* VAR. *EVERTA*)

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ABSTRACT

The effect of weed density on the growth and reproductive performance of *Zea mays everta* using *Euphorbia heterophylla* as the test weed was investigated. The result of the experiment revealed that there was no significant difference between the control and the treatments, as well as among the treatments in the early growth performance of popcorn for the first four weeks of planting, but as from the fifth week upward, there was a significant difference between the control and the treatments as well as among the treatments and the difference was observed on the leaf length, leaf number, leaf width, stem girth and leaf dry weight. For the reproductive performance, there was significant difference between the control and the treatments but there was no significant difference among the treatments observed in the fruit number, cob weight, weight of 100 seeds, cob length and cob circumference, also there was no significant difference between the control and the treatments observed in the number of seed rows per cob.

Key words: Competition, *Euphorbia heterophylla*, maize, popcorn

SAŽETAK

Istraživan je utjecaj broja jedinki korovne vrste *Euphorbia heterophylla* na rast i komponente prinosa kukuruza kokičara *Zea mays* var. *everta*. Prema rezultatu pokusa nije bilo značajne razlike između kontrole kukuruza bez korova i tretmana kukuruza s korovima tijekom prva četiri tjedna od sjetve. Nakon petog tjedna postojala je značajna razlika između kontrole i tretmana,

naročito s gledišta duljine lista, broja listova, širine lista, obujma stabljike i masi suhog lišća.

Kod komponenti prinosa uočene su značajne razlike između kontrole i tretmana s korovom, ali nije primijećena značajna razlika između tretmana unutar s korovom u broju plodova, masi klipa, masi 100 zrna, duljini klipa i opsegu klipa. Nije primijećena značajna razlika između kontrole i tretmana u broju redova zrna po klipu.

Ključne riječi: natjecanje, *Euphorbia heterophylla*, kukuruz kokičar

INTRODUCTION

Maize is one of the most important cereals in Nigeria and West Africa in general. Guatam *et al* (2011) reported that different concentrations of phosphorus and growth environment can affect the dry matter yield of maize.

In Nigeria, growth and production of maize are often challenged by weed.

A weed is a plant out of place or a plant growing where it is not wanted. A plant is regarded as a weed either because it interferes with human activity or welfare occurs spontaneously in human described habitats. Weeds are generally undesirable and may be prolific, persistent, competitive, harmful or even poisonous, (David, 1998). The effects of weed on a plant could be directly or indirectly. *Euphorbia heterophylla*, also known under the common names of fire plant, painted *Euphorbia*, desert poinsettia, wild poinsettia, fire on the mountain, paint leaf and Kalikow plant is a plant belonging to the Euphorbiaceous or spurge family. *E. heterophylla* is an annual plant with milky latex in all plants. It is a fast growing weed that can form a dense canopy impossible to harvest (Nester *et al.*, 1979). The competitive ability of *E. heterophylla* was reported by Olorunmaiye and Ogunfolaji (2002) in cowpea (*Vigna unguiculata*) where effect increased with increase in its population.

There is paucity of information on weed competition in pop corn maize.

It was therefore the objective of this study to investigate the effect of weed density (*E. heterophylla*) on the growth and yield of pop corn maize (*Zea mays everta*).

MATERIALS AND METHODS

The experiment was carried out at the Faculty of agriculture pavilion, University of Ilorin to evaluate the effect of weed density (*Euphorbia heterophylla*) on the performance of *Zea mays* var. *everta*. The experiment was a randomized design with each treatment of weed density in three replicates. Planting pots of 24.50 cm in width and 17.50 cm depth each were filled with about 10Kg Sandy- loam soil. Viability test was carried out on the *Zea mays* var. *everta* using germination test method. The seeds of *Zea mays* var. *everta* used in the study were procured from Ipata market in Ilorin, Kwara State, while the fruits of *Euphorbia heterophylla* were collected manually on the waste land at the bank area of the University of Ilorin, Ilorin, Nigeria. The *Euphorbia heterophylla* fruits collected were sun dried covered with wire gauze to trap the seeds that were released through explosive mechanism. The seeds collected were stored in the refrigerator to retain their viability. Five seeds of *Zea mays* var. *everta* were planted per pot and arranged in an open space within the pavilion and watered regularly once daily and twice daily when the number of leaves increased with increased rate of transpiration, while weed seeds *Euphorbia heterophylla* were planted according to the desired density of 5, 10, 15, 20, 25 and 30 seeds per pot. NPK 15: 15: 15 fertilizer was applied at the rate of 7.0 g per pot in the 2nd and 4th week after planting through broadcasting method. Destructive harvesting of *Zea mays* var. *everta* seedlings was made at intervals to determine dry weights at 2, 4, 5, 6 and 7 weeks after planting to determine weight of their dry matters.

Growth and reproductive parameters were also taken. The growth parameters were taken weekly which included stem height, number of leaves, leaf width, leaf length, stem girth, stem dry weight and leaf area. While the reproductive parameters taken included cob weight, weight of 100 seeds, number of seeds per cob, number of rows per cob, cob length and cob circumference.

The data collected were analyzed using statistical package for social science (SPSS) for analysis of variance to test for the significant difference between the control and the treatments and among the treatments as well. Duncan multiple range test (DMRT) was used to separate the means.

RESULTS

Vegetative performance

Effect of weed density on stem height was not statistically significant at 5-10WAP (weeks after planting) between the weed free (control) maize plants and the treatments of different weed density (Table 1). Values of stem heights, however, became significant at 11 and 12WAP. In most cases the stem heights of control maize plants were shorter than those of the experiment with various weed densities (Table 1). This may be a result of less competition for light among the maize plants in the control experiment and the competition for light in the various weed density treatments.

Table1: Effect of number of weeds (*Euphorbia heterophylla*) on stem height of *Zea mays* var. *everta* (cm)

Tablica 1 Učinak broja jedinki korova (*Euphorbia heterophylla*) na visinu stabljike *Zea mays* var.*everta* (cm)

Number of weed /pot.	Time							
	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP
0.0 (control)	19.7a	27.0a	64.8a	103.6a	145.7a	144.0a	144.1ab	144.3ab
5.0	20.0a	30.7a	69.0a	104.3a	132.0a	129.7a	131.0b	131.0b
10.0	23.4a	35.0a	82.8a	123.3a	150.3a	156.5a	156.5ab	156.5ab
15.0	23.4a	34.9a	74.8a	114.5a	151.3a	151.5a	152.2ab	152.2ab
20.0	23.4a	27.2a	70.3a	126.5a	153.3a	158.1a	169.9a	162.9a
25.0	23.4a	29.0a	67.8a	115.0a	143.7a	144.4a	145.4ab	145.4ab
30.0	20.2a	28.1a	64.3a	109.3a	144.3a	151.7a	152.0ab	152.0ab

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Maize leaves were longer in the control experiment than weed density treatments as from 7-12WAP, size of leaf breadth also followed the same pattern (Tables 2&3). Number of leaves increased steadily with the age of maize plants from 6-9WAP (Table 4). This reduction may be due to senescence and death of older leaves. Weed treatments have no significant effect on the number of leaves in maize plants (Table 4). Stem girth increased steadily with the age of maize plants from 5-10WAP in all the treatments and control

experiments and reduced at 11 and 12WAP (Table 5). Stem girth was slightly bigger in the control experiment (Table 5). This increase in stem girth may be as a result of reduction in the vegetative growth in preference of reproductive growth.

Table 2: Effect of number of weeds (*Euphorbia heterophylla*) leaf length of *Zea mays* var. *everta* (cm)

Tablica 2 Učinak broja jedinki korova (*Euphorbia heterophylla*) na duljinu lista *Zea mays* var. *everta* (cm)

Number of weed /pot.	Time							
	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP
0.0 (Control)	58.67a	27.00b	70.67a	72.47a	73.50a	73.60a	68.67a	71.17a
5	59.33a	30.67ab	63.87a	64.87a	65.37a	60.40a	57.27a	56.83ab
10	68.00a	35.00ab	69.80a	69.07a	67.40a	67.73a	56.90a	55.17ab
15	57.17a	34.90ab	61.83a	59.30a	64.23a	64.50a	54.43a	48.50b
20	62.47a	53.70a	72.60a	72.33a	71.67a	69.77a	57.40a	63.40ab
25	57.67a	39.40ab	61.93a	61.27a	58.00a	62.23a	56.20a	63.43ab
30	56.57a	45.67ab	63.47a	65.07a	68.67a	66.30a	64.73a	64.30ab

Means carrying the same letters along the same column are not significantly different at (P < 0.05)

Table 3: Effect of number of weeds (*Euphorbia heterophylla*) on the leaf breath of *Zea mays* var. *everta* (cm)

Tablica 3 Učinak broja jedinki korova (*Euphorbia heterophylla*) na širinu lista *Zea mays* var. *everta* (cm)

Number of weed /pot.	Time							
	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP
0.0 (Control)	4.87a	5.63a	7.53a	4.47a	7.20a	7.10a	6.83a	6.73a
5	4.77a	5.37a	5.67b	5.63b	5.57bc	5.43bc	5.50abc	5.47abc
10	4.33a	4.87a	5.70b	5.23b	4.73c	4.73c	4.30c	4.10c
15	4.27a	4.53a	5.47b	5.47b	5.40bc	5.20bc	5.13bc	5.00cb
20	5.00a	5.33a	5.90b	6.10ab	6.30abc	5.43bc	5.27bc	5.07bc
25	4.20a	4.30a	5.67b	5.73b	5.47bc	5.50bc	5.53abc	5.07cb
30	4.77a	5.07a	6.47ab	6.47ab	6.43abc	3.37a	6.23ab	6.33ab

Means carrying the same letters along the same column are not significantly different at (P < 0.05)

Table 4: Effect of number of weeds (*Euphorbia heterophylla*) on number of leaves in *Zea mays* var. *everta*

Tablica 4 Učinak broja jedinki korova (*Euphorbia heterophylla*) na broj listova *Zea mays* var. *everta*

Number of weeds /pot	Time							
	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP
0.0 (control)	9.33ab	13.00a	14.67a	15.33a	16.00a	13.33a	12.33a	11.00a
5.0	9.67ab	13.00a	14.67a	15.00a	15.00a	13.00a	12.67a	12.33a
10.0	9.33ab	13.33a	14.67a	15.33a	15.67a	13.00a	12.33a	11.67a
15.0	10.33a	13.00a	14.00a	15.67a	15.67a	13.67a	12.00a	11.33a
20.0	9.33ab	13.33a	14.33a	15.67a	15.67a	14.00a	12.67a	12.00a
25.0	9.00b	12.67a	14.33a	14.33a	15.67a	132.33a	12.33a	12.33a
30.0	9.33ab	12.33a	15.00a	14.67a	15.00a	13.33a	12.33a	12.67a

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 5: Effect of number of weeds (*Euphorbia heterophylla*) on stem girth of *Zea mays* var. *everta* (cm)

Tablica 5 Učinak broja jedinki korova (*Euphorbia heterophylla*) na obujam stabljike (cm)

Number of weeds /pot	Time							
	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP
0.0 (control)	3.17a	4.57a	5.77a	5.80a	5.83a	5.57a	3.23a	4.57a
5.0	3.10a	4.13a	5.70b	5.23a	5.10ab	4.53ab	3.50a	3.60ab
10.0	2.67a	3.83a	4.70b	5.17a	4.70b	4.23b	3.23a	3.23b
15.0	3.03a	4.30a	5.03ab	5.13a	5.17ab	4.27b	3.80a	3.37ab
20.0	2.60a	3.93a	4.90ab	5.17a	5.53ab	4.83ab	3.83a	3.60ab
25.0	2.87a	4.03a	4.73b	4.90a	5.13ab	4.77ab	3.17a	3.67ab
30.0	3.17a	4.13a	5.20ab	5.37a	5.80a	4.83ab	3.83a	3.57ab

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 6: Effect of number of weeds on the shoot dry weight of *Zea mays* var. *everta* (g)

Tablica 6 Učinak broja jedinki korova na težinu suhog izdanka *Zea mays*.var.*everta* (g)

Number of weeds/ pot	Time				
	2WAP	4WAP	5WAP	6WAP	7WAP
0.0 (Control)	0.15c	1.89a	3.90a	5.24a	6.82a
5	0.19abc	2.03a	2.25b	4.25ab	4.71a
10	0.27a	2.01a	2.10b	3.10bcd	4.29a
15	0.25ab	2.11a	2.30b	3.41bc	6.69a
20	0.19ab	2.16a	2.76ab	2.02d	4.63a
25	0.17bc	1.40a	2.35b	3.97b	4.36a
30	0.16bc	1.77a	1.98b	2.35cd	3.73a

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 7: Effect of number of weeds (*Euphorbia heterophylla*) on the leaf area of *Zea mays* *everta* (cm²)

Tablica 7: Učinak broja jedinki korova (*Euphorbia heterophylla*) na područje lista *Zea mays* var.*everta* (cm²)

Number of weeds /pot	Time							
	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP	12WAP
0.0	205.87a	114.15a	413.70a	420.80a	403.26a	397.30a	357.91a	364.45ab
5.0	203.25a	112.05a	271.45a	273.82a	272.63ab	245.93ab	237.17ab	234.3ab
10.0	219.77a	124.39a	296.47a	270.48a	239.71b	240.33ab	186.11b	177.19b
15.0	186.72a	120.30a	253.60a	255.42a	260.77ab	252.94ab	209.81ab	194.30b
20.0	234.51a	267.93a	323.76a	332.57a	340.73ab	311.74ab	268.16ab	238.5ab
25.0	182.28a	125.18a	263.38a	263.38a	238.13b	257.49ab	232.66ab	244.8ab
30.0	201.78a	149.86a	313.89a	235.47a	327.10ab	326.28ab	321.28ab	314.6ab

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Shoot dry matters were taken at 2, 4, 5, 6 and 7WAP the inception of fruiting. Shoot dry matter increased with the age of maize plants and was highest in the control experiment (Table 6). Leaf areas increased with the age of maize plants from 5-10WAP and reduced at 11 and 12 WAP (Table 7). This may be due to reduction in number of leaves as a result of senescence of older leaves.

Reproductive performance

Reproductive performance of the various weed treatments and the control experiment was considered and the control experiment produced the largest cob weight (46.84g) followed by the weed treatment of 5weeds per pot (45.0g)(Table 8). Weights of 100 seeds were highest in the control experiment (11.61), while the number of rows per cob was not significantly different in all the treatments (Tables 9&10). Control experiment produced the highest cob circumference and cob length (Tables 11&12).

Table 8: Effect of number of weeds (*Euphorbia heterophylla*) on the cob weight of *Zea mays* var.*everta* (g)

Tablica 8 Učinak broja jedinki korova (*Euphorbia heterophylla*) na težinu klipa *Zea mays* var.*everta* (g)

Number of weeds/pod	Cob weight (g)
0.0 (control)	46.84a
5.0	45.40a
10.0	25.47ab
15.0	22.62a
20.0	40.20ab
25.0	32.20ab
30.0	35.82ab

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 9: Effect of number of weeds (*Euphorbia heterophylla*) on the weight of 100 seeds of *Zea mays* var. *everta* (g)

Tablica 9 Učinak broja jedinki korova (*Euphorbia heterophylla*) na težinu 100 sjemenki *Zea mays* var. *everta* (g)

Number of weeds/pod	Weight of 100 seeds (g)
0.0 (control)	11.61a
5.0	9.45a
10.0	9.28a
15.0	9.80a
20.0	10.42a
25.0	10.53a
30.0	11.10a

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 10: Effect of number of weeds (*Euphorbia heterophylla*) on the number of seed rows of *Zea mays* var. *Everta*

Tablica 10 Učinak broja jedinki korova (*Euphorbia heterophylla*) na broj redova zrna *Zea mays* var. *everta*

Number of weeds/pod	Number of seed rows/pod
0.0 (control)	12.00a
5.0	13.00a
10.0	11.67a
15.0	11.33a
20.0	13.67a
25.0	13.00a
30.0	12.00a

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 11: Effect of number of weeds (*Euphorbia heterophylla*) on cob circumference of *Zea mays* var. *Everta*

Tablica 11 Učinak broja jedinki korova (*Euphorbia heterophylla*) na obujam klipa *Zea mays* var. *everta*

Number of weeds/pod	Cob Length (cm)
0.0 (control)	10.20a
5.0	9.47a
10.0	8.90a
15.0	8.73a
20.0	9.50a
25.0	9.33a
30.0	9.30a

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

Table 12: The effects of weed density (*Euphorbia heterophylla*) on the cob length of *Zea mays* var. *everta* (cm)

Tablica 12 Učinak broja jedinki korova (*Euphorbia heterophylla*) na duljinu klipa *Zea mays* var. *everta*

Number of weeds/pod	Cob Length (cm)
0.0 (Control)	15.07a
5.0	13.33a
10.0	12.80a
15.0	11.33a
20.0	13.80a
25.0	13.63a
30.0	13.40a

Means carrying the same letters along the same column are not significantly different at ($P < 0.05$)

DISCUSSION

All the weed densities had significant effects on the growth and yield of popcorn and this was observed on the stem height, leaf length, leaf width, leaf area, leaf number, stem girth and shoot dry weight and the reproductive yield which included cob weight, fruit number, weight of 100 seeds, number of seeds per cob, cob circumference and cob length.

There was an increase observed in the stem height of popcorn under different weed density regimes but not in the control. This increase may be as a result of competition between popcorn and the weed (*E. heterophylla*) for light. This is in line with the work of Rao, (2000) who observed that weeds compete with crops for most of the resources via; nutrients, moisture, light and space, therefore, poses serious problem to the growth of crops if not controlled. Olorunmaiye and Ogunfolaji, (2002) also observed an increase in the stem height of cowpea in competition with *Euphorbia heterophylla*.

There was observed reduction in the leaf length of popcorn in all the treatments under weed competition compared to the control. This is in line with the work of Eke and Okereke (1990) who demonstrated that *E. heterophylla* reduced the growth rate of maize at a ratio of four weed plants per crop plant.

The density of *E. heterophylla* reduced the yield of popcorn compared with the weed free control in terms of the cob circumference and cob length. This

observation of reduction in yield due to the presence of weed agreed with the findings of Nester *et al.*, (1979) who comment on how yield of crops can be reduced to zero by dense infestation of *E. heterophylla*, also Olorunmaiye and Ogunfolaji (2002) who reported reduction in cowpea yield with increase in *E.heterophylla* population. Reproductive parameters such as cob weight, weight of 100 seeds, number of seed rows per cob, cob length, reduction or increase in yield with increase in *E.heterophylla* population was not statistically significant and may be genetically controlled.

There was an observed reduction in the leaf width, leaf length, stem girth and leaf area of popcorn in the presence of weed (*E. heterophylla*) compared with the weed free control. This observation agreed with the findings of Eke and Okereke (1990) who demonstrated that (*E. heterophylla*) reduced the growth rate of maize at the ratio of four weed plants per one crop plant.

In conclusion, *E.heterophylla* competes with popcorn and has a great effect on the growth and reproductive performance of popcorn irrespective of the density of the weed available

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