

NISEB 2000040/1410

Effect of density and duration of *Euphorbia heterophylla* (L.) on the performance of cowpea (*Vigna unguiculata*) (Walp).

K. S. Olorunmaiye and R. T. Ogunfolaji

Department of Biological Sciences, University of Ilorin, Ilorin, Nigeria

(Received August 11, 2000)

ABSTRACT: A study of the effect of weed density and weed duration on the performance of *Vigna unguiculata* (Walp) using *Euphorbia heterophylla* as the test weed was carried out on a sandy loamy soil. The result revealed that there was no significant difference between the control and the treatment, and among the treatments in the performance of cowpea in the first three weeks of planting. Increase in the weed density and weed duration however reduced the leaf number per plant, stem height, pod and seed number per plant. Increase in weed density and duration also caused a reduction in both the quality and quantity of the reproductive performance of cowpea in terms of pod length, filling potential, seed number per plant, pod weight and weight of fifty seeds per plant.

Key Words: Cowpea; *Vigna unguiculata*; Weed density; Weed duration; *Euphorbia heterophylla*.

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp) occupies a prominent place among the legumes grown in Africa, Asia, Southern U.S.A., Central and South America (Bhan et al., 1982; Ferry, 1990). Cowpea is the most popular food legume in Nigeria where the largest quantity is produced (Anon, 1992; Kochhar, 1981).

The presence of weeds, especially during the early stage of growth causes severe competition thereby reducing the grain yield of cowpea substantially. Weeds compete with cowpea for nutrient, moisture, light and space (Fadayomi, 1979; Ayeni et al., 1984). Weeds with good competitive ability show a faster rate of root elongation and development than crop (Wiese, 1968; Ayeni et al., 1984). Such weeds have been reported to cause yield losses ranging from 50 to 80% in cowpea (Moody, 1973; Remison, 1978; Akobundu, 1979; Nangju, 1980).

Yield reduction in cowpea with increasing density of milkweed (*Euphorbia heterophylla*) was reported by Remison (1978). Weed management studies at the International Institute of Tropical Agriculture, Ibadan, Nigeria, revealed that a density of 10 plants/m² of milkweed reduced cowpea yield by 25 – 53 percent while 80 plants/m² reduced yield by 68 – 75 percent (IITA, 1977).

The longer weeds compete after crop emergence, the greater their effect becomes. Duration of weed competition often called the critical period defines the maximum period weeds can be tolerated without affecting final crop yield. A single timely weeding was reported to produce maximum yield in cowpea (Vander and Vermaat, 1978) while the critical period for weed competition was reported to be between 20 and 40 days of crop growth (Moody, 1973).

Weeds constitute a major limiting factor to cowpea production and probably the most important yield depressing factor to cowpea production in Nigeria. The present study was carried out to determine the competing ability of cowpea with weed under different weed densities and to find out the critical period of weed-crop competition.

Materials and Methods

Seeds of cowpea (*Vigna unguiculata* (L.) Walp) variety IT 845-2246-4 used for this study were obtained from International Institute of Tropical Agriculture (IITA), Kano Station, while seeds of milkweed (*Euphorbia heterophylla* L.) were collected locally on the waste land adjacent to the Department of Biological Sciences, University of Ilorin, Ilorin.

Viability test was carried out on the seeds using floatation method. Seeds that floated in water were separated and discarded as non viable while those that settled under water were collected as viable seeds. Thirty-six sets of polybags were filled with well drained sandy loamy soil and randomly arranged in an open space in the Department of Biological Sciences, University of Ilorin, Ilorin. The polybags were then separated into two sets of eighteen each. One set of eighteen soil-filled polybags was used to study effects of weed density while the second set was used to study the effects of weed duration. For weed density study, two seeds of cowpea were planted in the centre of each pot and seeds of *Euphorbia heterophylla* were sown in a concentric ring round the cowpea seeds. Cowpea seedlings were thinned down to one plant per pot one week after germination while the seedlings were thinned down to the required number of stands per pot one week after germination, i.e. 1, 4, 6, 8, 10 referred to as wd1, wd2, wd3, wd4 and wd5, respectively. The control pot contained only cowpea. Weed duration effect was studied by allowing 3 stands of *Euphorbia heterophylla* plants per pot for a particular period of time and removed (weeded) as appropriate (3, 4, 5, 6 weeks after planting) referred to as wc1, wc2, wc3 and wc4, respectively. there were two control experimenta. One was weed free while the other was weedy throughout the experimental period (wc5).

Growth parameters as well as reproductive parameters like leaf number, stem height, pod length, pod weight, pod number, filling potential, seed number per plant were taken. Growth parameters were taken fortnightly while the reproductive parameters were taken at the end of the experiment.

These results were treated to statistical analysis of variance to test for significant differences between the control and the treatments as well as among the treatments.

Results

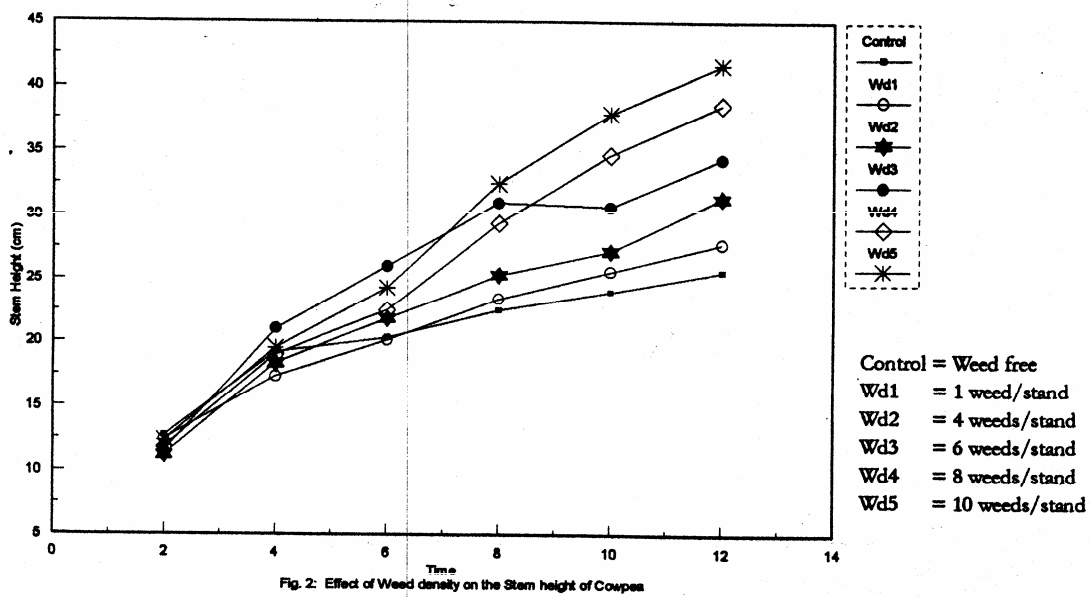
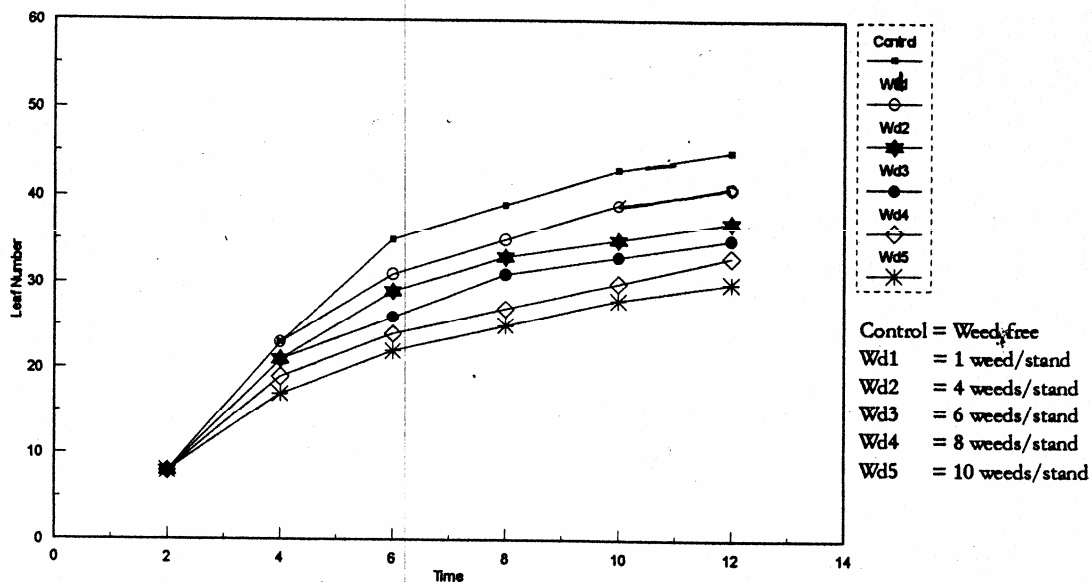
Weed Density

Leaf Number

There were no significant differences in the leaf number of the control experiment and all the treatments during the first two weeks after planting. However, differences occurred in leaf number between the control and the treatments and among the treatments as leaf number in the control were progressively higher than the leaf number in all the treatments as from the 4th week after planting. Increase in leaf number at 12 WAP may be attributed to the decrease in the vegetative growth of the weed (*Euphorbia heterophylla*) which was almost completing its life cycle (Fig. 1) as well as continuous availability of water.

Stem Height

Cowpea stem height was better in the control than the treatment only in the first two weeks after planting. Increase in height was observed in the treatments than in the control as from the 4th week after planting (Fig. 2). This may be as a result of competition for light between the cowpea and *E. heterophylla*.



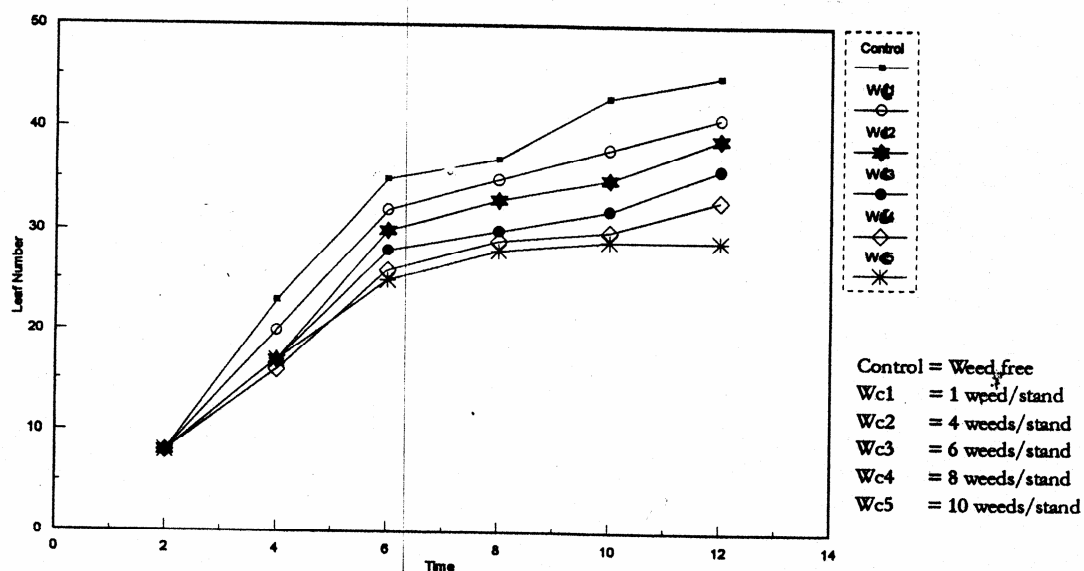


Fig. 3: Effect of Weed duration on the leaf number of cowpeas

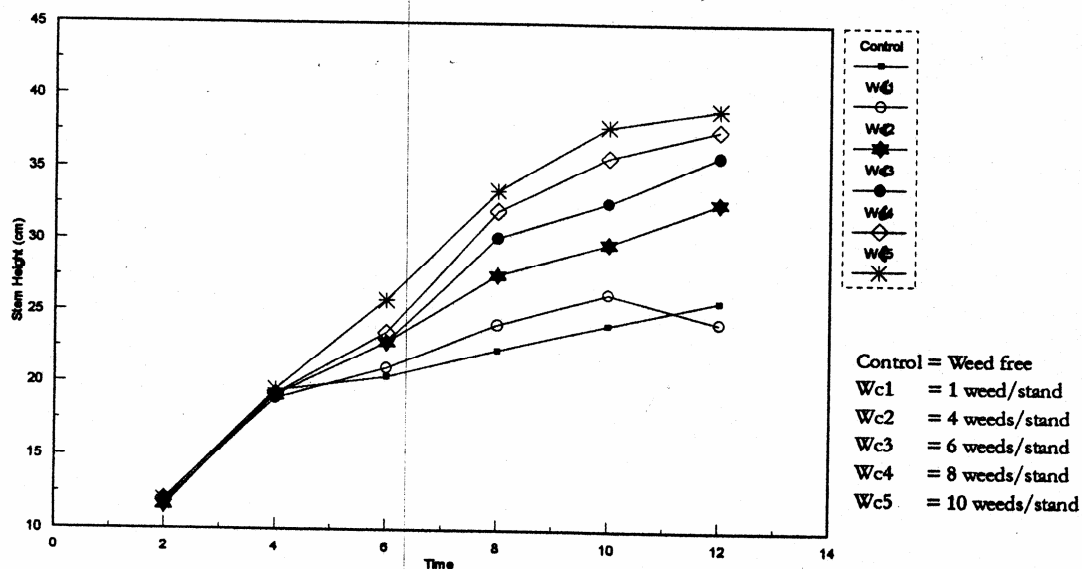


Fig. 4: Effect of Weed duration on the stem height cowpeas

Reproductive Yield

There were reductions in the reproductive yield of cowpea in all the treatments compared with the control in terms of pod number and pod weight/plant, seed number/plant, weight of 50 seeds per plant as well as the filling potential per pod. there was no significant difference in the pod length between the control and the various treatments (Table 1).

Table 1: Effect of weed density on the reproductive growth of cowpea.

Treatment	Pod length	Pod Number/Plant	Pod wt./Plant	Seed number/Plant	Wt. of 50 seeds/plant	Filling potential (Seed No/Pod length)
Control (Weed free)	14.10	11.3	21.97	120.0	7.98	0.75
wd ₁	14.60	10.0	18.16	110.0	6.61	0.75
wd ₂	14.13	9.0	17.54	90.0	6.37	0.71
wd ₃	14.00	9.0	17.53	84.37	6.13	0.67
wd ₄	13.34	9.0	17.32	80.54	5.05	0.67
wd ₅	13.13	8.6	16.45	77.0	4.42	0.69

*Values represent the means of 3 replicates.

Weed Duration

Leaf Number

Duration of *E. heterophylla* longer than 3 – 4 weeks after planting produced reduction in leaf number compared with the weed free control. There was a significant difference between the weed-free control and the weedy control (Fig 3).

Stem Height

There was a progressive increase in stem height as the duration of *E. heterophylla* increased with the weedy control producing the greatest stem height.

Reproductive Yield

Duration of *E. heterophylla* reduced the yield of cowpea compared with weed free control in terms of pod number and pod weight per plant, pod length, seed number per plant, weight of 50 seeds per plant and filling potential (Table 2).

Discussion

There was a progressive reduction in the leaf number of cowpea as the density of weed (*E. heterophylla*) increased. This finding agreed with the report of Remison (1978) who observed a reduction in the leaf number of cowpea under competition with different weed densities of *E. heterophylla*. There was also observed reduction in the number as the duration period of the weed increased, especially as from 4 weeks after planting (Fig. 1).

Table 2: Effect of weed duration on the reproductive growth of cowpea.

Treatment	Pod length	Pod Number/Plant	Pod wt./Plant	Seed number/Plant	Wt. of 50 seeds/plant	Filling potential (Seed No/Pod length)
Control (Weed free)	15.10	11.0	18.79	115.5	9.0	0.75
wc ₁	14.50	9.0	17.93	94.5	7.79	0.72
wc ₂	14.00	9.0	17.38	81.0	6.73	0.64
wc ₃	13.40	7.0	16.41	52.0	5.09	0.55
wc ₄	12.30	6.0	14.70	46.0	4.12	0.62
wc ₅	10.0	5.0	13.79	42.0	3.77	0.84

*Values represent the means of 3 replicates.

Increase in leaf number at 12 weeks after planting may be as a result of decrease in the vegetative growth of the weed (*E. heterophylla*) which was almost completing its life cycle as well as a result of continuous availability of water to the crop. Increase in height of cowpea under different weed density regime than the control may be as a result of competition for light. The same observation was recorded in cowpea under weed duration experiment (Figs. 2, 3 and 4).

There was reduction in the reproductive yield of cowpea in all the treatments under weed density compared with the control in terms of pod number and pod weight per plant, seed number perplant, weight of 50 seeds per plant as well as filling potential per pod (Table 1). This observation also agreed with the findings of Remison (1978) and the result of yield obtained froman unweeded plot of cowpea (Makinde and Ogunyemi, 1998; Pal and Singh, 1990).

Duration of *E. heterophylla* reduced the yield of cowpea compared with the weed free control in terms of pod number and pod weight per plant, pod length, seed number per plant, weight of 50 seeds per plant and filling potential (Table 2). This observation of reduction of yield due to weed duration agreed with the findings of Bhan et al. (1982) and Moody (1973).

References

- Akobundu, I. O. (1979) Weed control in Nigeria. Pesticide Articles and News Summaries 25, 287 – 298.
- Anon (1992) FAO Production Yearbook, 1992, Rome.
- Ayeni, A. O.; Duke, W. B. and Akobundu, I. O. (1984) Weed interference in maize, cowpea, maize/cowpea intercrop in a subhumid tropical environment. Influence of cropping season. weedRes. 24, 269 – 279.
- Bhan, V. M.; Balyan, R. S. and Sign, S. P. (1982) Influence of time of weed removal and seed species on the grain yield of cowpea. Indian J. Agron. 27(3), 267 – 271.
- Fadayomi, O. (1979) Effect of crop spacing on weed competition and seed yield in cowpea (*Vigna unguiculata* Walp.) C.V. Ife Brown. Ife J. Agric. 1, 45 – 50.
- Ferry, R. L. (1990) The cowpea production, utilization and research in the United States. Horticultural reviews 12, 197 – 222.
- IITA (1977) Annual Report. International Institute of Tropical Agriculture, Ibadan, Nigeria. p. 1000.
- Kochhar, S. L. (1981) Tropical Crops – A Textbook of Economic Botany. Macmillan Publishers. p. 150.
- Makinde, J. O. and Ogunyemi, S. (1998) Evaluation of imidazole-based herbicides mixtures for milk weed (*Euphorbia heterophylla* L.) control in cowpea (*Vigna unguiculata* (L.) Walp). Nig. J. Weed Sci. 11, 39 – 44.

- Moody, K. (1973) Weed control in cowpeas. Proceedings of the 3rd Nigeria Weed Science Group Meeting, Samaru Institute of Agricultural research, Nigeria, pp. 13 – 22.
- Nangju, D. (1980) Effect of plant density, spatial arrangement and plant type on weed control in cowpea and soybean. In: Weed and Their Control in Humid and Subhumid Tropics. Akobundu, I. O. (Ed.), IITA Proceedings Series 3, 288 – 299.
- Pal, U. R. and Singh, S. P. (1990) Crop-weed competition and weed control in soybean (*Glycine max* (L.) Merrill) in southern guinea savanna of Nigeria. Nig. J. Agric. Technol. 2, 42 – 49.
- Remison, S. V. (1978) Performance of cowpea (*Vigna unguiculata* (L.) Walp) as influenced by weed competition. J. Agric. Sci. (Camb.) 90(3), 523 – 530.