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Weed control with alachlor in irrigated cowpea *(Vigna unguiculata* (L.) Wale) in a forest zone of Nigeria

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Abstract

The influence of irrigating cowpea to different phenological stages on weed control, weed species and density, and cowpea grain yields was investigated in the field in the dry seasons of 1983/84 and 1984/85. Results showed that moisture strees, in treatment that were irrigated till the end of the vegetative phase, led to a reduction in grain yields when compared with treatments that received irrigation till flowering or podding. Weed control by alachlor was inadequate for treatments that received irrigation till the end of vegetative phase only, but adequate for treatments that received irrigation for more than the vegetative phase of growth. There was a good control of *Euphorbia heterophylla* L., *Spigelia anthelmia* L. and *Amaranthus spinosus* L. by alachlor. The potential of sedges being serious problem weeds under irrigation was observed.

Introduction

In the humid and subhumid tropics of West Africa, farmers rely on rainfall for cowpea production. However, in recent years, the potential of a third crop grown under irrigation is being explored by medium to large scale farmers that can afford irrigation expenses. Weed control, weed species and weed dynamics in rainfed cowpea in Nigeria is fairly well understood (Nangju *et al.* 1979, Lagoke *et al* 1982, Akobundu 1982, Akinyemiju 1987). However, irrigated cowpea production in Nigeria is recent and as such information on the influence of irrigation on weed control, weed species and crop yield in cowpea is scanty.

In the Savanna zone of Nigeria, irrigation agriculture is more prevalent largely due to the comparatively shorter rainy season. Irrigation however encourages different types of weed species from rainfed crops (Moolani, 1978).

In order to find out the most appropriate phenological stage to stop irrigation and yet obtain good quality and high grain yeild of cowpea, a series of study was begun at the Obafemi Awolowo University, Ile-Ife. This paper reports the effect of irrigating cowpea to different phenological stages on weed control with alachalor (2-chloro-N-(2, 6-diethylphenyl)-N- (Methoxymethyl) acetamide). The choice of alachlor is based on the fact that it is a commonly recommended herbicide under rainfed cowpea production in the rain-forest belt of Nigeria (Akobundu 1982)

Materials and Methods

The experiment was conducted at the Teaching and Research Farm of the Obafemi Awolowo University in the dry seasons (November - February) of 1983/84 and 1984/85. Irrigation schedule was planned on the basis of cowpea phenology as presented in Table 1. These stages were developed from a preliminary experiment conducted earlier. Water supply was by overhead sprinkler system with as sprinkler swoop of about 10m. The soil was maintained at or close to field capacity for the period of growth requiring irrigation by watering at least 3 times a week. The

amount of irrigation water supplied each time was about 30mm.No rainfall was observed during the period of the experiment.

The experiment was sited on a loamy-sand soil with an organic matter content of 2% and pH of 6.1. The soil was ploughed and harrowed before the experiment was layed out. Ife Brown variety of cowpea was planted at a spacing of 0.30m within and 0.60m between rows, 24 plants per row and 5 rows per plot. A plot of 5 planted rows, 3m x 7.2m constituted an experimental unit. There were 4 replications per treatment. Randomization was achieved by locating each block on different sites of similar soil characteristics, and randomizing treatments within each block. The experiment was a randomized complete block design. A single pre-emergence spray application of 3.0kg a.i./ha alachlor was carried out at planting using a knapsack sprayer previously calibrated to deliver 250 l/ha spray solution under a pressure of 2-3 kg/cm^2.

Insect pests were controlled during vegetative phase of growth with a forthnightly application of monocrotophos (500 g a.i./ha), and during podding, benomyl at 3 g/l was added to the insecticide spray to control the attack of Brown blotch

TABLE 1: STAGES OF COWPEA *(VIGNA UNGUICULATA* (L.) WALP) PHENOLOGY THAT RECEIVED IRRIGATION DURING THE EXPERIMENT.

	Stages of crop growth that received irrigation	Period after planting that received irrigation (Days after planting)
I	At planting	0
II	From planting till full emergence	0 - 4
III	From planting till early vegetative growth	0 - 21
IV	From planting till late vegetative growth	0 - 34
V	From planting till middle of flowering	0 - 49
VI	From planting till about first pod ripe	0 - 57

(Colletotricum spp.).

Data on cowpea biomass was obtained by harvesting at soil level two randomly selected stands of cowpea at 40 days after planting (d.a.p.). The harvested cowpea plants were separated into leaves and stem, dried in the oven at 80°C for 48 hr and the dry weight expressed on per plant basis. Weed control rating was done 40 d.a.p. by comparing the level of control in each treatment with a hand weeded but irrigated control. Weed identification and count at 40 d.a.p. was conducted within a 1m x 1m quadrat randomly placed within each treatment. Three of such quadrats were taken for each treatment and averaged to obtain a plot mean. Weeds were sorted out within each quadrat, counted, identified and later dried at 80°C for 48 hr in the oven. Cowpea yield and yield components were also obtained. Grain yields was adjusted to 10% moisture content after shelling. Data collected were statistically analysed using the least significant difference (LSD) at 5% level (Steel and Torrie 1980).

Results and Discussion

The influence of moisture supply covering different phenological stages of cowpea development on its performance is shown in Table 2. Cowpea performance was better when the period of irrigation extended to the flowering and podding stages than when irrigated period was shorter. Cowpea survival, dry matter production and number of leaves were significantly lower in plants that received irrigation to different stages before the end of the vegetative phase when compared to treatment that were irrigated for longer periods (Table 2). Also,the number of days to first flower, days to peak flower, total number of flowers and pods, and seed yield per plant were adversely affected when irrigation was withheld before the end of the late vegetative phase (Table 2). The performance of cowpea irrigated till early flowering was not significantly better than the treatments that received irrigation till about the first ripe pod state (Table 2). The quality and yield of cowpea in these two treatments were comparable and represent the highest yield in all the treatments. However, the yield reported here is lower than the yield of cowpea grown in late seasons (Nangju 1979, Akinyemiju 1987). Generally cowpea cv. Ife Brown yields in the late seasons is lower than in the early season in the Ife ecological zone (Alofe, personal communication, Akingbohungbe 1982, Akinyemiju and Echendu 1987). The implication of this result is that even though the quality of cowpea produced under irrigation is better than rainfed production, the yield *per se* may not be as high as in rainfed cowpea.

TABLE 2: SURVIVAL, DRY MATTER PRODUCTION AND, YIELD COMPONENTS OF COWPEA (*VIGNA UNGUICULATA* (L.) WALP) SUBJECTED TO PLANNED WATER —DEFICIT IRRIGATION

	Stages of Crop Growth that Received Irrigation	Survival (%)	Mean Dry Matter Production (40.d.a.p) Stem (g.plant)	Leaf (g/plant)	Total (g/plant)	No. of Leaves	Days to 1st flower	Days to Peak flower	Total No. of flower per plant	Total No. of pods per plant	Seed yield (g/plant)
I	At Planting (0 d.a.p.)[1]	71	2.6	3.7	6.3	35	41.0	56.0	14.1	14.0	5.6
II	From Planting till Full Emergency (0-4 d.a.p.)	68	1.7	3.5	5.1	34	40.0	54.0	16.3	15.0	7.7
III	From Planting Till Early Vegetative Growth (0-31 d.a.p.)	74	3.0	6.3	10.0	57	41.0	52.0	20.8	18.1	11.6
IV	From Planting Till Late Vegetable Growth (0-34 d.a.p.)	69	7.1	14.4	21.5	113	42.5	53.0	25.7	24.2	22.5
V	From Planting Till Mid Flowering (0-49 d.a.p.)	90	8.0	18.0	26.0	132	43.5	53.0	26.7	25.7	26.2
IV	From Planting Till First Pod Ripe (0-57 d.a.p.)	96	9.9	22.1	32.0	139	42.5	55.0	21.2	21.0	34.0
	LDS .05	5	3.1	6.1	9.0	35	1.5	2.0	4.0	6.0	10

Weed control by alachlor as estimated by visual rating was generally adequate except where moisture was stopped at early or late vegetative phase. The dry weight of both the broad leaved and the grassy weeds also reflected the poor weed control by alachlor when the moisture was stopped at early and late vegetative phase (Table 3). The reason for the surge in weed when irrigation was stopped at the vegetative phase is still subject to further investigation.

TABLE 3: WEED CONTROL AND WEED BIOMASS AFTER A PRE-EMERGENCE APPLICATION OF ALACHLOR FOR WEED CONTROL IN COWPEA SUBJECTED TO PLANNED-WATER-DEFICIT IRRIGATION

	Stages of Plant Growth that Received Irrigation	Weed Control (%)	Broad Leaved Weed (g/m^2)	Grasses (g/m^2)
I	At Planting (0 d.a.p.)[1]	88	1.8	2.0
II	From Planting Till Full Emergency (0-4 d.a.p.)	86	1.3	1.3
III	From Planting Till Early Vegetative Growth (0-21 d.a.p.)	54	1.4	6.0
IV	From Planting Till Late Vegetative Growth (0-34 d.a.p.)	66	1.2	3.3
V	From Planing Till Mid Flowering (0-49 d.a.p.)	88	1.9	3.5
VI	From Planting Till First Pod Ripe (0-56 d.a.p.)	90	0.9	3.9
	LSD .05	—	0.5	1.0

1 d.a.p. is days after planting.

Weed species commonly encountered on the experimental site are listed in Table 4. The list is a compilation of the weeds that were observed in the experimental area in the last 3 years (Akinyemiju 1987). The list shows a preponderance of broad leaved weeds as compared to grassy weeds; only a species of *Cyperaceae* was found. In general, alachlor at 3.0 kg a.i./ha drastically reduced the growth of the weed species from a non-crop composition of 24 weeds to 8 during the experimental period (Table 5).The species and density of weeds were influenced by the level of irrigation received. Where irrigation was stopped at planting only 4 weed species were encountered. The number and density of weed species increased as the period of irrigation increased until the last stage of irrigation when a maximum of 6 species of different densities were observed (Table 5). It is significant to note that *E. heterophylla, S. anthelmia* and *A. spinosus* are not often controlled by alachlor in rainfed cowpea production (IITA 1976, Akobundu 1982, Akinyemiju 1987, O'Makinwa 1987). Also, *A. alternifolius* and the sedges are not generally problem weeds in rainfed cowpea (Lagoke *et al* 1982, Akinyemiju 1987). However in this study, *E. heterophylla, S. anthelmia, A. spinosus* were present at very low densities indicating a good level of control, while *M. alternifolius* was relatively less controlled by alachlor (Table 5).

Moolani (1978) observed that the most serious problem weed in irrigation schemes in Nigeria are sedges. Result of the present study support this observation, however, the seriousness of sedges as problem weeds is reduced on this site probably because irrigation of the site is not continuous but alternated with rainfed crop production. Alternating irrigation with rainfed crop production may be a management strategy that can lead to the reduction in the seriousness of sedges as problem weeds in irrigation schemes in Nigeria.

TABLE 4: WEED SPECIES[1] OF THE EXPERIMENTAL FIELD AT IFE, NIGERIA.

Weed Family	Weed Species	Life Cycle
Amaranthaceae	*Amaranthus hydridus* L.	A
	Amaranthus spinosus L.	A
Asteraceae	*Aspillia africana* (Pers.) C.D. Adams	A or P
	Ageratum conyzoides L.	A
	Chromolaena odorata (L.) R.M. King & Robinson	P
	Synedrella nodiflora (L.) Gaertns.	A
Caparidaceae	*Cleome ciliata* Schum. & Thonn	A
Commelinaceae	*Aneilema beniniense* (P. Beauv.) Kunth	P
	Commelina erecta L.	A
Cyperaceae	*Mariscus alternio flius* Vahi	P
Euphorbieaceae	*Euphorbia heterophylla* L.	A
	Euphorbia hirta L.	A
Loganiaceae	*Spigelia anthelmia* L.	A
Malvaceae	*Sida acuta* Burm. F.	P
Nyctaginaceae	*Boerhavia diffusa* L.	P
Poaceae	*Brachiaria deflexa* Robyns	A
	Cynodon dactylon (L.) Pers	P
	Echinochloa colona (L.) Link	A
	Eleusine indica Gaerth.	A or P
	Eragrostis tenella Roem & Schult.	A
	Imperate cylindrica (L.) Beauv.	P
Portulacaceae	*Talinum Triangulare* (Jacq.) Wild.	P
Solanaceae	*Physalis angulata* L.	A
	Solanum torvum Sw.	A or P

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A = Annual, P = Perennial.

O'Makinwa, R.O. (1987). Germination of *Euphorbia heterphylla* L. and its control in cowpea *(Vigna unguiculata* (L.) Walp.). *M. Sc. thesis, University of Ife, Ile-Ife, Nigeria.* 64pp.

Steel, R.G.D. and Torrie, J.H. (1980). *Principles and Procedures of Statistics 2nd Ed. McGraw-Hill Book Co., N.Y. 481pp.*