VARIETAL RESPONSE OF COWPEA AND WEEDING REGIME ON THE GROWTH AND YIELD PARAMETERS OF COWPEA AT UMUDIKE SOUTHEASTERN NIGERIA.

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ABSTRACT
The field experiment was conducted at the Eastern Research Farm of Michael Okpara University of Agriculture Umudike to investigate the suitable weeding regime to enhance yield of 4 varieties of vegetable cowpea (*Vignaunguiculata (L). Walp*). The experiment was set up as a split-plot in randomized complete Block Design (RCBD) with the vegetable cowpea varieties (ITO3K-324-9, IT98K-692, 1T99K-377-1 and IT04K-399-1)occupying the main plot and the weeding regime (weed X1, weed X2, weed free and NO weeding) occupying the subplot. Data collected from the field were subjected to analysis of variance (ANOVA) for a split-plot in randomized complete block design (RCBD) using GenStat Statistical Package. Significant treatment means were separated using least significant difference at 5% probability level. ($LSD_{0.05}$). Variety 1T04K-339-1 significantly improved plant height, number of branches, number of leaves and leaf area of vegetable cowpea at 4 WAP, while at 8 WAP, variety 1T99K-377-1 proved superior over other varieties in plant height, leaf area and number of seeds/pod. Yield parameters were maximized when variety 1T03K-324-9 was grown, despite its poor growth characteristics. The study identifies single weeding at 4 WAP as being most conducive for optimum yield of vegetable cowpea varieties under Umudike conditions.

Keywords: Growth parameters, vegetable cowpea, weeding regime, yield parameters

INTRODUCTION
Cowpea (*Vignaunguiculata (L). Walp*) is an annual legume with lots of common names, such as Crowder pea, black-eyed pea and southern pea, lubia, niebe, coupe or frijoles (Adediran*et al.*, 2005). The largest production of cowpea is in Africa, with Nigeria and Niger predominating, but Brazil, India, Australian and U.S. all have significant production. There are two types of cowpea, the seed type and vegetable type (for leafy greens, green pods fresh shelled green peas and shelled dried peas) (Adediran *et al.*, 2005; Ekeleme and Nwofia, 2005; Umaharam *et al.*, 1997) in the humid forest fringes,. The most widely grown varieties are the vegetable types whose immature succulent pods are eaten by humans. (Ekeleme and Nwofia, 2005). It is usually grown as companion crop in yam, cassava and their mixtures.

Weed infestation is a major constraint to crop production. Cowpea is generally susceptible to weed infestation at all periods of growth; the most damaging effects occurring during the early stage after planting (Onochie, 1975). Its competition with weeds depends, to some extent, on how long after planting the crop stays weed-free before the canopy covers the ground. Weeds are removed by hand pulling and traditional hoe. This method is labor intensive and often not appropriate during flowering stage (Ekeleme *et al.*, 2003).An experiment was carried out to determine the growth, yield and yield components of four vegetable cowpea cultivars when subject to different weeding regimes in Umudike, Southeastern Nigeria.

MATERIALS AND METHOD
The experiment was conducted at the Eastern farm of Michael Okpara University of Agriculture Umudike (MOUAU).The location falls within latitude 05°2° N and longitude 07°32° E, with a nearly level to gently undulating topography and slope percent ranging from 1 to 3%.Four varieties of vegetable cowpea (IT98K-692, IT03K-324-9, IT99K-1 and IT04K-339-1) obtained from the International Institute of Tropical Agriculture (IITA) Ibadan were used in the study. The experiment was laid out as a split plot in a Randomized Complete Block Design (RCBD) with the main plots being the vegetable cowpea varieties, while four weeding regimes (no weeding (NW), weed free (WF), weeding once (WXI) and weeding twice (WX2)) occupied the sub-plots. The experiment was replicated three times. Each sub-plot measured 2 m× 3.5m with 1m alley between sub-plots and replicates. Two seeds were sown per hole on the flat at a spacing of 25cm × 50cm. Insect pest was controlled with *Cypermetherin* (EC) at 150ml in 20-liters of water from bud initiation stage. Pre-cropping soil samples were randomly collected from four locations at 0 – 30 cm soil depth, and bulked together as composite soil sample. The soil sample was air dried in a room temperature for 48 hours, and subsequently sieved with a 2mm sieve before laboratory analysis.Particle size distribution was measured by the hydrometer method (Day, 1965).Soil pH (H_2O) was measured (soil / water ratio of 1:.2.5) with a digital pH Meter (McLean, 1982). Available phosphorus was determined using Bray II method (Bray and Kurtz 1945). Percent organic carbon (%O.C.) was determined by the dichromate oxidation method of Walkley and Black (Nelson and Sommers, 1982). Organic matter (O.M) was determined by multiplying %O.C with the conventional Van Bernmeller factor of 1.724. Total nitrogen was determined by Micro-Kjeldahl method (Bremmer and Mulvaney, 1982). Growth data (plant height, numbers of leaves, number of branches, leaf area) were obtained at 4 and 8 weeks after planting (WAP). Number of fresh pods per plot was obtained

by counting the number of pods from each plot at every harvest made twice a week from a 1m quadrant. Fresh pod yield/m^2 was obtained by harvesting the pods from 1 m quadrants at every harvest twice a week. Fresh and dry pod weights were obtained by weighing fresh/dry pods harvested per $\mathbf{m^2}$with electric sensitive measuring scale. The average length of the pod was obtained by collecting 10 pods from each plot and determining their average length using a meter rule in centimeter. The numbers of seeds/pod extracted from dry pods collected from each plot was used for the calculation of 100 seed weight (g).

Data Analysis

All data measured were subjected to statistical analysis for a split-plot design as outlined by Steel and Torrie (1980). Mean separation for significant ($P < 0.05$) effects were carried out using Fishers' Least Significant Difference (F-LSD) as described by Obi (1986).

RESULT AND DISCUSSION

Initial soil test results

Results of the initial physico-chemical properties of the study soil are as shown in Table 1. The study soil had a sandy clay loam texture, and a slightly acidic soil reaction. Percentage total nitrogen was low (0.063%) with a moderate value of available phosphorus (19.35 mg/kg). Percentage soil organic matter was medium (1.272%).

Growth indices

Average plant height

Results on plant height showed that plant height was very significantly ($P < 0.01$) influenced by variety at 4 and 8 WAP. Weeding regime and variety x weeding regime interaction did not significantly ($P > 0.05$) affect plant height at both 4 and 8 WAP (Table 2). Planting of IT04K-339-1 produced tallest plants (12.53 cm) which did not differ significantly with plant height (12.37 cm) of IT03K-324-9 at 4 WAP. However, at 8 WAP, variety IT99K-377-1 which recorded the lowest plant height (9.84 cm) at 4 WAP, returned the tallest plant (73.03 cm) that differed significantly only with plant height (52.58 cm) obtained from IT03K-324-9 variety (Table 2).

Table 1. Physico-chemical properties of the study soil at 0 – 30 cm depth

Soil property	Value
Sand (g kg^{-1})	691.0
Silt (g kg^{-1})	56.0
Clay(g kg^{-1})	253.0
Texture	Sandy clay loam
pH	5.0
Available P (mg/kg)	19.35
Total N (g kg^{-1})	0.63
Organic carbon (g kg^{-1})	7.38
Organic matter (%)	12.72

Table 2. Effect of variety, weeding regime and variety x weeding regime interaction of growth parameters of cowpea.

	Plant height (cm)		Number of branches		Leaf number		Leaf area (cm^2)	
Treatment	**4 WAP**	**8 WAP**	**4 WAP**	**8 WAP**	**4 WAP**	**8 WAP**	**4 WAP**	**8 WAP**
Variety								
IT03K-324-9	12.37	52.58	3.97	3.00	9.91	21.14	280.1	1058.9
IT98K-692	10.18	61.13	3.28	2.61	9.63	20.48	403.6	1331.5
IT99K-377-1	9.84	73.03	1.95	2.83	6.51	17.36	326.8	2271.3
IT04K-339-1	12.53	71.09	3.48	4.05	11.94	24.83	514.1	1846.6
$LSD_{(0.05)}$	1.32**	18.45**	0.66**	0.76**	1.29**	5.09**	62.8**	394.7**
Weeding regime								
Weed X1	10.96	62.40	2.85	3.03	8.94	19.81	359.5	1469.3
Weed X2	12.15	67.97	3.58	3.44	10.51	22.74	406.3	1663.0
Weed free	10.98	64.03	3.03	2.99	9.36	21.25	384.9	1609.4
No weeding	11.31	63.43	3.03	3.03	9.18	20.00	373.9	1766.7
$LSD_{(0.05)}$	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Variety x Weeding regime interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

**** = Significant at 1% probability level; NS = Not significant at 5% probability level; WAP = Weeks after planting.**

Average number of branches

Number of branches of vegetable cowpea was significantly ($P < 0.01$) affected by cowpea variety. Varieties ITO3K-324-9 and IT04K-339-1 recorded significantly highest number of branches (3.97 and 3.48, respectively), which did not differ significantly from each other. Lowest number of cowpea branches (1.95) was recorded by IT99K-377-1 variety at 4 WAP (Table 2). At 8 WAP, IT04K-339-1 maintained the highest number of branches (4.05), significantly over other varieties. Two varieties, ITO3K-324-9 and IT98K-692 suffered reductions in average number of branches at 8 WAP compared with number of branches recorded by the varieties at 4 WAP.

Average number of leaves

In terms of number of leaves, variety IT04K-339-1 recorded significantly ($P < 0.01$) highest number of leaves both at 4 WAP (11.94) and at 8 WAP (24.83) over all other varieties at 4 WAP and over IT99K-377-1 at 8 WAP. Variety IT99K-377-1 maintained lowest number of leaves at both 4 and 8 WAP.

Average leaf area

Average leaf area of vegetable cowpea was significantly ($P < 0.01$) influenced by variety at 4 and 8 WAP. Variety IT04K-339-1 recorded the highest leaf area (514.1 cm2) at 4 WAP, while IT99K-377-1 variety, which recorded the lowest leaf area (326.8 cm2) at 4 WAP, surpassed other varieties at 8 WAP by recording significantly highest leaf area (2271.3 cm2) (Table 2).

Weeding regime and variety x weeding regime interaction did not significantly ($P > 0.05$) influence any of the growth parameters measured.

Yield and yield parameters

Fresh pod weight (t/ha) and pod length (cm)

The effects of variety, weeding regime and variety x weeding regime interaction on fresh pod weight (t/ha) of vegetable cowpea are as shown in Table 3. Variety and variety x weeding regime interaction did not significantly ($P > 0.05$) influence fresh pod weight. However, weeding regime very significantly ($P < 0.01$) influenced fresh pod weight of vegetable cowpea. All weeding regimes (weeding X1, weeding X2 and weed free) significantly yielded higher fresh pod weight than when vegetable cowpea was not weeded (No weeding (5.04 t/ha)). Optimum fresh pod yield (6.30 t/ha) was obtained from when weeding was carried out once (Weeding X1).

Similarly, weeding once (Weeding X1) produced pods with longest length (16.73 cm) which differed significantly ($P < 0.01$) with pod lengths from weeding twice (16.41 cm), weed free (16.49 cm) and no weeding (16.43 cm) (Table 4). Variety and variety x weeding regime interaction did not show any significant ($P > 0.05$) influence on pod length of vegetable cowpea (Table 4).

Number of seeds/pod and number of pods/m^2

Analysis of variance conducted showed that number of seeds/pod and number of pod/m^2 were highly significant ($P<0.01$) among the varieties, while weeding regime did not show any significance ($P>0.05$)for number of seeds/pod, but significantly ($P<0.05$) influenced number of pods/m^2. Variety x weeding regime interaction did not significantly influence both parameters (Table 5).The results showed that variety IT99K-377-1 had the highest number of seeds (14.69/pod) while variety IT04K-339-1 had the least number of seeds (11.83/pod). Varieties IT98K-692 and IT03K-324-9 had the highest number of pods (158.75 and 138.42 pods/m^2, respectively) while variety IT99K-377-1 recorded the least number of pods (61.08 pods/m^2).The result also showed that optimum number of pods (107.50 pods/m^2) was obtained from plots that were weeded once, which did not differ significantly with values obtained from plots that were weeded twice (127.75 pods/m^2) and plots that were maintained

Table 3. Effect of variety and weeding regime on fresh pod weight (t/ha) of vegetable cowpea at harvest.

Variety	Weed X1	Weed X2	Weed Free	No Weeding	Variety mean
IT03K-324-9	8.32	8.83	8.45	7.17	8.19
IT98K-692	7.45	5.82	8.57	5.67	7.55
IT99K-377-1	3.82	4.19	3.25	3.63	3.72
IT04K-339-1	5.60	4.48	5.37	3.69	4.78
Weeding regime mean	6.30	6.50	6.41	5.04	
$LSD_{(0.05)}$ Variety = ns					
$LSD_{(0.05)}$ Weeding regime = 1.44**					
$LSD_{(0.05)}$ Variety x weeding regime interaction = ns					

***** = Significant at 0.1% probability level; NS = Not significant at 5% probability level.**

Table 4.Fresh pod length (cm) of vegetable cowpea as influenced by variety and weeding regime.

Variety	Weed X1	Weed X2	Weed Free	No Weeding	Variety mean
IT03K-324-9	19.23	18.63	18.50	18.83	18.80
IT98K-692	15.13	15.27	15.07	14.67	15.03
IT99K-377-1	17.70	17.17	18.23	16.87	17.49
IT04K-339-1	14.83	14.57	14.17	15.33	14.73
Weeding regime mean	16.73	16.41	16.49	16.43	
$LSD_{(0.05)}$ Variety = ns					
$LSD_{(0.05)}$ Weeding regime = 0.095**					
$LSD_{(0.05)}$ Variety x weeding regime interaction = ns					

***** = Significant at 0.1% probability level; NS = Not significant at 5% probability level.**

Table 5. Number of seeds/pod and number of pods/m^2 of vegetable cowpea as influence by variety, weeding regime and variety x weeding regime interaction.

	Weeding regime									
	Weed X1	Weed X2	Weed Free	No Weeding	Variety mean	Weed X1	Weed X2	Weed Free	No Weeding	Variety mean
Variety	Number of seeds/pod					Number of pod/m^2				
IT03K-324-9	13.00	12.43	12.10	12.90	12.61	135.67	148.00	142.35	127.67	138.42
IT98K-692	12.83	13.30	12.83	12.73	12.93	125.33	196.00	179.33	134.33	158.75
IT99K-377-1	14.13	14.83	15.13	14.67	14.69	65.67	69.67	58.67	50.33	61.08
IT04K-339-1	11.30	11.47	11.47	11.83	11.61	103.33	97.33	117.00	85.33	100.75
Weeding regime mean	12.82	13.10	12.88	13.03		107.50	127.75	124.33	99.42	
$LSD_{(0.05)}$ Variety = 0.32**						$LSD_{(0.05)}$ Variety = 21.0**				
$LSD_{(0.05)}$ Weeding regime = ns						$LSD_{(0.05)}$ Weeding regime = 21.0*				
$LSD_{(0.05)}$ Variety x weeding regime interaction =ns						$LSD_{(0.05)}$Interaction =ns				

***, ** = Significant at 5 and 1% probability levels, respectively; NS = Not significant at 5% probability level.**

weed free (124.33 pods/m^2).

The 100 seed weight (g) and pod weight (g) of vegetable cowpea

Results shown in Table 6 showed that 100 seed weight(g) and pod weight (g) among the vegetable cowpea varieties were highly significant ($P< 0.01$),while weeding regime and variety x weeding regime interaction did not significantly ($P>0.05$) affect 100 seed weight and pod weight. Variety IT03K-324-9 had the biggest 100 seeds weight (18.24 g) among the vegetable cowpea varieties while variety IT98K-692 had the smallest 100 seeds weight (12.93 g). Highest pod weights of 6.83 and 6.38 g were obtained from varieties IT03K-324-9 and 1T99K-377-1, respectively which differed significantly ($P < 0.01$) with lower pod weightsobtained from IT98K-692 (5.27 g) and IT04-339-1 (4.73 g).

DISCUSSION

The result obtained in this study consistently showed that cowpea varieties, significantly influenced average plant height, average number of branches, average number of leaves, leaf area at 4 and 8 WAP, average number of seed/pod, number of pod/m^2, 100 seed weight (g) and average pod weight. In terms of growth parameters, there were differences in varietal performance at different periods of observation. Variety 1T04K-339-1 showed consistency in improving plant height, number of branches, number of leaves and leaf area at 4 WAP. However, at 8 WAP, variety 1T99K-377-1 produced tallest plants with highest leaf area. It appeared like the improvements in growth parameters at 4 WAP by 1T04K-339-1 did not translate into improvement in yield parameters; instead variety 1T99K-377-1 which improved growth parameters at 8 WAP produced highest number of seeds/pod. Variety 1T03K-324-9, though it performed poorly in growth parameters, recorded the highest number of pod/m^2, highest 100 seeds weight and highest pod weight. The study demonstrated that weeding is a critical farm operation that improved fresh pod yield (t/ha), while no weeding suppressed fresh pod yield (t/ha). Optimum number of pod/m^2 and pod length were obtained when

Table 6. The simple effects of variety and weeding regime and interaction effect of variety x weeding regime on the 100 Seed Weight (g) and Pod Weight (g) of vegetable cowpea in Umudike, Southeast Nigeria

	Weeding regime									
	Weed X1	Weed X2	Weed Free	No Weeding	Variety mean	Weed X1	Weed X2	Weed Free	No Weeding	Variety mean
Variety	100 Seed Weight (g)					Pod Weight (g)				
IT03K-324-9	18.70	19.17	16.93	18.17	18.24	6.93	6.65	6.76	6.97	6.83
IT98K-692	12.77	13.27	12.97	12.70	12.93	5.54	5.07	5.52	4.96	5.27
IT99K-377-1	16.00	15.87	16.07	14.87	15.70	6.42	6.40	6.80	5.89	6.38
IT04K-339-1	14.73	14.33	14.43	14.10	14.40	4.70	4.90	4.39	4.92	4.73
Weeding regime mean	15.55	15.66	15.10	14.96		5.90	5.76	5.87	5.69	
$LSD_{(0.05)}$ Variety = 1.06**						$LSD_{(0.05)}$ Variety = 0.55**				
$LSD_{(0.05)}$ Weeding regime = ns						$LSD_{(0.05)}$ Weeding regime = ns				
$LSD_{(0.05)}$ Variety x weeding regime interaction =ns						$LSD_{(0.05)}$Interaction =ns				

**** = Significant at 1% probability level; NS = Not significant at 5% probability level.**

weeding was done once at 4 WAP (Weeding X1). It identifies single weeding at 4 WAP as being most conducive for optimum yield of vegetable cowpea varieties at Umudike. Reduction in number of pods/m^2caused by increased length of weed interference period (No weeding) was accompanied by simultaneous reduction in fresh pod yield (t/ha). A similar result was reported by Al-Thaihabi *et al* (1994) in chickpea, where weed interference also caused reduction in number of pods and branches per plant and reduced seed size. The significant reductionin yield parameters obtained in weed free and weeding X2 regimes over the weeding X1 regime reflect the reduced effect of weed competition in weeded plots (Akobundu, 1978).

CONCLUSION AND RECOMMENDATION

Based on the results of this study, yield is maximized when weeding X1 regime is maintained throughout the life cycle of vegetable cowpea (*Vigna unguiculata L. walp*). Yield is also maximized under Umudike condition when variety 1T03K-324-9 is grown, despite its poor growth characteristics.

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