

Response of Vegetable Cowpea (*Vigna unguiculata*) to Intra-Row Spacing and Defoliation at Garkawa

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Abstract: A field experiment aimed at investigating the response of vegetable cowpea to intra-row spacing and defoliation at 4, 6 and 8 Weeks after Sowing (WAS) was conducted in 2009 at the Plateau State College of Agriculture, Garkawa, Nigeria (Southern guinea Savannah). Treatments consisted of four intra-row spacing (20, 30, 40, 50 cm, respectively) and four defoliation levels (0, 25, 50 and 75%, respectively). These were factorially combined and laid out in a Randomized Complete Block Design with three replications. Vegetable Cowpea growth related characters (plant height, shoot fresh weight) per plant increased significantly with decreasing levels of intra-row spacing. The intra-row spacing of 20 cm yielded 5.7 g edible leaf yields per plot. Defoliation level at 25% gave 6.8 edible leaf yields. The interaction between intra-row spacing at 20 cm and defoliation level at 25% produced the highest green pod yield of 404.7 kg/ha. Based on these findings, it would be suggested that harvesting 25% leaves of vegetable cowpea at a spacing of 20 cm at 4 and 6 WAS be practiced for optimum leaf and seed production.

Key words: Cowpea, defoliation, intra-row, spacing, vegetable, yields

INTRODUCTION

In spite of the high production of cowpea in Nigeria (about 1.289 metric tonnes annually) Most researches have focused on cowpea for seed production only, only few studies have been made on varieties that are primary grown for their tender leaves (Schippers, 2000; Badi and Magaji, 2005). Varieties that are prostrate with long vines are utilized most importantly for their leaves and young green pods.

The production of Vegetable Cowpea has been hampered by the use of either high or low population. Most farmers are not consistent in the use of intra row spacing, probably because of lack of knowledge of the botany of the crop (erect or prostrate). Furthermore, there is insufficient, knowledge on the number of leaves to be harvested at a time and at what interval should it be harvested without affecting the pod/seed yield. Major constraint facing farmers wishing to grow indigenous vegetables is lack of scientific information on its agronomy. When the leaves of vegetable cowpea are defoliated, what is the effect on pod/seed performance of the crop? How many leaves should be harvested at a time and at what spacing should the crop be planted without affecting the yields at a specific environment; it would be necessary to make such recommendations based on information derived from trials conducted in such areas.

In view of the above, the present study was undertaken with the following objectives:

- To investigate the response of leaf and pod yields of vegetable cowpea to intra row spacing
- To investigate the quantity of leaves to be picked during the period of growth without affecting the yields
- To study the interactions between leaf defoliation and intra-row spacing on the growth and yields of Vegetable Cowpea.

METHODOLOGY

The experiment was conducted at the Plateau State College of Agriculture Garkawa, Nigeria (Southern guinea Savannah) Teaching and Research farm during the 2009 wet season. Garkawa is located at latitude 10°11' and longitude 8°21' E with maximum mean temperature of 28°C and minimum temperature of 11°C.

The treatments consisted of two factors: Intra-row spacing (20, 30, 40 and 50 cm,) and defoliation (0, 25, 50 and 75%, respectively) each, using a local variety of vegetable cowpea 'yaro da kokari' sourced from the National Seed Council. There were sixteen treatment combinations, each of the treatment was assigned to a plot using picking from a hat without replacement and

Table 1: Properties of the soil of the experimental site at 0-15 cm soil depth in 2009

Soil property	
Mechanical analysis (%)	
Sand	75.90
Silt	10.03
Clay	14.07
Textural class: Sandy loam	
Chemical composition	
P (1:1H ₂ O)	6.09
% Organic carbon g/kg	5.89
% Total Ng/kg	1.07
C/N ratio	6.78
Available P (mg/kg)	6.88
Exchangeable cations (Cmol/kg)	5.02
Exchangeable bases (Cmol/kg)	2.68
Calcium	0.87
Magnesium	0.56
Potassium	0.15
Sodium	4.70
Cation exchange capacity (Cmol/kg)	75.60

replicated three times. These were arranged in a Randomized Complete Block Design. The land was ploughed to a fine tilth, it was then marked out into 48 plots of 15 m² (3*5 m) each with 1.5 m spacing between blocks and 1.0 m spacing between plots.

Data on rainfall, temperature, relative humidity during the experimental period were recorded and presented in Table 1. Using a tabular auger, soil samples were taken at 0-15 cm depth, samples were analyzed in the soil and plant laboratory of the Abubakar Tafawa Balewa University, Bauchi, Nigeria for their physico-chemical properties using standard procedures as described by Black (1965). The crude percent protein of dry leaves per 100 g dried edible portion was determined as described by AOAC (1980).

Vegetable characters as well as developmental characters were taken at 4, 6, and 8 WAS. Five plants were randomly selected in the inner rows; their leaves were harvested at 0, 25, 50 and 75%, respectively. Data collected were subjected to 'Fisher's test as described by Snedecor and Cochran (1967). The response to intra-row spacing, defoliation rate and their interactions in all characters measured were considered. Means that were significantly different were separated using Duncan Multiple Range Test (DMRT) (Duncan, 1955). The Standard Error (SE) of means that were not significantly different were computed separately.

RESULTS AND DISCUSSION

The significant effect of plant height (Table 2) and of the interaction between intra-row spacing and defoliation rate on plant height (Table 3) was because intra-row spacing and plant leaves are two contributing factors to the plant density in a plot, which made competition for

Table 2: Effects of intra-row spacing and defoliation on plant height (cm) or vegetable cowpea

Treatment	Weeks After Sowing (WAS)		
	4	6	8
20	23.3 ^a	26.3 ^a	27.4
30	20.3 ^b	21.2 ^b	21.3
40	19.2 ^b	20.1 ^b	21.3
50	18.2 ^b	19.1 ^b	20.1
SE	0.86	1.58	1.92
Defoliation (%)			
0	23.4 ^a	26.3 ^a	22.3
25	20.4 ^b	21.3 ^b	22.3
50	19.2 ^b	21.2 ^b	22.2
75	19.1 ^b	21.1 ^b	22.2
SE	0.86	1.58	1.92
SXD	NS	NS	NS

Means within a column of treatment followed by unlike letter (s) are significantly different at 5% level of significance (DMRT)

Table 3: Interaction between intra-row spacing (cm) and defoliation (%) on the plant height (cm) of vegetable cowpea

Treatment spacing (cm)	Defoliation rate (%)			
	0	25	50	75
20	21.4 ^a	22.4 ^a	18.1 ^b	17.9 ^b
30	19.3 ^b	18.3 ^b	17.2 ^b	17.7 ^b
40	18.4 ^b	17.6 ^b	16.7 ^c	16.5 ^c
50	17.6 ^b	16.3 ^b	16.2 ^c	16.4 ^c
SE±1.47				

Means within a column of treatment followed by unlike letter (s) are significantly different at 5 % level significance (DMRT)

Table 4: Interaction between intra-row spacing (cm) and defoliation (%) on shoot fresh weight (g) per plot of vegetable cowpea

Treatment spacing (cm)	Defoliation rate (%)			
	0	25	50	75
20	16.0 ^c	18.4 ^a	15.1 ^{bc}	09.4 ^d
30	16.2 ^c	17.3 ^b	15.2 ^{bc}	08.4 ^e
40	17.3 ^b	16.3 ^c	15.2 ^{bc}	08.2 ^e
50	17.4 ^b	15.0 ^{bc}	16.5 ^c	07.3 ^f
SE± (p<0.05)				

Means within a column of treatment followed by unlike letters are significantly different at 5% level of significance (DMRT)

space, nutrients, light and moisture possible. This is similar to the findings of Itai and Birnbaum (1991) who reported that increase in height of herbaceous annual vegetable crops is characterized by the leaves at the apex of the middle of leaf lamina. This finding is contrary to the work of Dunshik (2005) who reported a non-significant difference in plant height of vegetable cowpea when cowpea leaves were harvested at 8 WAS.

The significant interaction between intra-row spacing and defoliation on shoot fresh (Table 4) weight as well as green pod yield (kg^h⁻¹) of vegetable cowpea (Table 5) was because leaves of plants are important organs in the manufacture of its food and plays a vital role in the growth and development of the crop. The best combination was obtained at 2 m intra-row spacing and 25% defoliation rate. This shows that minimal leaf harvest was a positive practice.

Table 5: Interaction between intra-row spacing (cm) and defoliation rate (%) on the green pod yield (kg/ha) of vegetable cowpea

Treatment spacing (cm)	Defoliation (%)			
	0	25	50	75
20	3858.1 ^d	4047.5 ^a	3903.1 ^c	3968.1 ^b
30	3896.2 ^c	3979.4 ^b	3977.2 ^b	3956.0 ^b
40	3968.4 ^b	3974.3 ^b	3873.2 ^c	3884.1 ^c
50	3970.3 ^b	3971.2 ^b	3884.3 ^c	3875.3 ^c
SE± (p≤0.05)				22.3

Means within a column of treatment followed by unlike letter (s) are significantly different at 5% level of significance (DMRT)

Table 6: Effect of intra-row spacing and defoliation on the edible leaf yield (g) per plant of vegetable cowpea

Treatment	4	6	8
Spacing (cm)			
20	4.1	4.2	4.0
30	4.3	4.4	4.0
40	5.6	5.8	5.0
50	4.1	5.9	5.6
SE±	0.70	0.72	0.72
Defoliation rate (%)			
0	6.9	7.2	7.2
25	5.9	6.9	6.6
50	5.7	6.9	6.9
75	4.6	5.8	5.6
SE±	0.70	0.70	0.72
SXD	NS	NS	NS

The leaf edible yield of vegetable cowpea (Table 6) was significantly influenced by intra-row spacing ($p \leq 0.05$). Increasing intra-row spacing resulted in significant increase in plant height. This could be because decrease in plant population because of increase in intra-row spacing exacts a positive effect on the development of buds from which leaf developed because of low competition for light, nutrients and other favourable factors of growth. Bailey (1992) also reported that the growths of leaves of herbaceous annual vegetables are characterized by the increase in spacing.

SUMMARY AND CONCLUSION

A field experiment was conducted at the Plateau State College of Agriculture, Garkawa. The aim was to investigate the response of vegetable cowpea to intra-row spacing and defoliation. Treatment consisted of four intra-row spacing (20, 30, 40, 50 cm, respectively) and four defoliation levels (0, 25, 50 and 75%, respectively).

These were factorial combined and laid out in a randomized complete block design with three replications. Vegetable cowpea growth related characters (plant height, Shoot fresh weight per plant increased significantly with decreasing levels of intra-row spacing. Similarly, green pod yield per unit land area increased. The interaction between intra-row spacing at 20 cm and defoliation of vegetable cowpea at 25% at 4 and 6 WAS showed a positive response. It is therefore, concluded that among the intra-row spacing tried, 20 cm intra-row spacing was most appropriate, while defoliation at 25% at 4 and 6 WAS, was most appropriate.

REFERENCES

- AOAC, 1980. Official Methods of Analysis. Association of official Analytical Chemists. 13th Edn., Washington D.C.
- Badi, S.H. and H.K. Magaji, 2005. Effect of some plant products in the control of cowpea bruchids (*Calosobruchus maculatus*). J. Env. Sci., 9(1): 40-43.
- Black, C.A., 1965. Methods of Soil Analysis 11. Chemical and Microbiological Properties. American Society of Agronomy, Madison Wisconsin, pp: 1572.
- Bailey, J.M., 1992. The Leaves we Eat. Southern Pacific Commission Noumea, New Caledonia, pp: 60.
- Duncan, D.B., 1955. Multiple range and multiple F test. Biometrics, 11: 1-42.
- Dunshik, D., 2005. Effect of Leaf Harvest on the Growth, yield of vegetable cowpea. Unpublished National Diploma Project, College of Agriculture, Garkawa, Jos. pp: 23.
- Itai, C. and H. Birnbaum, 1991. Synthesis of Plant Growth Regulators by Roots. Marcel Dekker, New York, pp: 63-178.
- Schippers, R.R., 2000. African Indigenous Vegetables. An overview of the cultivated species. Chatham, UK, Natural Resources Institute /ACP-EU Technical centre for Agricultural and Rural Co-operation, pp: 101-104.
- Snedecor, G.W. and W.G. Cochran, 1967. Statistical Method. 6th Edn., IOWA State University Press, IOWA, USA, pp: 458.