

The effect of Decumbence, Climbing, and Bushy Traits on Yield and Yield Components of Cowpea (*Vigna unguiculata* (L.) Walp.)

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To compare their performance in yield and yield components, cowpea lines with varying growth habits, namely decumbent, climbing, and bushy were grown in 1989 and 1990. The growth habits were observed to have significantly affected the grain yield and its components. The determinate, bushy grain cowpea produced peduncles per plant comparable to the other growth forms but showed a remarkable decline in yield and yield components. Both the climbing and decumbent habits had a significantly higher percentage pod set than the bushy type. The climbing and decumbent growth forms did not differ in grain yield; significant differences between them were recorded only in the number of seeds per pod and 100-seed weight. The nature of the limiting effects of plant growth habits on grain yield is discussed.

1 Introduction

3 growth habits, decumbent, climbing and bushy, have been reported (EBONG 1970, UGURU and UZO 1991) among cowpea varieties in Nigeria. The climbing and decumbent cowpea types were relatively more vegetative and better adapted to the region south of 10° N latitude than the bushy grain cowpea. The pod development in the latter is essentially vestigial; of the 6 flowers subtended by a peduncle (OJEHOMON 1969) only one or two (sometimes none) actually achieve physiological development.

Many factors of plant growth and development have been reported to the grain yield in cowpea influence (EZEDINMA 1965, 1967; STEWARD 1969; ENYI 1972),

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but no attempt has been made to investigate the effect of plant habits on the yield of the crop. This forms the basis of this study.

2 Material and methods

Two vegetable cowpea accessions, a decumbent AN-14-D and a climbing AE-16-Sc, and one grain cowpea accession, the bushy AD-36-W (Vita 7), were selected for this study. These were grown from March to June in 1989 and 1990 at the Faculty of Agriculture farm, University of Nigeria, Nsukka. The experimental design was a randomized complete block design (RCBD) with 4 replications. Entries were grown in 4-row plots 9.0m long with spacing between and within rows of 90 x 30cm, respectively (ENYI 1972). Staking was done 3 weeks after planting for the climbing accession. Data on peduncles per plant, flowers per peduncle, pods per peduncle, seeds per pod, 100-seed weight (g), and grain yield (t/ha) were collected from the 52 plants in the 2 middle rows. The 100-seed weight was obtained by weighing 100-seeds randomly picked from each accession. The grain yield was calculated as the product of the shelling fraction and pod weight expressed in t/ha. The percentage pod set was calculated as the ratio of the mean number of pods set on a peduncle to the mean number of open flowers produced per peduncle expressed in per cent.

3 Results and Discussion

The mean number of leaves produced by cowpea types in 1989 and 1990 is shown in Table 1.

Tab. 1: Mean number of leaves/plant at 3,6,9 and 12 weeks after planting (WAP) in 1989 and 1990

Variety/growth habit	1989				1999			
	3WAP	6WAP	9WAP	12WAP	3WAP	6WAP	9WAP	12WA
PAD-36-W (Bushy)	14.0	75.0	185.0	193.0	16.0	97.0	262.0	258.0
AE-16-Sc (Climbing)	5.0	55.0	190.0	225.0	5.0	108.0	301.0	386.0
AN-14-D (Decumbent)	9.0	68.0	172.0	227.0	8.0	82.0	222.0	253.0
F-LSD 0.05	1.88	5.94	42.88	43.98	2.45	8.85	ns	11.21
ns=non-significant								

The analysis of variance of the randomized complete block design (Table 2) showed significant differences among the growth forms in the mean number of leaves per plant. This indicates that a significant variation exists among the cowpea genotypes. The bushy habit produced leaves more profusely at the early (3WAP) and mid-vegetative (6WAP) growth stages (table 1). With the onset of the reproductive phase, the rate of leaf production dropped particularly in the determinate bushy cowpea. This is in contrast to the climbing and decumbent types that continued to add more leaves after the onset of the reproductive development. The number of peduncles per plant showed that the different cowpea lines had similar potentials in the production of reproductive nodes. The climbing and decumbent growth forms had relatively wider internodes as suggested by the smaller number of leaves at 3 and 9 weeks after planting (WAP). This may have accounted for the smaller number of peduncles per plant produced by both habits. The bushy grain cowpea produced and sustained less flowers per peduncle, a possible consequence of the high incidence of premature flower abortion. A mean percentage pod set of 41% was obtained for the bushy habit; 73% for the climbing habit and 71% for the decumbent habit. (Tab. 3 and 4)

Tab. 2: Analysis of variance for the number of leaves showing only the degrees of freedom and mean square values for 1989 and 1990

Source of variation	Degrees of freedom	1989				1990			
		3WAP	6WAP	9WAP	12WAP	3WAP	6WAP	9WAP	12WAP
Block	3	1	935.6	663.8	0.33	0.23	228.0*	1839.0	1276.9*
Variety/ growth habit	2	90.37**	658.5**	337.8	2424.5	124.5	681.5**	0.51	2273.2**
Error	6	1.87	18.72	974.2	1024.7	32	41.5	2645.0	341.55
Total	11								

* = significant at 5% probability level
 ** = significant at 1% probability level

The percentage pod set and seeds per pod appear to have a decisive effect on the yield of cowpea, hence the higher grain yield in both the climbing and decumbent habits. It appears that both cowpea types had a larger number of leaves exposed to the photosynthetically active radiation (PAR), which contributed to a greater production of photosynthates for the sustenance of flowers and pods and a greater seed-filling rate. The younger leaves associated with the indeterminate growth habit (GREEN et al. 1977) are photosynthetically more active and may, therefore, have contributed to the better seed-filling rate and enabled the climbing and decumbent types to sustain more flowers and pods.

Tab. 3: Mean values of yield components in 1989 and 1990

Variety/growth habit	1989							1990						
	Pedun- cles/ plant	flo- wers/ pedun- cle	Pods/ pedun- cle	%Pod set	Seeds/pod d	100- seed weight (g)	Grain yield (t/ha)	Pedun- cles/ plant	Flo- wers pedun- cle	Pods/ pedun- cle	%Pod set	Seed s/pod d	100- seed weight (g)	Grain- yield (t/ha)
AD-36_W (Bushy)	54.0	2.3	1.2	52.0	10.0	12.3	0.66	49.0	2.4	1.4	30	10.0	12.4	0.25
AE-16-Sc (Climbing)	49.0	3.8	2.7	68.0	17.0	10.1	1.06	40.0	4.0	3.1	78	16.0	10.7	1.28
AN-14-D (Decumbent)	53.0	4.4	3.2	73.0	12.0	11.5	1.14	48.0	4.1	2.8	68	12.0	10.8	1.06
F_LSD 0.05	ns	1.15	0.60	7.20	1.10	0.43	0.19	ns	0.40	0.34	11.8 5	2.56	0.19	0.23
ns = non significant														

Tab. 4: Analysis of variance for the yield and yield components showing only the degrees of freedom and mean square values for 1989 and 1990

Sources of variation	Degrees of freedom	1989							1990						
		Pedun- cles/ plant	Flower /pedun- cle	Pods/ pedun- cle	%Pod set	Seeds/ pot	100- seed weight	Grain yield	Pedun- cles/ plant	Flowers /pedun- cle	Pods/ pedun- cle	Pod set	Seeds/ pod	100- seed weight	Grain yield
Block	3	77	0.11	0.45	14.6	0.53	0.07	0.002	39.79	13.10	0.20	13.10	0.25	0.08	0.04
Variety/ growth habit	2	38	5.25**	4.23**	481.5**	44.33**	4.95**	0.27**	97.35**	3.64**	0.84**	2416.0**	39.75**	3.63**	0.64**
Error	6	28	0.695	0.19	27.10	0.61	0.09	0.02	22.40	0.083	0.06	74.45	3.46	0.02	0.03
Total	11														
** : significant at 1 % probability level															

Perhaps the non-significant differential response between the climbing and decumbent habits in flowers per peduncle, pods per peduncle, percentage of pod set and grain yield is a possible indication that their canopies do not differ greatly in light utilization during the reproductive phase. The differences in their seed-filling rates and seed sizes could be adduced more to inherent genetics than to environmental factors.

**UGURU, M.I. Einflüsse der kriechenden, rankenden oder buschigen Wuchsformen auf Ertrag und Ertragskomponenten von Cowpea (*Vigna unguiculata*(L.) Walp.)
Zusammenfassung**

Zum Vergleich von Ertragsleistung und Ertragskomponenten wurden 1989 und 1990 Linien von Cowpea mit unterschiedlichem Habitus (kriechend, rankend, buschig) angebaut. Es konnten signifikante Einflüsse auf den Kornertrag und seine Komponenten festgestellt werden. Der buschige Körnertyp mit determinantem Wuchs bildete zwar weitgehend mit den anderen Wuchsformen übereinstimmend Infloreszenzstiele, war aber deutlich negativer im Ertrag und den Ertragskomponenten. Der kletternde und der kriechende Typ hatten einen signifikant höheren Hülsenansatz als der Buschtyp und auch den gleichen Ertrag. Signifikante Unterschiede gab es zwischen beiden nur in der Anzahl der Samen pro Hülse und der 100 Kornmasse. Diskutiert werden die begrenzenden Einflüsse der Wuchsform auf den Ertrag.

M.I. UGURU: L'influence de formes de croissance grimpantes, vrillées ou touffues sur le rendement et les composantes de rendement de Cowpea (*Vigna unguiculata* (L.) Walp.)

Pour comparer le rendement et les composantes de rendement, on a cultivé en 1989 et en 1990 des lignes de Cowpea avec un habitus différent (grim pant, vrillé, touffu). ont été constatées des influences significatives sur le rendement de graines et ses composantes. Le type de graines touffues avec croissance déterminante a formé, il est vrai, des tiges d'inflorescence largement conformes aux autres formes de croissance, mais il était nettement plus négatif quant au rendement et aux composantes de rendement. Le type grim pant et celui vrillé était caractérisé par une inflorescence de cosses remarquablement plus haute que le type touffu et par, en même temps, un rendement identique. Des différences significatives entre les deux n'ont existé que pour ce qui concerne le nombre de graines par cosse et la masse de 100 graines. Sont discutées les influences limitatives de la forme de croissance sur le rendement.

M.I. UGURU: Influencias de las variedades rastreras, trepadoras o tupidas sobre el dendimiento y los componentes de rendimiento de Cowpea (*Vigna unguiculata* (L.) Walp.)

Para compara el rendimiento y los componentes de rendimiento se cultivaron en los años 1989 y 1990 líneas de Cowpea con diferentes hábitos (rastreras, trepadoras, tupidas). Se pudieron determinar influencias significantes en cuanto al rendimiento de granos y a sus componentes. El tipo de grano tupido con un crecimiento determinante, formó en forma considerable y al igual que las otras variedades, tallos de inflorescencia, pero flué a la vez, claramente negativo en el rendimiento y en los componentes de rendimiento. Los tipos rastrero y trepador presentaron una formación de vainas significativamente mayor que el tipo tupido y también el mismo rendimiento. Diferencias significantes hubo solo en cuanto a la cantidad de granos por vaina y en cuanto a la massa de 1000 granos. Se discute la influencia limitante de la forma de crecimiento sobre el rendimiento.

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