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Studies on the vegetative traits of two selected F_3 cowpea lines in kanannado x wild

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Abstract
Data on vegetative or growth traits of cowpea plants, especially, on plant height, number of leaves and number of branches per plant are essential for progress on improvement of vegetative and grain yields by breeders and agronomists. An experiment was carried out in the wet season of 2022 on a field in Bar-Arewa, Bogoro Local Government Area of Bauchi State, Nigeria. Two cowpea F_3 lines 1 and 2, tagged as Enje 001 and Enje 002, were selected from F_2 plots of Kanannado x Wild (*var. pubescens*) on the bases of some genetic and agronomic attributes. These were laid in a complete randomised design with three replications. Gene segregation and recombination resulting to uncovering of recessive alleles accounted for the novel growth habit observed in this cross. Line affected plant height, number of leaves and number of branches in both weeks of sampling (4 and 8) ($p = 0.05$), except for number of branches at 4 weeks after sowing. Line 2 outperformed Line 1 in all the vegetative traits studied. Therefore, it can be selected and stabilised for vegetative yield in cowpea.

Keywords: Kanannado x wild, cowpea plants, *var. pubescens*

Introduction

The importance of cowpea to life in the tropics cannot be over-emphasised. It is a multifunctional crop, because all parts of the plant are nutritious, providing protein, carbohydrates, vitamins and mineral salts. Cowpea grains and leaves are rich sources of high-quality protein; 20-25% protein and 50-67% starch. This provides an excellent supplement to the lower quality cereal or root and tuber proteins consumed in much of this region (Kitch, *et. al*., 1998) [7].

It serves as a cover crop while growing, thereby protecting the soil from erosion. *In situ* decay of root residues and tips of the crop increases the soil nutrient status. Also, the above-ground parts of the plant could be harvested and stored as fodder for subsequent sale at the peak of the dry season, yielding as much as 25% of the annual income of farmers involved in this practice (Duke, 1990) [3].The cowpea plant fixes atmospheric nitrogen through symbiosis with nodule bacteria *(bradirhizobium)*. Hence, it is a key component in crop rotation schemes (Sanginga *et al*., 2003) [9].

Utilisation of the cowpea vegetative parts has been explored to an extent on a world scale. For instance, vegetable type of cowpeas are very popular in China, Korea, Indonesia, Philippines and Thailand, where they are grown as a pure crop in wide rows with trellis support. The bush- type vegetable cowpea is relatively early- maturing, and it has a semi- erect plant type with long peduncles and 25-30 cm long pods. The pods are thick, fresh and succulent. These are grown as a pure crop without any trellis support. Fodder-type cowpeas are grown pure or in intercrop with maize and sorghum at high densities, and harvested along with the cereals at the time of flowering for green fodder (Amable and Rugambisa, 1992) [2].

Cowpea is consumed in Tanzania, Kenya, Uganda, Rwanda and Burundi, both as grain and as a vegetable, but unlike in Asia where green pods are eaten, in East and southern Africa the tender leaves are regularly picked and eaten as spinach. Cowpea leaves are a more important source of food than cowpea grain in this region. Almost every household has a few rows of late-maturing, drought-tolerant spreading type cowpea (Amable and Rugambisa, 1992) [2].

In the savannah areas, for example, northern part of Nigeria and Niger republic, cowpea fodder is important because of the large number of cattle and the long dry season when there is no much grass to graze upon. In these areas, the farmers grow two types of varieties in the same field: the grain-type which matures earlier and the fodder-type which matures late and is normally harvested at the end of the rainy season, just before permanent wilting sets in (Mortimore, 1989) [8].

Ample opportunities for further improvement of cowpea through the exploitation of the available germplasm and their potentials can be increased through further research in plant physiology to identify more efficient genotypes and plant architecture. The characterisation of height per plant, leaves per plant, branches per plant and pods per plant, has been carried out on landrace cowpeas and the wild species *V. unguiculata* Subsp. Dekindtiana (Joshua and Namo, 2019) [6]. It was also reported in this study that height per plant, number of leaves per plant and number of branches per plant were influenced genotypically. This explained that cowpea genotype accounted for the differences observed in these traits.

Hence, there is the need to characterise and study the performance of some of the cowpea vegetative traits in Kanannado x Wild F_3 lines for varietal development.

Materials and methods

The study was conducted on a field in Bar Arewa village which is situated seven kilometres south of Tafawa Balewa town and five kilometres north of Bogoro town in Bauchi State during the wet season of 2022. Bauchi is located at 10^0 22N and 9^0 46"E and at 609 metres above sea level. Bauchi lies in the Northern Guinea Savannah zone of Nigeria. Soil samples were collected from three different parts along the length of the experimental field at the depth of 0 – 30 cm. The physicochemical properties of the soil were analysed at the Agricultural Services, Training and Marketing Centre, in Mangu, Plateau State, Nigeria. The results revealed a sandy-loamy soil with P^H of 6.280, Ca (ppm) of 540.000, Mg (ppm) of 102.000 and O.M (ppm) of 0.520.

Materials used in this study consisted of two F_3 cowpea lines advanced from Kanannado x Wild (*var. pubescens*), tagged as ENJE 001 and ENJE 002 respectively for identification and description purposes only. These were selected and picked from the Kanannado x Wild (*var. pubescens*) F_2 stands on the bases of plant morphology, seed characteristics and yield.

The land used for the field evaluation was planted with corn the previous year. The vegetation in the field was burned using a chemical herbicide with active ingredients: Paraq (1–dimenthyl bipyridylum dichloride…24% ww paraquat dichloride (with emetic, dye and stench). The shrubs were cleared using cutlass and the left-over grasses and trashes were removed from the experimental field using rake. Thereafter, the land was ploughed using cattle-drawn ridger. The entire experimental field measured 22.0 m x 20.0 m which was then marked out using a measuring tape into three replications of 4.5 m x 22.0 m each. The replications were then divided into two plots each measuring 2.0 m x 22.0 m. Relays between adjacent replications measuring 1.5 m and 0.5 m served as discards between adjacent plots. These were clearly separated using pegs. The two cowpea lines were laid out in a randomised complete design with three replications.

Sowing of the seeds was done on July 29, 2022, following a heavy rainfall the previous day. Seeds free of any physical defect were used. Inter-and intra-row spacing was 0.5 m and 1.0 m, respectively. Two seeds were sown about 2.0 cm depth per hole for both the two lines. The seedlings were later thinned to one plant per stand two weeks after emergence.

Hand-weeding was employed using small hoe at four weeks after sowing. This was repeated at eight weeks after sowing. Anthills were controlled using Permethrin 0.60% (dust) at the rate of 25 g per anthill by dusting. This was done before sowing to avoid damage to young seedlings. Pre-and post-flowering insecticides were sprayed to control and manage damage by insect pests on leaves, flowers and pods. The broad-spectrum insecticide called Sharp shooter (Profenofos 40%+ Cypermethrin 4%) at the rate of 1 litre: 120 litres of water was used.

Data collection and analysis

The parameters that were observed and data collected include plant height, leaf number and number of branches.

Plant height: This was measured using a long wooden metre-rule from the base of the plant to the apical bud of the central branch four and eight weeks after sowing.

Number of leaves per plant: Leaf number per plant was determined by counting four and eight weeks after sowing.

Number of branches per plant: This was done by counting the number of branches on each of the plants four and eight weeks after sowing.

Data collected during this study were subjected to an analytical tool available in System Analytical Statistics (SAS) Software: Analysis of Variance (ANOVA) was computed using the Statistical Analysis for Agricultural Research (STAR) (2014). Where significant differences occurred among treatment means, Least Significant Difference (LSD) was used to separate the treatment means.

Results and discussions

Table 1: Growth Characteristics of the Parents and F_3 Lines

Character		Genotype		
	Kanannado	**Enje 001**	**Enje 002**	***Var. pubescens* (Wild)**
Growth Habit	Spreading	Semi-Erect	Spreading	Spreading

Plate 1: Morphological Appearance of Line 1 (Enje 001).

Plate 2: Morphological Appearance of Line 2 (Enje 002)

Table 2: Mean Height (cm) per Plant in Kanannado X Wild F_3 Lines

Line	4 WAS	8 WAS
1	29.27	34.63
2	64.83	78.41
LSD	12.08	7.17

Note: WAS= Weeks after Sowing
LSD= Least Significant Difference

Table 3: Mean Number of Leaves per Plant in Kanannado X Wild F_3 Lines

Line	4 WAS	8 WAS
1	16.63	23.91
2	34.70	56.27
LSD	5.42	11.95

Note: WAS= Weeks after Sowing
LSD= Least Significant Difference

Table 4: Mean Number of Branches per Plant in Kanannado X Wild F_3 Lines

Line	4 WAS	8 WAS
1	2.23	2.28
2	3.07	3.39
LSD	NS	0.41

Note: WAS= Weeks after Sowing
LSD= Least Significant Difference
NS = Not Significant

The growth attributes of the parents and the two F_3 lines are presented in table 1. The two parents had spreading growth habit alongside line 2 (Plate 2), while line 1 had semi-erect growth habit. The semi-erect growth habit observed in line 1(Plate 1) was not seen on both parents. This could be due gene segregation and recombination at this generation of cross, resulting to the uncovering of the recessive alleles under the influence of the dominant alleles controlling cowpea plant growth habit. This is required, because a new plant form is available for selection (Joshua, 2022) [4]
The results for plant height are presented in Table 2. Statistical difference (P=0.05) was observed in both weeks of sampling. Line 2 had taller plants as compared with line 1. Table 3 presents the results for number of leaves per plant. Statistical difference was also observed in both weeks of sampling. Line 2 had higher number of leaves per plants as compared with line 1. Similarly, the results for number of branches per plant are presented in Table 4. Statistical difference was observed in weeks eight of sampling, while no statistical differences (P=0.05) was observed in week four, the non significant difference observed at this week for the trait may be due to the time of sampling. Line 2 had higher number of branches per plants in week eight when compared with line 1. The difference reported on these traits, namely plant height, number of leaves and number of branches per plant could be due to the genotypic differences of the lines (Joshua and Namo, 2019) [6]. This also goes to say that the difference may not only observed on the vegetative yield, but also on the grain yield, since both growth and grain yield components in cowpea are determined by these traits.

Conclusions
The results obtained in this study, showed that gene segregation and recombination at this generation of cross, resulted to the uncovering of the recessive alleles under the influence of the dominant alleles controlling cowpea plant growth habit cowpea. Line influenced statistically the three vegetative traits studied namely; height per plant, number of leaves per and number of branches. Line 2 (Enje 002) when stabilised, holds hope for both vegetative and grain yields in cowpea.

Conflict of Interests
The authors have not declared any conflict of interests

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