

EFFECTS OF SPACING ON THE GROWTH AND YIELD OF *MUCUNA FLAGELLIPES* (VOGEL EX HOOK)

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Abstract

The effects of spacing on the growth and yield of *Mucuna flagellipes* (Vogel ex Hook) was investigated in two cropping seasons (2010 and 2011) in the Teaching and Research Farm, Department of Agronomy, Cross River University of Technology, Obubra, Cross River State. The experimental design was a randomized complete block design (RCBD). Treatments were five spacings: 20 x 1.0m, 40 x 1.0, 60x1.0, 80 x 1.0 and 1.0 x 1.0m laid out in a randomized complete block design (RCBD) with three replications. Data collected on number of leaves, branches, nodules per plant, dry matter of plant fractions and yield parameters were statistically analyzed using Analysis of Variance (ANOVA) procedure. Close spacing of 20 x 1.0m with highest plant population significantly ($p < 0.05$) reduced number of leaf blades, branches, and dry matter of plant fractions per plant. It also produced plants with longer vine length than the other spacings. Dry matter yield per plant, Pod and seed yield per plant were higher in plots with wider spacing of 1.0 x 1.0m in 2010 and 2011 cropping seasons. The highest *Mucuna flagellipes* seed yield of 3.23 and 3.42 tons/ha were produced from plots with plant spacing of 20 x 1.0m in 2010 and 2011 cropping seasons. The wider spacing of 1.0 x 1.0m gave the lowest seed yield of 1.45 and 1.56 ton/ha during the two seasons. Farmers can cultivate *Mucuna flagellipes* at a spacing of 20 x 100 or 40 x 100cm for optimum growth and seed yield under Obubra condition.

Introduction

Mucuna flagellipes is of *Fabaceae* family, sub family *Papilionioideae* (Polhill and Raven, 1981). It is one of the neglected legumes of Nigeria (Anonymous, 1979). *Mucuna flagellipes* is variously called 'Ukpo' in Igbo, 'Karangiwa' in Hausa, 'agbarin' in Yoruba and 'Ibaba' in Efik (Oyenuga, 1986). The seed and leaf of *Mucuna flagellipes* have high economic importance in pharmaceutical industry and other domestic uses. The seed has high content of protein, oils and minerals (Odedele, 1983). It is use in soup preparation among the Igbos (Oyenuga, 1986; Okigbo, 1980). The gum produced from the seed could be used as a binder in the formulation of ephedrine hydrochloric tablet (Chukwu, 1986; Eyiuche, 1988). The leaves are used to formulate local hair dye (Okoro, 1989).

In spite of economic importance of *Mucuna flagellipes*, it is one of the neglected known legumes grown at sub-subsistence level. There is paucity of literature on the cultivation, growth and yield of *Mucuna flagellipes* in regular farms in Nigeria. It was considered necessary to introduce *Mucuna flagellipes* into a regular farming system. Earlier researchers; Muoneke and Asiegbu (1997), Nwofia and Ekeleme (2005) reported the use of adequate plant population increase total crop yield per unit area of land. There is no literature on the effects of spacing on the growth and yield of *Mucuna flagellipes*. This study aimed to determine the effects of various plant populations on the growth and yield of *Mucuna flagellipes* to provide literature to aid in commercial cultivation of the crop.

Materials and Methods

Field experiments were carried out in the Cross River University of Technology, Department of Agronomy, Obubra, Teaching, and Research Farm in 2010 and 2011 cropping seasons. Obubra is located on latitude 05° 59'N and longitude 08° 15' E (Cross River Agricultural Development Project, 1992). The experimental site was cleared and the land ploughed in April, 2010 and 2011. The experimental design was a randomized complete block design (RCBD). Treatments were five spacings: 20 x 100cm = 50,000, 40 x 100cm = 25,000, 60 x 100cm = 16,666, 80 x 100cm = 12,500, 100 x 100cm = 10,000 *Mucuna flagellipes* plants/ha laid out in a randomized complete block design with four replications. There were 16 plots and each plot measured 4 x 6m with area of 24 m².

The seeds of *Mucuna flagellipes* from Obubra market, Cross River were soaked in water at room temperature for 24 hours before planting at the rate of two seeds per hole according to schedule spacings (treatments) for both 2010 and 2011 cropping seasons. Data were collected on number of leaves, branches and nodules per plant, leaf area and leaf area index (LAI) at 10weeks after planting (WAP), 15WAP, 20WAP, 25WAP. Dry matter of plant fractions were collected by destructive sampling of one plant per plot. The destructive sampled plants were separated into leaves, vine and roots nodules. They were oven-dried and weighed.

Statistical Analysis

Data collected were analyzed using analysis of variance (ANOVA) procedure for randomized complete block design experiments as described by Gomez and Gomez (1984). Fisher's Least Significant Difference (F-LSD) at 5 % probability level was used to separate treatments means for statistical significant difference as described by Obi (2002).

Results and Discussion

At various periods of measurements either at 10 weeks after planting (WAP), 15, 20 or 25WAP, the number of *Mucuna flagellipes* leaves per plant significantly decreased with increasing spacing (plant population) in 2010 and 2011 cropping seasons (Table 1). The number of leaves per plant was significantly higher in the wider spacings of 80 x 1.0m and 1.0 x 1.0m as compared with the other close spacing especially at 20 to 25 WAP. The highest number of leaves per plant was obtained in plots with the spacing of 1.0 x 1.0m in the two seasons. The closer the plant spacing, the lower the leaf area per plant. *Mucuna flagellipes* leaf area per plant was significantly higher in lower plant population plots than in higher population plots with closer spacing. Throughout the periods of measurements: that is at 10WAP, 15WAP or 25WAP in both 2010 and 2011 the widest plant spacing of 1.0 x 1.0m produced plants that significantly had the highest leaf area per plant. Leaf area index increased significantly with decreases in plant spacing (Table 1). Plots with closer spacing of 20 x 1.0m and 40 x 1.0m produced higher values of leaf area index than those with wider spacing at 10, 15, or 25 weeks after planting. The plant spacing of 20 x 1.0m with 50,000 plants /ha produced significantly the highest leaf area index values of 6.216 and 6.314 at 25 weeks after planting in 2010 and 2011 cropping seasons, respectively. Whereas leaf area per plant decreased as plant spacing increased, leaf area index increased with increasing row spacing.

This increase in leaf area index as plant spacing increases agrees with the findings by Agbo *et al.*, (2008); and Muoneke and Asiegbo, (1997). Close spacing significantly reduced branching in *Mucuna flagellipes*. At all periods of measurements, plots with wider spacing produced higher number of branches per plant as compared with closer spacing in the two seasons. The fewer branches, number of leaves and leaf area per plant recorded in plots with closer spacing in this study agrees with the result obtained by Nwofia *et al.* (2005). They also observed less number of leaves and branches per plant in close spacing plots of cowpea. Leaf dry matter production per plant decreased significantly with increases in plant spacing (Table 3). At 25 weeks after planting, leaf dry weight per plant almost doubled in plots with wider spacing of 80 x 100cm and 100 x 100cm.

Throughout the periods of measurements, either at 10WAP, 15WAP or 25WAP leaf and vine dry weight per plant was higher in wider row spacing than in closer row spacing. The widest spacing of 100 x 100cm produced the highest leaf dry weight per plant of 63.1g and 60.59g in 2010 and 2011, respectively. Dry matter weight reduction in plant parts associated with higher plant population densities have been reported by other workers (Okpara, 2000; Muoneke and Asiegbo, 2005).

Mucuna flagellipes pod and seed yields per hectare increased significantly with increasing plant spacing (Table 3). On per plant basis, the number of pods per plant, seed weight per plant decreased with increased in plant spacing. Plots with wider row plant spacing gave higher number of pods and seed per plant than plots with closer row spacing in both 2010 and 2011 cropping seasons. The highest seed yield of 2.59 and 2.67 t/ha per hectare was obtained in plots with wide spacing of 20 x 100cm in 2010 and 2011, respectively. The decrease in yield and yield components (pod and seed weight per plant) obtained in this study could be due to intra-specific competition in the closer row spacing. Earlier researchers in plant spacing (Muoneke *et al.*, 1997; Oseni, T. O. and Fawusi, M. O. A. (1987), Muoneke and Asiegbo, 1997 and Okpara, 2000) reported significant decreased in pod and seed yield per plant as a result of intra-specific competition for nutrient, sun light, water, air and even space.

Conclusion

Based on the result of this study, farmers should cultivate *Mucuna flagellipes* at a spacing of 40 x 100cm or 60 x 100cm for optimum growth and seed yield under Obubra condition.

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Table 1: Effects of spacing on the number of leaves, branches per plant, leaf area index and vine length at 10, 15, and 25 weeks after planting on *Mucuna flagellipes* in 2010 and 2011 cropping seasons

Plant Spacing (cm)	Number of leaves per plant			Leaf Area (cm ²) per plant			Leaf Area Index (LAI)			Number of branches per plant			Plant height (cm) Vine length		
	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP
2010 cropping season															
20 X 100cm	12.1	18.6	32.1	41.3	59.3	91.6	0.101	1.513	6.216	2.1	3.2	5.1	209.2	371.6	611.3
40 X 100cm	16.3	21.4	39.5	53.4	68.5	131.3	0.091	1.332	5.314	2.1	4.0	8.3	193.1	302.4	574.1
60 X 100cm	19.1	25.3	46.2	68.1	80.4	143.1	0.074	1.279	4.018	3.0	4.5	11.1	185.2	281.5	551.4
80 X 100cm	23.4	28.1	51.3	69.8	93.2	151.9	0.065	1.188	3.784	3.5	5.1	13.1	161.7	262.8	433.1
100 X 100cm	24.1	31.3	63.1	74.3	113.3	173.5	0.054	0.968	3.013	3.6	5.3	15.4	153.8	235.7	418.4
LSD(0.05)	1.2	1.6	3.2	1.4	4.5	3.6	0.011	0.011	0.02	0.01	0.3	1.2	4.1	5.3	7.1
2011 cropping season															
20 X 100cm	11.5	19.1	31.5	42.1	61.2	87.7	0.111	1.531	6.314	2.2	3.2	6.1	207.1	383.5	623.1
40 X 100cm	16.2	22.3	38.1	52.3	67.4	132.1	0.089	1.343	5.451	2.4	4.1	8.5	195.3	301.9	578.9
60 X 100cm	18.3	24.5	46.5	65.4	81.3	144.2	0.075	1.281	4.021	3.1	4.6	12.1	187.5	287.4	557.4
80 X 100cm	21.2	29.3	52.1	70.1	92.1	150.3	0.057	1.193	3.795	3.4	5.2	13.4	170.1	265.1	439.2
100 X 100 cm	23.5	32.4	62.5	73.9	111.9	162.1	0.053	0.945	3.022	3.7	5.4	15.6	155.3	241.1	419.5
LSD(0.05)	1.1	1.4	3.2	1.3	4.3	3.4	0.01	0.01	0.02	0.01	0.3	1.1	4.2	5.4	7.3

Table 2: Effects of spacing on the number of leaves, branches per plant, leaf area index and vine length at 10, 15, and 25 weeks after planting on *Mucuna flagellipes* in 2010 and 2011 cropping seasons

Plant Spacing (cm)	Number of leaves per plant			Leaf Area (cm ²) per plant			Leaf Area Index (LAI)			Number of branches per plant			Plant height (cm) Vine length		
	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP	10 WAP	15 WAP	25 WAP
2010 cropping season															
20 X 100cm	12.1	18.6	32.1	41.3	59.3	91.6	0.101	1.513	6.216	2.1	3.2	5.1	209.2	371.6	611.3
40 X 100cm	16.3	21.4	39.5	53.4	68.5	131.3	0.091	1.332	5.314	2.1	4.0	8.3	193.1	302.4	574.1
60 X 100cm	19.1	25.3	46.2	68.1	80.4	143.1	0.074	1.279	4.018	3.0	4.5	11.1	185.2	281.5	551.4
80 X 100cm	23.4	28.1	51.3	69.8	93.2	151.9	0.065	1.188	3.784	3.5	5.1	13.1	161.7	262.8	433.1
100 X 100cm	24.1	31.3	63.1	74.3	113.3	173.5	0.054	0.968	3.013	3.6	5.3	15.4	153.8	235.7	418.4
LSD(0.05)	1.2	1.6	3.2	1.4	4.5	3.6	0.011	0.011	0.02	0.01	0.3	1.2	4.1	5.3	7.1
2011 cropping season															
20 X 100cm	11.5	19.1	31.5	42.1	61.2	87.7	0.111	1.531	6.314	2.2	3.2	6.1	207.1	383.5	623.1
40 X 100cm	16.2	22.3	38.1	52.3	67.4	132.1	0.089	1.343	5.451	2.4	4.1	8.5	195.3	301.9	578.9
60 X 100cm	18.3	24.5	46.5	65.4	81.3	144.2	0.075	1.281	4.021	3.1	4.6	12.1	187.5	287.4	557.4
80 X 100cm	21.2	29.3	52.1	70.1	92.1	150.3	0.057	1.193	3.795	3.4	5.2	13.4	170.1	265.1	439.2
100 X 100cm	23.5	32.4	62.5	73.9	111.9	162.1	0.053	0.945	3.022	3.7	5.4	15.6	155.3	241.1	419.5
LSD(0.05)	1.1	1.4	3.2	1.3	4.3	3.4	0.01	0.01	0.02	0.01	0.3	1.1	4.2	5.4	7.3

Table 3: Effects of spacing on the yield and yield component of *Mucuna flagellipes* in 2010 and 2011 cropping seasons

Plant spacing (cm)	No of pods per plant	No of seeds per pod	Average No of seeds per plant	Pod yield per plant (g)	Seed yield per plant (g)	Seed yield per hectare (t/ha)
2010 Cropping Season						
20 x 100cm	11.01	1.4	23.2	101.7	98.3	2.59
40 x 100cm	15.8	2.1	33.4	198.2	126.7	2.23
60 x 100cm	19.0	2.9	41.3	212.6	253.5	2.01
80 x 100cm	21.3	3.2	46.2	247.5	332.8	1.82
100 x 100cm	23.4	3.3	49.2	256.7	411.5	1.58
LSD (0.05)	1.0	0.1	3.4	13.1	7.5	0.01
2011 Cropping Season						
20 x 100cm	11.6	1.4	25.3	104.4	97.9	2.67
40 x 100cm	16.0	2.3	37.1	195.3	128.4	2.26
60 x 100cm	19.4	3.0	43.4	219.6	261.7	2.03
80 x 100cm	20.8	3.1	48.2	251.5	340.4	1.91
100 x 100cm	24.1	3.2	50.11	263.3	426.2	1.61
LSD (0.05)	1.0	0.1	3.2	13.5	7.4	0.01