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RESIDUAL EFFECT OF MUCUNA ON THE GROWTH OF SESAME (*SESAMUM RADIATUM* SCHUM) AT DIFFERENT PLANT SPACING

REZIDUALNO DJELOVANJE MUCUNE NA RAST SEZAMA (*SESAMUM RADIATUM*) U RAZLIČITIM RAZMACIMA BILJKE

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ABSTRACT

A field experiment was conducted at the National Horticultural Research Institute (NIHORT) Ibadan. The experiment was aimed at determining the growth and development of sesame grown at different spacing in a land previously cultivated with and without mucuna. It was a split plot experiment arranged in a randomized complete block design and was replicated three times. The main plot treatment was the residual effect of mucuna at two levels and the sub-plot treatment was spacing at three levels (50 × 30 cm, 50 × 40 cm and 50 × 50 cm). The result showed that sesame planted on mucuna fallowed land at wider spacing between plants significantly enhanced the growth of sesame. All the growth parameters examined had over 10 % increase with the leaf length and breadth having the highest value of 17.91 and 17.65 % respectively under the mucuna fallowed land compared with the non fallowed land. Increasing the spacing between sesame plants and consequently decreasing the plant population will be beneficial if the plant is grown for its vegetative part.

Key words**:** growth, mucuna, sesame, spacing

SAŽETAK

Obavljen je terenski pokus pri Nacionalnom institutu za poljoprivredna istraživanja u Ibadanu. Cilj je pokusa bio odrediti rast i razvoj sezama uzgajanog u različitim razmacima na zemlji koja je ranije obrađivana sa i bez mucune. Bio je to pokus metodom podijeljenih parcela (split plot) u slučajnom potpunom bloku s tri ponavljanja. Tretman glavne parcele bilo je rezidualno djelovanje mucune na dvije razine, a tretman podparcele bio je razmak na tri razine (50 x 30 cm, 50 x 40 cm i 50 x 50 cm). Rezultat je pokazao da je sezam zasijan na ugaru s mucunom uz veći razmak između biljaka značajno povećao rast. Svi ispitani parametri imali su porast iznad 10% s duljinom i širinom lista najveće vrijednosti od 17,91 odnosno 17,65% na zemlji tretiranoj mucunom u usporedbi s netretiranom zemljom. Povećanje razmaka između biljaka sezama i prema tome smanjenje populacije biljaka bit će korisno ako se biljka uzgaja radi vegetativnog dijela.

Ključne riječi: rast, mucuna, sezam, razmak

INTRODUCTION

Sesame (*Sesamum radiatum* Schum) is a member of the family *Pedaliaceae* and it is an important vegetable consumed in some parts of Nigeria and many other parts of the tropics. It is an annual herb that grows up to about 120 cm in height. The first leaves can be harvested 8–10 weeks after sowing while harvesting for seed is after about 4 months after sowing. The plant occurs throughout the tropical Africa mainly as weed (Hutchinson and Dalziel, 1963). It is one of the many neglected and underutilized leafy vegetables despite its numerous nutritional benefits. *Sesamum radiatum* adds to the protein, vitamin and mineral contents of the predominantly starchy diets of the people of tropical Africa (Oyenuga and Fetuga, 1975; Omidiji, 1978). It also has several medicinal and cosmetic uses.

Sesame is usually propagated by seeds, it can be drilled on the field or broadcast on a well-prepared seed bed, 1000 seeds of the plant weigh an average of about 2.5 g. It could also be raised in the nursery and the seedlings transplanted to a well prepared seed beds (Auwalu, 1995). *Sesamum radiatum* could be classified as a leafy vegetable. The young shoots are timely cut for use in soup and the cooked leaves have slimy texture. It is sometimes grown for its seeds, which are consumed whole, toasted or after grinding as paste. Edible oil can also be extracted from the seed. The seed contains about 32.3% of oil which is similar in composition to *sesamum indicum*.

Mucuna is a leguminious cover crop and an efficient, low-cost source of nitrogen with considerable potential to improve soil fertility in intensified cropping systems (Buckles *et al*., 1998; Carsky *et al*., 1998; Anonymous, 1998). Two different management systems are usually used for the integration of *Mucuna* into cropping systems. One is a sole cover crop fallow for severely degraded fields while the other is a relay cropping of mucuna with cereal crops for fields requiring less rehabilitation. Carsky *et al*., (2001) noted that the most common benefit of Mucuna fallow is related to the improved N nutrition of a subsequent cereal crop, which is mostly related to the biomass and N content of the Mucuna fallow *Mucuna*'s ability to restore soil fertility is important in enhancing the growth and yields of crops on a continuously cropped fields.

Despite the numerous potential of *sesamum radiatum*, there is paucity of information and researches on its nutrition and response to plant population and soil fertility in the tropics. It therefore becomes imperative to establish the response of *sesamum radiatum* to spacing and an enriched soil. Hence, this study was initiated with the objectives of determining the residual effect of mucuna and spacing on the growth of sesamum radiatum.

MATERIALS AND METHODS

The experiment was conducted at the experimental field of the National Horticultural Research Institute (NIHORT) in 2010. The experimental design was a randomized complete block design in split plot arrangement replicated three times. The main plot treatment was the residual effect of mucuna (with (M+) and without (M-)) and the sub-plot treatment was spacing at three levels (50 × 30 cm, 50 × 40 cm and 50 × 50 cm). Mucuna seeds were planted on part of the field in the preceding season and the plant was ploughed into the soil at maturity so that its residual effect could be observed on the *Sesamum radiatum*. The sesame seeds were drilled on the field using a plot size of 2m x 2m and were later thinned three weeks after germination. Weeding was done as and when due. Data were collected on the stem diameter, plant height, number of branches, leaf length, leaf breadth and the seed yield per plant. The matured pods of each plant were harvested separately, the seeds were then carefully removed and weighed to get the seed weight per plant. All data were then subjected to analysis of variance using SAS PROC. GLM and the significant means were separated using LSD at 5% probability level.

RESULTS

The result of the soil analysis of the experimental field before the cropping of mucuna used for fallow indicated that the soil was depleted in the macro element and thereby needed to be left for fallow in order to rejuvenate the soil (Table 1).

Table 1: Characteristics of the soil before the introduction of mucuna for fallow

Tablica 1 Karakteristike tla prije unošenja mucune u ugar

Soil properties	Value
pH (H_2O)	5.55
Ca (cmol/kg)	2.04
Mg (cmol/kg)	0.41
Na (cmol/kg)	0.07
K (cmol/kg)	0.11
ECEC (cmol/kg)	2.73
% base sat.	96.17
% C	0.8
N g/kg	0.08
Av. P (mg/kg)	10.1
Cu (mg/kg)	1.65
Zn (mg/kg)	3.35
Fe (mg/kg)	6.6
Mn (mg/kg)	11.16
Sand (g/kg)	855
Silt (g/kg)	100
Clay (g/kg)	45

The residual effect of mucuna and spacing significantly enhanced the diameter of the stem and plant height but there was no interaction between the two (Table 2). Plants sown at the spacing of 50 cm × 50 cm had a higher stem diameter compared with the spacing of 50 × 30 cm. Mucuna fallowed land significantly increased the plant height (116.07 cm) compared with the field where there was no mucuna (104.83 cm). Spacing of 50 × 50 cm significantly increased the plant height compared with the spacing of 50 × 30 cm but it was not significantly different from the spacing of 50 × 40 cm (Table 2).

Table 2: Effect of mucuna and spacing on the stem diameter of sesame and plant height

Tablica 2 Djelovanje mucune i razmaka na promjer stabljike sezama i visinu biljke

Spacing (cm)	Stem diameter (cm)			Plant Height (cm)		
	M+	M-	Mean	M+	M-	Mean
50 × 30	1.15	1.00	1.08	112.00	97.00	104.50
50 × 40	1.22	1.07	1.15	116.22	107.72	111.97
50 × 50	1.35	1.09	1.22	120.00	109.83	114.92
Mean	1.24	1.05		116.07	104.85	
$LSD_{0.05}$						
MUCUNA		0.031			6.552	
SPACING		0.066			4.761	
M × S		0.077			6.346	
ANOVA						
MUCUNA		***			***	
SPACING		**			**	
M × S		ns			ns	

ns- not significant ** - significant at ($p < 0.01$) *** - significant at ($p < 0.001$)

The numbers of branches of the sesame plant were significantly ($p < 0.001$) increased by the mucuna fallow and the increased spacing of the plant (Table 3). The mucuna fallowed land significantly enhanced the number of branches compared with the non fallow land. The spacing of 50 cm × 50 cm was significantly better than other spacings in terms of the number of branches.

The mucuna fallowed land significantly enhanced the length of the leaf when compared with the un-fallowed land. As the spacing of the plant increase and the plant population decreased the length of the leaf were significantly ($p < 0.001$) enhanced (Table 4). The mucuna fallowed land and the increase in the plant spacing significantly increased the breadth of the leaves (Table 4).

Table 3: Effect of mucuna and spacing on the number of branches of sesame

Tablica 3 Djelovanje mucune i razmaka na broj grančica sezama

Spacing (cm)	Number of branches		
	M+	M-	Mean
50 × 30	18	15	16.83
50 × 40	20	17	18.33
50 × 50	22	17	19.67
Mean	20	17	
$LSD_{0.05}$			
MUCUNA		1.724	
SPACING		0.992	
M × S		1.469	
ANOVA			
MUCUNA		***	
SPACING		***	
M × S		ns	

ns – not significant *** - significant at ($p < 0.001$)

Table 4: Effect of mucuna and spacing on the leaf length and Breadth of sesame

Tablica 4 Djelovanje mucune i razmaka na duljinu i širinu lista sezama

Spacing (cm)	Leaf Length (cm)			Leaf Breadth (cm)		
	M+	M-	Mean	M+	M-	Mean
50 × 30	13.07	11.10	12.08	8.40	6.93	7.67
50 × 40	13.73	11.53	12.63	8.47	7.67	8.07
50 × 50	14.27	12.20	13.23	8.87	7.87	8.37
Mean	13.69	11.61		8.58	7.49	
$LSD_{0.05}$						
MUCUNA		0.208			0.291	
SPACING		0.238			0.201	
M × S		0.287			0.273	
ANOVA						
MUCUNA		***			***	
SPACING		***			***	
M × S		ns			*	

ns- not significant *** - significant at ($p < 0.001$)

The spacing of 50 × 50 cm gave a significantly ($p < 0.05$) higher seed weight (6.55 g/plant) per plant compared with other treatments; however spacing at 50 × 40 cm (6.42 g/plant) and 50 × 30 cm (6.38 g/plant) are not significantly different from each other (Table 5). The mucuna fallow significantly enhanced the seed weight compared with the non fallowed land.

Table 5: Effect of mucuna and spacing on the seed yield of sesame

Tablica 5.: Djelovanje mucune i razmaka na prinos sjemena sezama

Spacing (cm)	Seed yield (g/plant)		
	M+	M-	Mean
50 × 30	6.43	6.32	6.38
50 × 40	6.51	6.33	6.42
50 × 50	6.62	6.49	6.55
Mean	6.52	6.38	
LSD			
MUCUNA		0.13	
SPACING		0.05	
M × S		0.11	
ANOVA			
MUCUNA		**	
SPACING		*	
M × S		*	

* - significant at ($p < 0.05$)   ** - significant at ($p < 0.01$)

DISCUSSION

Application of mucuna as a fallow crop significantly increased the plant height (116.07 cm) compared with the field where there was no mucuna (104.83 cm), this increase in plant height in the fallowed land may be due to high nitrogen content of the soil in the fallowed land which ultimately resulted into better vegetative growth. This result conforms to the findings of Malik *et. al*., (1988) who also reported that plant height increased with increasing levels of nitrogen.

Increase in the breadth of the leaves in the fallowed land would lead to an increase in the photosynthetic activity of the plant, this could be corroborated by the work of (Auwalu and Babatunde, 2007) where they reported that wider leaf area would invariably lead to greater photosynthetic activity hence, higher total marketable (vegetative) yield.

The positive response of sesamum radiatum to all the growth parameters and the seed yield examined in the fallowed land may be attributed to the increase in the nutrient element in the soil particularly nitrogen as a result of the incorporated mucuna. The increase in the photosynthetic activity as a result of the wider leaf area would in turn enhance pod production and thus increase seed yield.

Results obtained from this study show significant improvement in the growth parameters and the seed yield as a result of the mucuna and increased spacing. This may not be surprising considering the role of mucuna in improving the nutrient status of the soil when used in rotation with other crops, particularly cereal crops.

CONCLUSION

The results obtained in this study showed that mucuna is a good alternative to the hitherto old practice of shifting cultivation as lands are no longer easily accessible to the resource poor farmers.

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REFERENCES

1. Auwalu, BM., (1995): Influence of Some Agronomic Practice on Growth, Yield and Nutritional Quality of Vegetable Sesame (*Sesamum radiatum* Schum), Ph.D Thesis, Abubakar Tafawa Balewa University, Bauchi. Nigeria pp: 124.

2. Auwalu BM, Babatunde FE (2007): Analyses of growth, yield and fertilization of vegetable sesame (*sesamum radiatum* Schum). *J. Plant Sci*., **2**: pp.108-112.
3. Anonymous, (1998): Towards sustainable development in Africa. Medium-term Plan 1999–2001. IITA, Ibadan, Nigeria.
4. Buckles D, Etéka A, Osiname O, Galiba M, Galiano G (editors). (1998): Cover crops in West Africa contributing to sustainable agriculture. IDRC, Ottawa, Canada; IITA, Ibadan, Nigeria; Sasakawa Global 2000, Cotonou, Benin. Pp 270
5. Carsky, R. J., Becker, M., and Hauser, S. (2001): *Mucuna* cover crop fallow systems: potential and limitations. In: *Sustaining Soil Fertility in West Africa*, Soil Science Society of America Special Publication No. 58, 111–135. (Eds Tian, G. Keatinge, J. D. H. and Ishida, F.). Madison, WI, USA: Soil Science Society of America/American Society of Agronomy.
6. Carsky RJ, Tarawali SA, Becker M, Chikoye D, Tian G, Sanginga N. (1998): *Mucuna*—herbaceous cover legume with potential for multiple uses. Resource and Crop Management Research Monograph No. 25. IITA, Ibadan, Nigeria.
7. Hutchinson L, Dalziel JM, (1963): Sesame. In Flora of West Tropical Africa Hepper, F. N. (Ed.), Vol. II. Crown Agents London, pp: 388-391.
8. Malik MA, Abbas G, Cheema ZA, Hussani KH, (1988): Influence of NPK on growth yield and quality of sesame (*Sesamum indicum* L.). *J. Agric. Res.* 26: 59–1
9. Omidiji MO, (1978): Tropical leafy and fruit vegetables in Nigeria. Vegetable for Hortic Humid Tropics, 3: 6-8.
10. Oyenuga and Fetuga, (1975): Dietary importance of fruits and vegetable. Proceedings of the 1st National Seminar on Fruits and Vegetables. University of Ibadan, Nigeria, pp: 122-131.

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