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Effect of Planting Methods and Fertilizer Rate on Forage Yield of *Centrosema Pascuorum* in Semi-Arid Zone of Nigeria

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Abstract
An experiment was conducted to evaluate the effect of planting method and fertilizer rate on forage yield of Centrosema pascuorum, at experimental field of crop science Department, Faculty of Agriculture Federal University Dutse, Jigawa State. The research was factorial laid out in randomize complete block design (RCBD) consisted of two methods of planting (Drilling and Broadcasting methods) each method consists of fertilizer rate of (0kgha^{-1}, 150kgha^{-1}, 200kgha^{-1}, 250kgha^{-1} and 300kgha^{-1}) respectively. The experiment were in the ratio of 2:5:3, the experimental plot were divided into 30 plots of 2x2m with spacing inter row spacing of 0.5m and intra row spacing of 1m and fertilizer used was single super phosphate(SSP) at different rate i.e 0kgha^{-1},150kgha^{-1},200kgha^{-1},250kgha^{-1} and 300kgha^{-1} which are denoted by (F1, F2 ,F3 ,F4 and F5) respectively. The data were collected on growth components of centrosema pascuorum at weekly interval for three times. different planting methods and effect of interaction of planting methods were not significant at (P <0.05) level of significance, while for the effect fertilizer rate three of the growths component of (number of leaves and number of branch) were significant at (P<0.05) level of significance, but plant height were not significantly different at(P<0.05) level of significance,the effect of interaction of fertilizer rate were all significant at (P<0.05) level of significance,. Base on the results obtained on the growth components of Centrosema pascuorum in this study, it can be recommended that any farmer intended to go into pasture production particularly production of Centrosema pascuorum can adopted Drilling methods used in this study. Further research can be carryout on intercropping of centrosema pascuorum with other grasses.

Keywords: Centrosema, Forage yield, fertilizer rate, Plant height and Number of leaves

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I. Introduction

Nutrition is one of the important management practices in ruminant production and it is the bed rock of performance in animal, but if there are limited forages; and reduction in nutrient composition of the available forage grasses and legumes during dry season, this poses a problem Amole *et al.*,(2011). In Tropical Africa, majority of ruminant animals are reared on natural pastures which decline in quality during the dry season (Bamikole, 1998). The legumes crop has different level of nitrogen concentration, this difference in nitrogen concentration among legumes may be attributed to nitrogen mineralization from litter decomposition. This may have been affected by nitrogen fixation in these legumes resulting in lower proportion of fixed nitrogen but significantly higher amount of fixed nitrogen in *Centrosemapascourum*.Gathumbi*et al*., (2004).The availability of feed resources and their rational utilization for livestock and poultry represent the most compelling task facing Animal Scientists in Nigeria and in deed most part of the developing countries of the world Ibrahim *et al*., (2014).There are many pasture crops used in feeding animals made up of grasses and legumes. Among the forage is *C. pascuorum* (centurion). *C. pascuorum* is an annual twining legumious herb that can root from the node of trailing herb under moist condition,*C. pascuorum* is suitable for mixture with grasses or pure stands and adapted to wide range of soil ranging from sand to heavy clay and from slightly acidic to alkaline soil (5 – 8.5). It is adapted to tropical areas with pronounced dry season up to 8 months (Feedipedia, 2019).This study will show us the effect of planting method and fertilizer rate of *C. pascuorum.*Majority of the livestock farmers in the study areawere not aware of the nutritive composition of the*C. pascuorum* as source of protein supplement to the animal diet. However, this research wants to evaluate the nutritive composition and forage yield by *C.*

pascuorum. It is suitable for mixtures with grasses, or in pure stands for ley-farming. It makes excellent hay; each year, there are 56,000 ha sown for hay production in Australia. More recently farmers in the Northern Territory, Australia, are growing cv. Cavalcade to produce legume cubes. Hay giving yields of about 7 t/ha is cut with a rotary head cutter and dried in the field to 10% moisture. Bales are shredded and mixed with bentonite (a volcanic-ash clay material containing Fe, Mg and either Na or Ca), sprayed with water to 12% moisture and then cubed under very high pressure. In 1997, 8000 tonnes of Cavalcade cubes were produced. Two pelleting plants operate at Katherine and Tortilla. Cavalcade hay and pellets provide feed on boats for 300,000 head live cattle exported from Darwin to Indonesia and the Philippines. *C. pascuorum* stands persist through a seed bank. For hay production, renovation every 3 or 4 years is recommended to maintain a pure stand. In ley farming, the *C.pascuorum* phase is able to provide 80-100 kg/ha N to the system, Thiagalingam *et al.,* (1997).

Ecology and Soil Requirements

Centrosema pascuorum is adapted to a wide range of soils, from sand to heavy clay and from slightly acid to alkaline soils (pH 5-8.5). Requires medium to high soil fertility. Occasionally, e.g. in the Pantanal of Brazil, found at sites with some seasonal flooding stress. *C. pascuorum* is adapted to tropical areas with pronounced dry seasons of up to 8 months; 700-1,500 mm rainfall per year are suitable. Though individual plants die off under drought conditions, populations persist through escape mechanisms such as annual life span, rapid growth and flowering, and high seed production. Morphologically, the narrow leaflets and phototropism (i.e. erect leaves oriented towards sunlight), osmotic and stomatal adaptation are also adaptation mechanisms to drought, Thiagalingam, *et al.,* (1997).

Experimental Area

The experiment was conducted in the experimental field of Crop Science Department, Faculty of Agriculture, Federal University Dutse, Jigawa state of Nigeria. Dutse is a Capital City of Jigawa State and located between latitude 11.00^{oN} to $13.00^{oN}$and longitudes 8.00^{oE} to 10.15^{oE} high temperature are normally recorded between the month of April and September the daily minimum and maximum temperature are 15^{o}c and 35^{o}c. Rain season last from May to September with average rainfall of between 600mm to 1000mm. The Sudan savannah vegetation zone is also made up vast grazing land suitable for livestock production and free from tse-tse fly infestation. The environment is conducive to different species of livestock production, such as cattle, sheep, goats, Rabbits donkeys, horses and poultry JARDA, (2012). Crops grown in the region include millet, rice sorghum, maize cowpea, groundnut, water melon, tomato, soya beans, sesame and so many tree crops. Commercial agricultural production includes grain of cereal and pulses, horticultural crops and livestock. MOA, (2013)

Materials use in the Research

The seed of ***Centrosema pascuorum*** (centurion) was purchased at National Animal Production Research Institute (NAPRI) Zaria. The single super phosphate fertilizer was used. However, the research was conducted in the experimental plot of crop science department, Federal University Dutse, Jigawa State. The weight scale tape was used for the measuring of plant height, branches and leaves.

Experimental Design

The research involves 2 factor that's method of planting and fertilizer rate, the factorial design containing the ratio of 2:5:3 and RCBD was adapted for this research. The randomization was conduct without bias and it shown below randomization scheme.

Table 1: Samples of fertilizer rate of both planting methods

S/N	R1	R 2	R 3
1	D1F5	B1F5	D1F1
2	D1F2	B1F4	D1F2
3	B1F5	D1F1	B1F5
4	B1F3	D1F4	B1F3
5	B1F1	B1F1	D1F3
6	B1F4	B1F3	B1F4
7	B1F2	B1F2	B1F2
8	D1F3	D1F5	B1F1
9	D1F1	D1F3	D1F4
10	D1F4	D1F2	D1F5

KEY

D_1 = Drilling method of planting

B_1 = Broadcasting method of planting

F_1 = 0kg/ha (control)

F_2 = 150kg/ha
F_3 = 200kg/ha
F4= 250kg/ha
F5= 300kg/ha

Field Layout and Experimental Design
A total land area of 14.5mx8m was used, the field was prepared by plouging and harrowing to enhance early plant germination. The experimental field was divided into 30plots each is 2mx2m and inter-row of 0.5m and intra-row1m.

PARAMETERS MEASURED
The parameters measured include the following:
Number of leaves
Number of branches
Plant height

Data Analysis Method
Data collected were stored in Microsoft Excel office 2013 and later subjected to ANOVA using system Analytical statistics package (SAS) package and differences between mean was separated using Duncan Multiple Range at probability level of 0.05.

II. Result and Discussion

The effect of planting methods and fertilizer rate on forage yield of *Centrosema pascuorum* is presented in Tables 2. below. Plant height, number of leaves, number and of branches, yield were measured at each period of yield assessment at a weekly interval from 3 to 6 weeks after sowing (WAS). The means of the result can summarize by Tables.2. The effect of planting methods on growth component of *Centrosema pascuorum* was presented in Table 2. The plant height, number of leaves and number of branches were not significant ($P < 0.05$) level of significance. This is contrary to the report of (Ayub *et al*., 2008) who reported that the yield of grass increase with theincrease in seed rate, because in this study the yield of *Centrosema pascuorum* remains statistically the same irrespective of the planting method.

From Table 3, the means plant height were not significance at ($P < 0.05$) level of significance which show that the fertilizer rate has no effect on plant height of *Centrosema pascuorum*, but the number of branches and number of leaves were significantly at ($P < 0.05$) level of significance which mean the fertilizer rate has effect on number of branches and number of leaves of *Centrosema pascuorum.* The plant height at 6 WAS (38.45cm) was lower than135cm reported by (Kiyothong *et al*., 2005) in Indonesia.

From Table 4, the plant height, number of branches and number of leaves were not significance at ($P < 0.05$) level of significance.

From Table 5, the number of branches, number of leaves and plant height were all significant at ($P<0.05$) level of significance which means that the interaction of fertilizer rate has effect on growth component of *Centrosema pascuorum*. this is in agreement with the finding of (Amole *et al*., 2015) who reported that plant height of sole *Lablab purpureus*is significantly higher than in mixture of *Andropogon gayanus* with single, double and triple rows of *Lablab purpureus*. Contrary to the finding of this study, (Kumar *et al*., 2016) reported not significant difference in terms of plant height of legume sole and intercrop mixture.

Table 2: Effect of planting methods on growth component of *Centrosema pascuorum*

Parameters	Drilling method	Broadcasting method	Sem	Los
Plant height(cm)	36.00	36.00	2.00	NS
Numberof leaves	35.00	35.00	1.56	NS
Numberof branches	100.00	98.00	5.82	NS

Mean along columns of drilling and broadcasting method show no significantly difference as compare with some of error mean (Sem) at 0.05 level of significance. SEM= Standard error of mean, LOS= Level of significance, NS= Not significance.

Table 3: Effect of Fertilizer Rate on Growth Component of *Centrosema pascuorum*

Parameters	Fertilizer Rate (kg/ha)						
	0	150	200	250	300	SEM	LOS
Number of branches	32.83^{c}	33.67^{bc}	35.33^{b}	41.50^{a}	42.67^{a}	5.82	*
Number of leaves	85.33^{c}	96.00^{bc}	99.83^{a}	108.17^{a}	104.17^{a}	5.82	*

Plant height(cm)	33.92	35.47	34.93	38.45	36.60	5.82	Ns

a, b,bc, c Means with different superscript throughout the fertilizer rate differ significant at 0.05 level of significance on the growing component of *Centrosema pascuorum.*
SEM= Standard error of mean, LOS= Level of significance, NS= Not significance, *= significance.

Table4.Interaction effect of Planting Methods on growth component of *Centrosema pascuorum*.

Parameters	Drilling method	Broadcasting method	SEM	LOS
Plant height	35.90	35.85	4.26	Ns
Number of leaves	99.93	97.47	9.53	Ns
Number of Branch	34.53	34.67	5.32	Ns

SEM= Standard error of mean, LOS= Level of significance, NS= Not significance, *= significance. Mean of both drilling and broadcasting method were not significant at (P<0.05) level.

Table5. Interaction effect of Fertilizer Rate on growth component of *Centrosema pascuorum*

Parameters	Fertilizer Rate (kg/ha)						
	0	150	200	250	300	SEM	LOS
Numberof branch	32.83^{b}	33.67^{a}	35.33^{a}	35.80^{a}	35.67^{a}	2.196	*
Plant height	33.92^{bc}	35.47^{b}	34.93^{b}	38.45^{a}	36.60^{b}	1.66	*
Numberof leaves	85.33^{c}	96.00^{b}	99.83^{ab}	108.17^{a}	104.17^{a}	7.32	*

Mean of parameters mention above were significance at 0.05 level of significance which means interaction effect fertilizer rate has effect on growth component of *Centrosema pascuorum.*

III. Conclusion and Recommendation

The study revealed that planting methods has no effect on forge yield on *Centrosema pascuorum* while fertilizer rate has effect on forage yield of *Centrosema pascuorum*. Base on the results obtained on the growth components of *Centrosema pascuorum* in this study, it can be recommended that any farmer intended to go into pasture production particularly production of *Centrosema pascuorum* can adopted drilling method of planting, because is the best as it shown in this research and fertilizer rate of 250kg/ha should be recommended.Further research can be carryout on intercropping of *Centrosema pascuorum* with other grasses.

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