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Effect of Plant Spacing on Seed Yield and Seed Quality of Cow Pea (*Vigna unguiculata*L.Walp.) at Dilla Sub-Station of the Southern Nation, Nationalities and Peoples' Regional State (SNNP)

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Abstract

The study was conducted in Dilla sub-station with objective of identifying optimum plant spacing for optimum seed yield and seed quality of forage cow pea. The study was based on a high yielding variety using the spacing of 10 cm, 20 cm, 30 cm and 40 cm between plants and between row spacing of 40 cm in a Randomized Complete Block Design (RCBD) with four replications. Agronomic information on yield attributes and yield were collected to evaluate treatment effects. Dry herbage yield was significantly ($p<0.05$) affected by plant spacing with the highest yield for plant spacing of 20 cm between plants. Plant spacing also had significant ($P<0.05$) effect on seed yield with the highest yield recorded for 30 cm spacing between plants. Based on the results of this study for increased herbage production a spacing 20 cm between plants is recomended while a spacing of 30 and 40 cm is recommended for seed production of cowpea at Dilla sub-stationand similar environment.

Keywords: Biomass yield; Seed yield; Plant spacing; Cowpea

Introduction

Feed shortage both in quantity and quality is the major constraint influencing animal performance in Ethiopia. Natural pasture and crop residues are the main feed sources. However, most of the feedstuffs obtained from natural pasture and crop residues have Crude Protein (CP) levels below 8% and Neutral Detergent Fiber (NDF) above 55%. Feedstuffs of such composition are insufficient to provide year round supply of adequate quantity and quality of nutrients above maintenance requirements. Various options have been advocated to improve the feed supply among which introduction of leguminous forages is the major one. Cowpea is well adapted to harsh environmental conditions such as low soil fertility, high temperatures and drought. Cowpea can fix nitrogen to improve soil fertility and productivity of the existing cropping system. Additionally, farmers feed cowpea fodder to livestock to increase income by reduction of heavy reliance on commercial fertilizers and sustainance of soil fertility [1]. Previous studies with cowpea indicated this legume improves soil fertility and enhances intake and utilization of poor quality roughage consequently improves livestock production and productivity. Another important feature of cowpea is its ability to suppress weeds particularly species. Forage legumes in general particularly cowpea is the most important forage plant that substantially improves productivity of ruminant livestock by enhancing nutritional efficiency and improving soil fertility for crop agriculture as well.

The demand for production of improved forage is increasing in southern region due to decreasing trend of grazing land for livestock production and increased awareness of farmers on improved forage production. However, supply of improved forage crop seed is below the demand, due to lack of forage seed production and there is no seed rate space that is recommended for seed production. Hence, identifying optimal plant spacing of cow pea for seed yield production will encourage seed producers which in turn have significant importance in improving feed quality and soil fertility and productivity. Therefore, this experiment was conducted to identify optimum plant spacing for optimum seed production of cow pea at Dilla sub-station of the Southern Nation, Nationalities and Peoples' Regional State (SNNP) [2].

Materials and Methods

Description of the study site

Dilla sub-station is characterized by Orthic Luvisols soil, with an average annual rain fall and temperature of 1300 mm and 21°C, respectively. The average minimum and maximum temperature of the area are 13.10 and 28.05°C, respectively. It has an altitude of 1572 masl, and is located at latitude and longitude of 38°18'30" E and 6°24'30" N, respectively.

Treatments and data collection

Plant spacing 10 cm, 20 cm, 30 cm and 40 cm, were used as experimental treatments in a plot size of 3 m × 2 m with spacing of 40 cm between rows and 1m between replication and plots. Two seeds were sown together at the onset of main rainy season in mid-July with extra seedling thinned 14 days after germination, leaving one plant per plot. A 100 kgNPS/ha was applied right before sowing. All plots were weeded twice before flowering. Number of branches per plant was counted by taking five plants per plot randomly. Number of pods per plant was also counted by using five plants per plot. Plants were harvested at ground level and fresh biomass weighed immediately using a 0.1 g scale. Then, a sub-sample of 15%-20% of the total

weight was separated and put into a paper bag for herbage dry matter determination. The samples were oven dried at 105°C for 24 hours in soil laboratory, Hawassa agricultural research center. To determine grain yield, the pods were harvested from the rest rows at optimum physiological maturity by hand picking and threshed [3].

Statistical analysis

The data was analyzed using analysis of variance in the general linear procedure of SPSS. Tukey multiple comparisons was used to separate treatment means.

Results and Discussion

Number of branches

Maximum yield of a particular crop in a given environment can be obtained at row spacing where competition among the plants is minimum. This can be achieved with optimum spacing which not only utilize soil moisture and nutrients more effectively but also avoids excessive competition among the plants. However, beyond certain limit yield cannot be increased with decreasing/increasing row spacing. Hence, optimum row spacing induces the plant to achieve its potential yield. Effect of between plant spacing on number of branch per plant is given Table 1. Plant spacing had significant effect on number of branches per plant. With increase in plant spacing the number of branches was noted to increase and the highest number of branch was recorded for a spacing of 40 cm between plants which is in line with report. In the current study there was no significant difference in number of branches per plant at 30 cm and 40 cm between plant spacing which is an indication of optimum level of spacing for branches per plant. The increased number of branches per plant at wider spacing positively correlates with seed yield which is in line with the findings [4].

Between plant spacing (cm)	Mean	Std. error	95% confidence interval	
			Lower bound	Upper bound
10	12	0.4	10.7	13.3
20	14.8	0.4	13.2	16.2
30	18.5	0.4	17.5	19.4
40	20	0.4	17.7	22.2

Table 1: Effect of between plant spacing on number of branch per plant.

Number of pod per plant

The effect of plant spacing of cow pea on number of pods per plant is given table 2. Plant spacing had significant effect on number of pods per plant. As plant spaing increases the number of pod per plant was noted to increase. There was no significant difference between plant spacing of 30 and 40 cm in terms of number of pods per plant which is in agreement with the findings. 2017 reported for similar crop under irrigation. Our study indicated that there was no significant difference in number of pod per plant at 30 cm and 40 cm between plant spacing (Table 2) which is indicator for optimum level of spacing for number of pods per plant. The higher pods per plant in wider spacing between plants is positively correlated.

Betweenn plant space	Mean	Std. error	95% confidence interval	
			Lower bound	Upper bound
10 cm	18.50	0.774	15.814	20.186
20 cm	19.00	0.774	16.314	21.686
30 cm	24.2	0.774	22.564	25.936
40 cm	26.50	0.774	23.814	28.186

Table 2: Effect of plant space on pod/plant.

Dry matter yields

The effect of plant spacing on dry matter yield of cow is given in table 3.There was statistically significant difference in biomass yield of cow pea in response to plant spacing with the higher yield recorded for a spacing of 20 cm between plants., The results of DM yield in this study is in line cowpea [5]. Previous studies conducted for herbage and seed yield on different cowpea geno types indicated that herbage dry matter yield of different cowpea genotypes ranges between 2.33 and 7.67 obtained herbage dry matter yield of over 4 t/ha. The average herbage dry matter yield obtained in the current study is similar to the findings reported an average dry matter herbage yield of 18.1 t/ha for different cowpea genotypes.

Conclusion

Plant spacing had significant ($P<0.05$) effect on yield attributes in terms of number of branch/pod with the increasing trend as plant

spacing increases. The highest biomass yield of cow pea was recorded for plant spacing of 20 cm while the highest seed yield was noted for plant spacing of 30 cm. Based on the results of this study a spacing 20 cm between plants is recomended for optimal herbage production while a spacing of 30 and 40 cm is recommended for seed production of cow pea at Dilla sub-station and similar environment.

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