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Original Article

Effect of Varieties and Phosphorus Fertilization on Yield and Quality of Cowpea Fodder in Mollisols of India

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Abstract

The field experiment was conducted during Kharif season of 2008-09 and 2009-10 at Instructional Dairy farm, G B Pant University of Agriculture & Technology, Pantnagar to study the effect of varieties and phosphorus on yield and quality of cowpea fodder yield attributes of cowpea in Mollisols of *Tarai* region of Uttarakhand. The experimental site was high in organic carbon, 0.848 %, medium in available nitrogen, 278.48 kg / ha, available phosphorus, 27.7 kg / ha and available potassium, 232.8 kg / ha with neutral in reaction, pH 7.6. The experiment consisted of 6 cowpea entries namely UPC-9202, UPC-4200, UPC-626, UPC 628, UPC-629 and Bundel Lobia-1 and three phosphorus levels viz. 40, 60 & 80 kg P_2O_5 / ha was laid out in factorial RBD with three replications. The UPC-626 produced 2.7% higher green fodder yield than UPC-629, though remained non significant to each other. The green fodder yield was recorded 22% higher at 80 P / ha than 60 kg P / ha, while it was 21% higher at 60 kg P / ha than 40 kg P / ha. Similarly 80 kg P had 9.8% higher dry fodder yield than 60 kg P level, while it was 34.6% higher at 60 kg P than 40 Kg P / ha. The crude protein was also recorded highest in UPC-628 at application of 80 kg P / ha.

Keywords

Cowpea; Crude Protein; Phosphorus; Fertilization.

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] commonly known as lobia, is a versatile multipurpose short duration annual legume crop and provides nutritious food to both men and animals. It has substantial ability to fix atmospheric nitrogen to improve soil fertility. The green fodder of cowpea contains about 15-20% crude protein and 50% digestible carbohydrate at the first stage of pod formation. The average grain and fodder yield of cowpea in India is 3q / ha and 25-45 t / ha. Being a leguminous crop, it responds well to phosphorus fertilization. Phosphorus is an important structural component of many bio-chemicals including nucleic acids and takes part in all types of metabolism of plant including energy transfer. It is considered to be the most important nutrient for growth, better nodulation and higher nitrogen fixation of legumes (Shukla and Yadav, 1982 and Rajshree and Pillai, 2001). Therefore phosphorus is well recognized in the maintenance of the soil fertility and improving crop productivity. There is ample evidence that indicates marked differences between cowpea genotypes and phosphorus uptake. Sairam et al.(1984) and Rajput and Singh (1996) reported that application of phosphorus improved the quality and fodder yields of cowpea. Recently number of high yielding cowpea varieties has been evolved with great potential of grain and fodder production but their response to phosphorus are yet to be worked out. Therefore the present field investigation was carried out to study the effect of varieties and phosphorus fertilization on growth, yield and quality of cowpea herbage.

Materials and Methods

The field experiment was conducted during Kharif season of 2008-09 and 2009-10 at Instructional Dairy farm, G B Pant Univ of Agric & Tech, Pantnagar to study the effect of phosphorus on yield and yield attributes of cowpea. The experimental site was high in organic carbon, 0.848 %, medium in available nitrogen, 278.48 kg / ha, available phosphorus, 27.7 kg / ha and available potassium, 232.8 kg / ha with neutral in reaction, pH:7.6. The experiment consisted of 6 cowpea entries namely UPC - 9202, UPC - 4200,

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UPC - 626, UPC - 628, UPC- 629 and Bundel Lobia-1 and three phosphorus levels viz. 40, 60 & 80 kg P_2O_5 / ha was laid out in factorial RBD with three replications. At the time of sowing, 30 kg N and 40 kg K_20 / ha were based dosed and phosphorus was applied as per the treatments. The experiment was laid out on 24 and 26 June during 2008-09 and 2009-10, respectively. The plant height, number of plants / m row length, L:S ratio, green and dry fodder yield and crude protein were estimated during both years and pooled data are given in Table 1.

Table 1: Effect of phosphorus levels on herbage yield and quality of cowpea entries (pooled data of 2008-09 & 2009-10)

	Treatments	Plant Height (cm)	No. of plants/m	L:S ratio	Green fodder yield (q/ha)	Dry fodder yield(q/ha)	Crude protein yield (q/ha)
A.	**Cowpea entries**						
	UPC 9202	588	7.3	0.70	245	56.68	7.90
	UPC 4200	550	7.2	0.63	242	41.70	6.73
	UPC 626	557	7.3	0.52	307	57.87	9.78
	UPC 628	556	8.0	0.71	252	45.70	7.49
	UPC 629	695	8.6	0.74	299	55.79	9.50
	Bundel Lobia–1	482	5.0	0.63	117	23.32	3.80
	SEm±	**4.5**	**0.4**	**0.01**	**4.5**	**0.89**	**0.15**
	CD at 5%	**03**	**1.1**	**0.04**	**13.0**	**2.57**	**0.42**
B.	**Phosphorus Levels : 3**						
	40 kg / ha	191	8.0	0.52	198	36.74	6.23
	60 kg / ha	191	7.0	0.65	240	49.47	7.28
	80 kg / ha	189	6.8	0.79	293	54.34	9.08
	SEm±	**3.2**	**0.3**	**0.01**	**3.2**	**0.63**	**0.10**
	CD at 5%	**ns**	**0.7**	**0.03**	**9.2**	**1.82**	**0.30**

Results and Discussion

Effect of Varieties

The pooled data of both years indicated that plant height, number of plants / m row length, L:S ratio, green and dry fodder yield and crude protein yield were affected significantly by cowpea varieties (Table 1). The plant height differed significantly among cowpea varieties and significantly tallest plants were recorded in UPC-629 followed by UPC-9202 and the shortest plants in Bundel Lobhia-1. The number of plants per m row length was noticed significantly higher in UPC-629 that remained significantly at par with UPC-628. The lowest plant height and also number of plants per m row length were observed in UPC-4200 followed by UPC-626. Nkaa et al. (2014) from Africa also reported that growth parameters varied with cowpea varieties. The L:S ratio being an index of better fodder quality was recorded significantly wider in UPC-629 that was significantly equal to UPC-28 and UPC-9202. The narrow L:S ratio was observed in Bundel Lobhia-1.The higher L:S ratio was the result of greater plant height resulted into more number of leaves. Ahmed *et al*. (2012) also recorded wider L:S ratio in UPC-626 and narrow in Bundel Lobhia-1.

The Green Fodder Yield was Recorded Significantly Higher in UPC-626 that had Significantly equal value to UPC-629. The UPC-626 produced 2.7% higher green fodder yield than UPC-629. The dry fodder yield was also recorded significantly higher in UPC-626 that had equaled significantly to UPC-9202 and UPC-629. The lowest values of green and dry fodder yield were recorded in Bundel Lobhia-1. Ahmed *et al*. (2012) and Nkaa et al. (2014) also supported the above findings in India and Africa, respectively. The crude protein yield was also varied significantly among cowpea varieties and significantly higher value was noticed in UPC-626 that was significantly at par with UPC-629. Bundel Lobhia-1 has significantly lowest crude protein yield followed by UPC-4200. The higher crude protein yield is a result of nitrogen content and dry fodder yield and differed among varieties due to genetic constitutions. Ahmed et al. (2012) also reported higher crude protein content as well as yield in UPC-626 and the lowest in Bundel Lobhia-1.

Effect of Phosphorus

The growth attributes like number of plants / m row length and L:S ratio varied significantly with phosphorus levels (Table 1). The plant height of cowpea did not differ significantly with P levels and also decreased with increase P level from 60 to 80 Kg / ha, however it remained equal at both 40 and 60 kg P / ha. The number of plants / ha decreased significantly from low to higher P levels and the highest value was recorded at 40 kg P / ha, while both P levels i.e. 60 and 80 kg / ha had significantly equal values but the minimum plants were counted at 80 kg P / ha. The L:S ratio increased significantly with increase P levels up to 80 kg / ha and significantly highest value was recorded at 80 kg / ha.

The green fodder yield and dry fodder yield improved significantly with increase P levels from 40

to 80 kg / ha with significantly highest values at 80 kg P / ha. The green fodder yield was recorded 22% higher at 80 P / ha than 60 kg P / ha, while it was 21% higher at 60 kg P / ha than 40 kg P / ha. Similarly 80 kg P had 9.8% higher dry fodder yield than 60 kg P level, while it was 34.6% higher at 60 kg P than 40 Kg P / ha. The higher P level increased nodulation and nitrogen fixation that help in the maintenance of the soil fertility and improving crop productivity (Shukla and Yadav, 1982; Rajput and Singh, 1996 and Ahmed et al., 2012). The crude protein yield was also increased with increasing levels of phosphorus levels. The highest value was recorded at 80 kg and lowest at 40 kg P / ha. Higher crude protein yield at increased levels of phosphate may be attributed to higher N uptake by the plant and fodder production under higher dose of phosphate application. Moreover, the improvement in the quality of cowpea fodder may be due to the fact that phosphorus being an essential constituent of DNA and various forms of RNA for protein synthesis which resulted in higher content as well as yield of crude protein (Thakuria and Ioikham, 1991).

The interaction effects of cowpea varieties and levels of phosphorus did not show significant variation for plant heght, number of plants / m row length, L:S ratio, green and dry fodder yield and crude protein.

Conclusion

The experimental results indicate that UPC 626 and UPC 629 had higher green forage yield, dry matter yield as well as crude protein production. Similarly, application of 80 kg phosphorus gave significantly highest values of yield and yield attributes. Therefore, cowpea entries UPC 626 and UPC 629 may be grown at application of 80 kg P / ha for higher green forage yield, dry matter yield as well as crude protein production.

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