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Original Research Article

Optimizing Sowing Time of Cowpea under Varied Levels of Phosphorus for Maximizing Fodder Yield

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A B S T R A C T

A field study was undertaken during summer, 2019 on sandy loam soils of S. V. Agricultural College, Tirupati to find out the optimum time of sowing and phosphorus level for maximizing the yield and quality of fodder cowpea. Three time of sowing *viz.*, I FN of January, II FN of January and I FN of February assigned to main plots and four levels of phosphorus *viz.*, 0, 20, 40 and 60 kg P_2O_5 allotted to subplots with three replications were maintained under split plot design. Higher leaf to stem ratio, green fodder yield, crude protein content and ash content were recorded with earlier sown crop *i.e.* I FN of January. Significantly higher leaf to stem ratio, green fodder yield, crude protein content and ash content was recorded with the application of 60 kg P_2O_5 ha^{-1}. The highest crude fibre content was recorded with the later sown crop (I FN of February) followed by that with earlier sown crop *viz.*, II FN of January and I FN of January. Significantly lower crude fibre content was recorded when the crop was supplied with 60 kg P_2O_5 ha^{-1} and the highest crude fibre content was recorded with control. The interaction between time of sowing and phosphorus levels influencing all the parameters were found to be non-significant. In conclusion, the present investigation revealed that fodder cowpea gives optimum green fodder yield with high nutritional quality if sown during I FN of January with 60 kg P_2O_5 ha^{-1}.

Keywords

Cowpea, Time of sowing, Phosphorus

Introduction

India has 15 % of the world cattle population, at present, the country faces a net deficit of 61.1 per cent in green fodder, 21.9 per cent in dry crop residues and 64 per cent in concentrated feeds. To meet the current level of livestock production and annual growth in its population, the deficit in all components of fodder, dry crop residues and feed concentrates has to be met from increasing productivity, utilizing untapped feed resources, increasing land area (not possible due to human pressure for food crops) or through imports. Cowpea (*Vigna unguiculata* L. Walp.) has emerged out as a potential crop for meeting the requirement of high quality fodder to fast expanding cattle population. It is a quick growing leguminous forage crop grown as a sole crop or mixed with cereal fodders and grasses to improve the nutritive value of the herbage. It contains 20 - 24 per cent crude protein, 43 - 49 per cent neutral detergent fibre, 34 - 37 per cent acid detergent fibre, 23 - 25 percent cellulose and 5 - 6 per cent hemicelluloses on dry matter basis. The digestibility of cowpea fodder is above 70 per cent. There is a large gap between the demand and supply of green fodder during the lean period which can be

narrowed down through the agronomic approaches. Among them, time of sowing and nutrient application is considered to be the most important factors determining the production potential of the crop. The optimum time of sowing is necessary for maximizing fodder yields, as it creates optimal growing conditions for the crop and also helps to maintain the regular supply of the green fodder especially to mitigate the fodder shortage during the summer season. Phosphorus application not only improves the nutritional profile of drymatter but also reported to stimulate growth, initiate nodule formation as well as influences the efficiency of the rhizobium-legume symbiosis in nitrogen fixation which is an energy-driving process. Keeping this in view, the present investigation was taken up in order to find out optimum time of sowing and phosphorus dose for maximizing the fodder production.

Materials and Methods

The present investigation was conducted at S.V. Agricultural College Farm, Tirupati campus of Acharya N. G. Ranga Agricultural University during summer, 2019 in a split plot design with three time of sowing *viz.*, I FN of January, II FN of January and I FN of February assigned to main plots and four levels of phosphorus *viz.*, 0, 20, 40 and 60 kg P_2O_5 ha^{-1} allotted to subplots.

The soil of the experimental field was sandy loam in texture, neutral in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and available potassium. Nitrogen was supplied @ 20 kg ha^{-1} common to all the plots through urea while phosphorus was supplied as per the sub plot treatments through single super phosphate. The full dose of N along with P_2O_5 was applied as basal dose at the time of sowing.

Results and Discussions

Leaf to stem ratio and fodder yield:

Fodder cowpea sown during I FN of January resulted in higher leaf to stem ratio and green fodder yield which was however comparable with that of II FN of January sown crop (Table 1). The higher leaf to stem ratio and fodder yield with earlier sowings might be due to higher leaf weight than green stem weight and early sown crop took maximum calendar days upto harvest that have resulted in longer vegetative phase that ultimately reflected on the green fodder yield respectively. Similar findings were reported by Ashwathi (2016) and Ram *et al.,* (2014). The lowest leaf to stem ratio and fodder yield was recorded when the crop was sown during I FN of February.

Among the different levels of phosphorus tested, application of 60 kg P_2O_5 ha^{-1} resulted in significantly higher leaf to stem ratio and fodder yield of cowpea followed by that with 40 kg P_2O_5 ha^{-1}, the latter was inturn on par with that of 20 kg P_2O_5 ha^{-1} (Table 1).

The response of crop to higher levels of phosphorus might be due to the fact that phosphorus plays a crucial role in photosynthesis, enhanced photosynthetic efficiency of leaves and thus the availability of photosynthates which inturn improved plant height, leaf area and hence dry matter production and succulency, number of leaves $plant^{-1}$ and number of branches $plant^{-1}$ resulting in increased leaf to stem ratio and fodder yield of cowpea. Significantly lower leaf to stem ratio at harvest and fodder yield were recorded with control. These findings are in accordance with those reported by Shekara *et al.,* (2012), Kumawat and Khinchi (2017) and Shekara *et al.,* (2010)

Table.1 Leaf:Stem ratio and green fodder yield of fodder cowpea at harvest as influenced by time of sowing and graded levels of phosphorus

Treatments	Leaf to stem ratio	Green fodder yield (t ha^{-1})
Time of Sowing		
T_1-I FN of January	0.97	16.7
T_2-II FN of January	0.93	16.0
T_3-I FN of February	0.87	14.7
SEm±	0.01	0.26
CD (P= 0.05)	0.05	1.1
Phosphorus levels		
P_1 - 0 kg P_2O_5 ha^{-1}	0.85	14.2
P_2 - 20 kg P_2O_5 ha^{-1}	0.90	15.4
P_3 - 40 kg P_2O_5 ha^{-1}	0.94	16.1
P_4 - 60 kg P_2O_5 ha^{-1}	0.99	17.1
SEm±	0.012	0.28
CD (P= 0.05)	0.04	0.8
Time of sowing × Phosphorus levels		
P at T		
SEm±	0.028	0.53
CD (P= 0.05)	NS	NS
T at P		
SEm±	0.023	0.49
CD (P= 0.05)	NS	NS

Table.2 Crude protein, crude fibre and total ash content of fodder cowpea at harvest as influenced by time of sowing and graded levels of phosphorus

Treatments	Crude Protein Content (%)	Crude Fibre Content (%)	Total Ash Content (%)
Time of Sowing (T)			
T_1 - I FN of January	18.2	27.0	13.8
T_2 - II FN of January	17.4	29.5	12.7
T_3 - I FN of February	15.8	31.5	11.4
SEm±	0.36	0.69	0.28
CD (P= 0.05)	1.5	2.8	1.1
Phosphorus levels (P)			
P_1 - 0 kg P_2O_5 ha^{-1}	15.6	32.0	11.4
P_2 - 20 kg P_2O_5 ha^{-1}	16.9	30.0	12.0
P_3 - 40 kg P_2O_5 ha^{-1}	17.4	29.0	12.9
P_4 - 60 kg P_2O_5 ha^{-1}	18.8	26.3	14.1
SEm±	0.40	0.76	0.34
CD (P= 0.05)	1.2	2.3	1.0
Time of sowing (T) × Phosphorus levels (P)			
P at T			
SEm±	0.73	1.37	0.57
CD (P= 0.05)	NS	NS	NS
T at P			
SEm±	0.70	1.34	0.58
CD (P= 0.05)	NS	NS	NS

Quality parameters

Fodder cowpea sown during I FN of January resulted in higher crude protein and total ash content, which was however on par with that of II FN of January sown crop (Table 2). This might be due to congenial weather conditions prevailed during the crop growth

period which resulted in better root growth, dry matter production and more uptake of nitrogen which led to higher crude protein and total ash content. The similar findings were reported by Ashwathi (2016) and Ram *et al.,* (2014). The lowest crude protein and total ash content were noticed with the crop sown during I FN of February. Crude protein and total ash content of fodder cowpea were significantly higher with application of 60 kg P_2O_5 ha^{-1} than that with other nutrient doses (Table 2). Increase in crude protein and total ash content might have resulted from marked increase in nitrogen content due to higher level of phosphorus which might have helped in more protein synthesis as nitrogen is a constituent of various essential metabolities including protein and amino acids and higher dry matter production and nutrient uptake respectively. These results were in agreement with the findings of Tandon and Patel (2009) and Kumar *et al.,* (2012). The lowest crude protein and total ash content were recorded with control. With regard to crude fibre content, crop sown during I FN of February resulted in higher crude fibre content in fodder cowpea while the minimum was with the crop sown during I FN of January (Table 2). Fodders with low crude fibre, high protein content and succulency are more palatable for animals. The lowest crude fibre content with early sown crop during I FN of January might be attributed to higher uptake of nitrogen by crop under favourable weather conditions like temperature, relative humidity and low evaporation rates resulting in more vegetative growth and higher crude protein content which inturn decreased the fibre content. These findings are in close agreement with the results reported by Kumar and Patel (2017) and Ashwathi (2016). Significantly lower crude fibre content was recorded with the application of 60 kg P_2O_5 ha^{-1} followed by that with 40 and 20 kg P_2O_5 ha^{-1} (Table 2). This might be due to the fact that at higher levels of phosphorus, the uptake of nitrogen is increased which is a prime constituent of amino acids that increases the protein content and reduces the crude fibre content. Similar results were obtained by Kumar *et al.,* (2012).

In conclusions, the present investigation indicated that fodder cowpea gives optimum green fodder yield with high nutritional quality if sown during I FN of January with 60 kg P_2O_5 ha^{-1}. If sowing is limited by any of the factors it can also be extended to II Fortnight of January without significant reduction in yield and quality.

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