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Effect of Sowing Window and Phosphorus Levels on Growth and Yield of Summer Fodder Cowpea

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ABSTRACT

Background: 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. 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 fertilizer application are considered to be the most important factors determining the production potential of the crop. Keeping this in view, the present investigation was taken up in order to find out the optimum time of sowing along with the optimum dose of phosphorus for the production of fodder cowpea.

Methods: The present experiment was undertaken during summer, 2019 on sandy loam soils of dryland farm, S.V. Agricultural College, Tirupati. Three time of sowing *viz.,* I fortnight (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.

Result: The plant height, number of leaves plant^{-1}, number of branches plant^{-1}, dry-matter production and number of nodules plant^{-1}, leaf to stem ratio and green fodder yield were higher with early sown crop *i.e.* I FN of January. Application of 60 kg P_2O_5 ha^{-1} resulted in significant improvement in the growth parameters, yield attributes and yield of fodder cowpea, while the lowest were recorded under control conditions (0 kg P_2O_5 ha^{-1}). The interaction between time of sowing and phosphorus levels influencing the above parameters was found to be non-significant. In conclusion, the present investigation revealed that fodder cowpea gives optimum green fodder yield with high nutritional quality on sown during I FN of January with 60 kg P_2O_5 ha^{-1}.

Key words: Cowpea, Phosphorus supplementation, Times of sowing.

INTRODUCTION

Green forages, the foremost component in the livestock production, have cooling effect on the animal body as they are palatable, easily digestible, nutritious and slightly laxative. The use of concentrates provides highest animal production per unit feed intake, but this may not be economical in countries like India where grains and concentrates are costly and/or having limited supply. Though cereal-based green fodders are palatable, succulent and nutritious with sufficient amount of carbohydrates, they are deficient in protein which is necessary for animal health and productivity. Proteins can be supplemented through leguminous green fodders. Cowpea [*Vigna unguiculata* (L.) Walp.] has emerged as a potential crop for meeting the requirements of high quality fodder to the fast expanding cattle populations. It is a major source of plant proteins and vitamins for man, feed for animals and also a cash crop. It provides palatable, notorious and balanced feed to milch animals. It contains 20-24% crude protein, 23-25 per cent cellulose and 5-6 per cent hemicelluloses on dry matter basis. The fodder cowpea has digestibility of about 70 per cent. Cowpea, when fully nodulated, can fix 20 to 140 kg N ha^{-1} in the soil. There is a wide gap between the demand and supply of green forage particularly during the lean period, which can be reduced through the agronomic approaches. Among these, sowing window and fertilizer application are considered to be the most important factors affecting the production potential of the crop. The sowing time of the fodder cowpea affects the fodder supply to considerable extent and hence, proper sequence of sowing the crops should be adopted in order to achieve maximum fodder yield along with maintaining the regular supply of the green fodder. Among the nutrients, phosphorus has an adverse impact on legume production as it is one of the vital nutrients required for optimum growth, development, productivity of plants (Kumar *et al*., 2021), as well as for nodulation and enhanced N-fixation (Yadav *et al.,* 2017). Being the leguminous crop cowpea responds more to phosphoric nutrient than nitrogen and potassium. Considering the above facts, the present investigation was

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taken up in order to find out the optimum time of sowing and optimum dose of phosphatic fertilizer for the production of fodder cowpea.

Materials and Methods

The field experiment was conducted at S.V. Agricultural College Farm, Tirupati campus, Acharya N. G. Ranga Agricultural University during the summer, 2019. The soil of the experimental field is sandy loam in texture, neutral in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and potassium. The experiment was laid out in split-plot design with three sowing time *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 weekly weather data prevailed during the season is given in Fig 1. Phosphorus was applied as per the treatments while nitrogen was applied in common to all the treatments.

Results and Discussion

Growth parameters

The results indicated that all the growth parameters (plant height, number of leaves $plant^{-1}$, number of branches $plant^{-1}$, dry-matter production and number of nodules $plant^{-1}$) were higher for the crop sown during I FN of January followed by that sown during II FN of January (Table 1) with no significant disparity between them. This might be due to the favourable climatic conditions that prevailed during the crop growth period and might have been instrumental in boosting up the crop growth. Our findings are in agreement with the findings of Kumar and Patel (2013) and Ahmed *et al.* (2017). A lower stature of growth parameters was recorded for the crop sown during I FN of February.

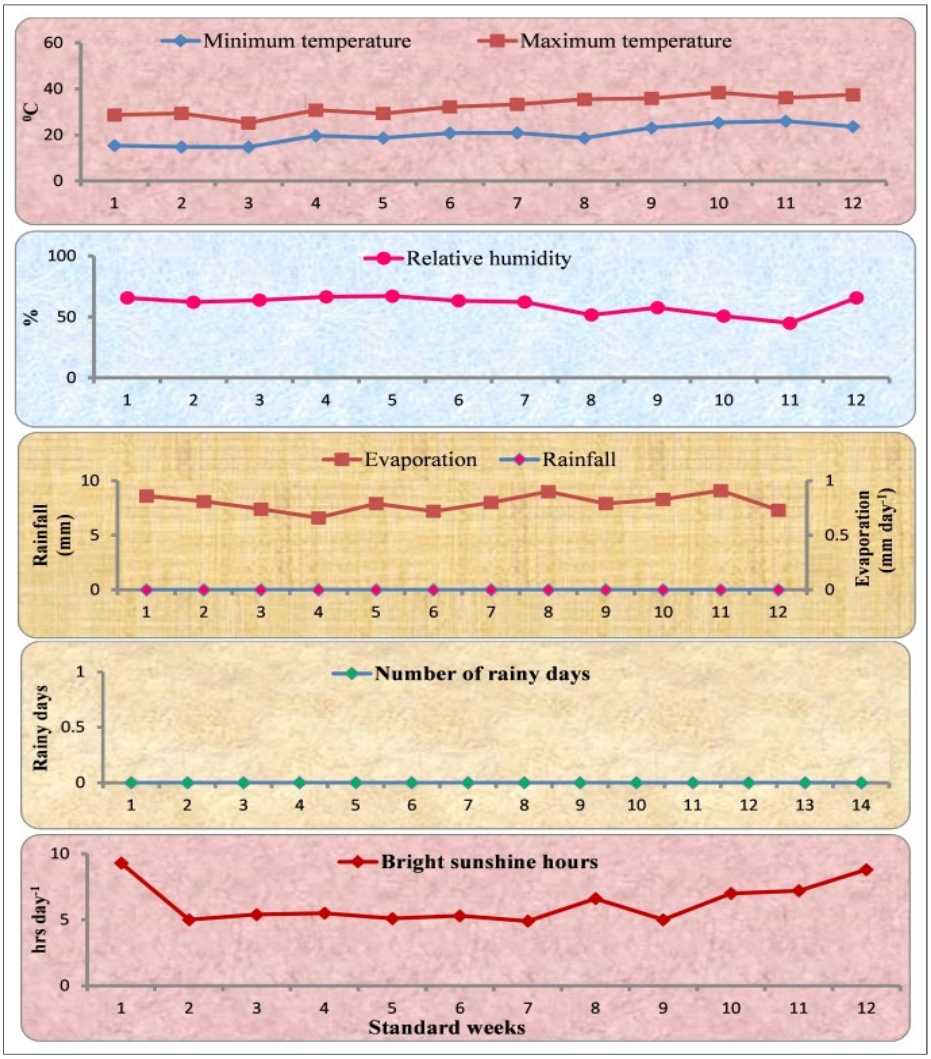


Fig 1: Standard week-wise meteorological data during the crop growth period of fodder cowpea (05-01-2019 to 20-03-2019).

Table 1: Influence of the time of sowing and level of phosphorus on plant height, number of leaves, number of branches, drymatter and number of nodules of fodder cowpea at harvest.

Treatment	Plant height (cm)	Number of leaves (plant^{-1})	Number of branches (plant^{-1})	Dry matter production (kg ha^{-1})	Number of nodules (plant^{-1})
Times of sowing					
T_1 - I FN of January	58.5	46.0	7.0	3297	21.6
T_2 - II FN of January	53.8	43.2	6.6	3131	20.6
T_3 - I FN of February	48.0	34.0	5.1	2844	18.3
SEm±	1.27	0.85	0.14	70.6	0.48
CD (P= 0.05)	5.1	3.4	0.6	285	1.9
Phosphorus level					
P_1 - 0 kg P_2O_5 ha^{-1}	6.1	17.8	5.5	2607	18.3
P_2 - 20 kg P_2O_5 ha^{-1}	6.8	19.9	6.1	2891	20.0
P_3 - 40 kg P_2O_5 ha^{-1}	7.4	21.3	6.3	3328	20.1
P_4 - 60 kg P_2O_5 ha^{-1}	8.3	23.9	7.0	3538	22.1
SEm±	0.10	0.60	0.17	69.87	0.54
CD (P= 0.05)	0.3	1.8	0.5	209	1.6
Times of sowing × Phosphorus level					
P × T					
SEm±	0.15	0.91	0.29	141.22	0.96
CD (P= 0.05)	NS	NS	NS	NS	NS
T × P					
SEm±	0.17	1.00	0.30	126.38	0.94
CD (P= 0.05)	NS	NS	NS	NS	NS

Application of 60 kg P_2O_5 ha^{-1} resulted in significant improvement in the growth parameters at all the stages of observation while the lowest value was recorded under the control (Table 1). Increase in the growth parameters with increasing phosphorus level can be attributed to the fact that phosphorus is required in large quantities in shoot and root tips where metabolism is high resulting in favourable effect on cell division/enlargement that is reflected on growth of the plant. Similar findings were observed with Kumar (2011) and Shekara *et al.* (2010). The interaction between time of sowing and phosphorus level influencing the growth parameters was observed to be non-significant.

Leaf to stem ratio and fodder yield

Higher leaf to stem ratio and green fodder yield of fodder cowpea was recorded when the crop was sown during I FN of January which was however on par with that of II FN of January (Table 2). The higher leaf to stem ratio and fodder output with earlier sowings could be related to higher leaf weight than green stem weight, as well as the fact that early seeded crops took the most calendar days to harvest, resulting in a longer vegetative period, which in turn reflected on the green fodder production. The results are in consonance with the findings of Ashwathi (2016), Ali *et al.* (2007) and Ram *et al*. (2014). Fodder cowpea sown during I FN of February recorded the lowest leaf to stem ratio and fodder yield (Table 2).

Table 2: Leaf: Stem ratio and green fodder yield of fodder cowpea at harvest as influenced by the times of sowing and graded level of phosphorus.

Treatment	Leaf to stem ratio	Green fodder yield (t ha^{-1})
Times 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 level		
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
Times of sowing × Phosphorus level		
P × T		
SEm±	0.028	0.53
CD (P= 0.05)	NS	NS
T × P		
SEm±	0.023	0.49
CD (P= 0.05)	NS	NS

The highest phosphorus level of 60 kg P_2O_5 ha^{-1} resulted in significantly higher leaf to stem ratio and green fodder yield compared to the lower levels of phosphorus tested. The next best treatment was 40 kg P_2O_5 ha^{-1} which was however on par with that of 20 kg P_2O_5 ha^{-1} (Table 2). The lowest leaf to stem ratio and green fodder yield was recorded with control (Table 2). The higher leaf to stem ratio and green fodder yield may be due to adequate nutrient supply and efficient utilisation through an extensive root system developed by phosphorus application, which resulted in higher plant height, leaf area, number of leaves $plant^{-1}$ and number of branches $plant^{-1}$. These results are in line with the earlier findings as reported by Shekara *et al.* (2012), Godara *et al.* (2016) and Kumawat and Khinchi (2017).

CONCLUSION

A larger part of the areas under cultivation is deficient in one or other nutrients. Therefore, the need of the day is to manage nutrient deficiencies to maximize the crop yield and quality (Kumar *et al*., 2022). The present investigation indicates that fodder cowpea gives optimum growth and yield on sown during I FN of January with basal application of P_2O_5 at the rate of 60 kg ha^{-1}. If sowing is delayed due to any of the reasons, it can be postponed until II Fortnight of January without a significant reduction in yield. This help managing both nitrogen and phosphorus nutritional requirements.

Conflict of interest

All authors declared that there is no conflict of interest.

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