http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences, 1 (3): 212-214, 1998 *Research Article*

Growth and Yield Response of Rice Bean (*Vigna umbellata*) Fodder to Different Levels of N and p

K. Iqbal, A. Tanveer, A. Ali, M. Ayub and M. Tahir
Department of Agronomy, University of Agriculture, Faisalabad-38040,
**Barani Training Institute, Daghal, Rawalpindi, Pakistan*

Abstract
Study to determine the effect of different levels of N and P on the fodder yield and quality of rice bean comprised NP combinations of 0-0 (control), 25-25, 25-50, 25-75, 50-25, 50-50 and 50-75 kg ha^{-1}. Plant height, number of branches, leaves and leaf area increased significantly by the application of N and P over control. Maximum green fodder yields of 50.35, 51.61 and 53.03 t ha^{-1} were obtained in plots fertilized at 50-25, 50-50 and 50-75 kg ha^{-1}, NP respectively. Crude protein, crude fibre and ash contents of the rice bean were increased by increasing rates of N and P.

Key words: Rice bean; NP; Fodder yield; Protein; Fibre and Ash contents

Introduction
In Pakistan, shortage of green fodder is one of the limiting factors to maintain present livestock population. This shortage is about 40-50 percent which reaches up to 75 percent in fodder lean period i.e. May-June and November-December. Pakistan has about 21 million hectares of cultivable area but due to shortage of food, arable crops are cultivated even on the marginal lands and as such the land cannot be shifted permanently to forage crops. Under such conditions, the evolution of high yielding crop varieties especially the leguminous fodder crops is the dire necessity in briding the production and demand gaps especially during scarcity periods. To meet the demand of fodder during lean periods, rice bean has been identified as the most promising fodder crop. It is a palatable and highly nutritious fodder and is richer than other legume fodders like cowpeas (*Vigna ungiculata*) and moth (*Vigna acontifolius*) in protein, calcium and phosphorus with more fodder yield (Chatterjee and Das, 1989). It can produce 32-82 q ha^{-1} dry berbage to meet scarcity of green forage during lean periods (Mukerjee *et al*., 1980).

It is an admitted fact that quality of a crop in respect to its protein contents is enhanced by nitrogen application, besides an increase in vegetative growth. But it is only possible when a suitable and proper amount of fertilizer is used. Jamriska (1987) found that N at 120 kg ha^{-1} improved crude protein, crude fibre compared with lower N rates (40, 80 kg ha^{-1}) in *Medicago sativa*. Sinha and Rai (1990) reported that increasing P_2O_5 and N rates (0, 75 and 150 kg ha^{-1}) increased *Trifolium alexandrium* yields. According to Grimak *et al*. (1991), NPK at 120+120+20 kg ha^{-1} gave the highest fodder yield of *Trifolium pretense*. It also gave the highest digestible crude protein yield. Jin *et al*. (1992) reported increased plant height, primary branches and number of leaves of *Vigna unguiculata* with increasing rate of P_2O_5 (0, 40, 80, 160 or 320 kg ha^{-1}). This crop has recently been introduced in the country and information regarding its production technology including fertilizer is not available from Pakistan.

Materials and Methods
The experiment was laid out in a randomized complete block design with four replications using a net plot size of 6 × 2 m. Rice bean variety P.1.2154 was sown in 25 cm apart rows with the help of a single row hand drill using a seed rate of 30 kg ha^{-1}. Experiment comprised nitrogen and phosphorus (P_2O_5) levels of 0-0, 25-25, 25-50, 25-75, 50-25, 50-50 and 50-75 kg ha^{-1}, Whole of nitrogen and phosphorus was applied at sowing in the form of urea and single superphosphate, respectively. This experiment was conducted at the Students' Farm, Department of Agronomy, University of Agriculture, Faisalabad on sandy clay loam soil. Soil samples taken at the time of sowing were chemically analyzed as suggested by A.O.A.C. (1960) and average values of N and P were found to be 0.05 percent and 7.51 ppm, respectively. For recording plant height, number of branches per plant and number of leaves per plant, twenty plants were selected at random from each plot and average was calculated. Leaves of plants harvested from 50 cm row length were removed and passed through leaf area meter to record leaf area. Total nitrogen, crude fibre and ash contents in plants were determined as suggested by A.O.A.C., (1960). The nitrogen percentage was then multiplied with a 6.25 factor to obtain protein percentage (Winkleman *et al*., 1992).

Crude fibre percentage (CFP) was calculated as follows:

$$\text{CFP (\%)} = \frac{\text{Weight of dried residues - weight of ash}}{\text{Weight of moisture free sample}} \times 100$$

Ash percentage was determined by the following formula:

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

The data collected were analyzed by using Fisher's analysis of variance technique. Least significant difference at 0.05 probability level was applied to compare the differences among treatment means (Steel and Torrie, 1984).

Results and Discussion

The data regarding the effect of different levels of N and P on the plant height (Table 1) revealed that plants of all the treated plots resulted in significantly more height than that of control. Plots fertilized at 50-75 kg ha^{-1} NP resulted in significantly maximum plant height followed by plants treated with 50-50 and 50-25 kg ha^{-1} NP. Generally there was increase in plant height with increased rates of NP that could be due to their adequate supply, better root growth and major role of N in increasing plant height (Jin *et al*., 1992). Significantly the highest number of branches per plant were recorded in plots fertilized at 25-50, 25-75, 50-25, 50-50 and 50-75 kg ha^{-1} NP, the differences among them being non-significant. The lower number of branches in unfertilized plot might be due to poor sprouting and plants failed to show full genetic potential (Jin *et al*., 1992). Data regarding number of leaves per plant (Table 1) indicated that all the treated plots resulted in significantly more number of leaves per plant as compared to control (18.70) and there was no significant difference between the treatments applied 25-50, 25-75, 50-25 and 50-50 kg ha^{-1} NP. The increase in number of leaves per plant with increase in nitrogen or P_2O_5 levels might be due to better nutrient supply for photosynthesis which resulted in better growth and development of leaves. Application of 25-50 kg ha^{-1} NP gave the maximum leaf area of 2431.94 cm^2 per plant which was statistically at par with leaf area obtained with 25-75, 50-25, 50-50 and 50-75 kg ha^{-1} NP. The difference in leaf area per plant could be attributed to differences in number of leaves and their response to differential doses of NP fetilizer as also reported by Jin *et al*. (1992). Moreover, non-significant increase in leaf area beyond 25-50 kg ha^{-1} NP could be due to genetic inability of crop plants. Increased levels of NP resulted in linear increase in green fodder yield. Treatment with 50-75 kg ha^{-1} NP resulted in more green fodder but did not differ significantly from treatments with 50-50 and 50-25 kg ha^{-1} NP. Next to follow were treatments with 25-75 and 25-50 kg ha^{-1} NP. Treatment with 25-25 kg NP ha^{-1} and control were trailing behind in descending order. The more green fodder yield obtained under higher fertilizer doses may be attributed to increased plant height, number of branches and number of leaves per plant and increased nitrogen rate which is a major factor in exploiting the maximum vegetative growth potential of any crop. Better response of crop at 25 kg N and 25 kg P_2O_5 ha^{-1} might be due to their more appropriate and balanced supply. Phosphorus availability is less in Pakistani soil due to its fixation even at high level. Similar conclusions had been drawn by Mukerjee *et al*. (1980).

Data regarding crude protein contents (Table 2) showed that successive increase in N fertilizer gave more protein percentage. Highest crude protein percentage in rice bean was obtained in plots fertilized with 50-75 kg ha^{-1} NP which was statistically similar with plants of plot having 50-50 kg ha^{-1} NP. These were followed by 50-25 and 25-75 kg ha^{-1} NP in respect of crude protein. Since N is an essential component of protein which might had resulted in more crude potein in plants receiving more NP (Jamriska, 1987).

Table 1: Effect of different levels of N and P on plant height, number of branches, number of leaves, leaf area per plant (cm^2) and fresh fodder yield (t ha^{-1}).

Treatments NP (kg ha^{-1})	Plant height (cm)	No. of branches per plant	No. of leaves per plant	Leaf area per plant (cm)	Fresh fodder yield (t ha^{-1})
0-0	76.84 e	3.14 c	18.70 d	590.18 c	23.75 d
25 - 25	106.20 d	3.58 b	28.60 c	999.63 b	30.89 c
25 - 50	112.78 cd	4.22 a	55.15 b	2431.94 a	46.96 b
25 - 75	114.25 c	4.10 a	55.13 b	2421.19 a	44.64 b
50 - 25	122.01 b	4.16 a	55.97 b	2294.25 a	50.35 a
50 - 50	126.01 b	4.20 a	56.96 b	2419.56 a	51.61 a
50 - 75	134.83 a	4.20 a	59.55 a	2310.96 a	53.03 a

Table 2: Effect of different levels of N and P on crude protein (%), crude fibre (%) and ash (minerals) contents (%) of rice bean fodder.

Treatments NP (kg ha^{-1})	Crude protein (%)	Crude fiber\ (%)	Ash (minerals) content (%)
0 - 0	15.23 d	25.65 d	4.27 e
25 - 25	15.57 d	27.42 cd	6.59 d
25 - 50	16.93 c	27.46 cd	8.21 bc
25 - 75	18.51 b	28.02 c	8.41 bc
50 - 25	19.64 b	30.23 b	8.13 c
50 - 50	21.33 a	32.12 b	9.33 ab
50 - 75	21.89 a	34.38 a	10.64 a

Means not sharing a letter in common differ significantly at 5% probability.

The addition of phosphorus increases the nitrogen percentage in legumes besides the maximum increase in dry matter production. This is attributed to better root development and plant metabolism. More protein contents could also be attributed to phosphorus which improved protein synthesis because it is an essential component of nucleo-protein. As regards the crude fibre contents it was maximum in plots fertilized at 50-75 kg ha^{-1}. Next to follow were plots with 50-25 and 50-50 kg ha^{-1} NP. Application of lower fertilizer rates i.e. 25-25 and 25-50 kg ha^{-1} NP failed to significantly improve crude fibre content as compared to control. More crude fibre contents at 50-75 kg ha^{-1} NP might had resulted from better adoption of N and P and their utilization towards growth. Similar results were reported by Jamriska (1987). Plants of plots fertilized at 50-75 kg ha^{-1} NP produced highest ash content (Table 2) but did not differ significantly when compared with plots fertilized at 50-50 kg NP ha^{-1}. Higher ash contents in fertilized plots may be attributed to more fodder yield. It can be concluded that rice bean as a fodder crop should be fertilized at 50-25 kg ha^{-1} NP, being more economical.

References

AOAC., 1960. Official Methods of Analysis. 9th Edn., Association of Official Analytical Chemists, Washington, DC., USA.

Chatterjee, B.N. and P.K. Das, 1989. Forage Crop Production: Principles and Practices. Oxford & IBH, UK., ISBN-13: 9788120403987, Pages: 484.

Grimak, N.I., V.F. Novalenko and K. Bespal, 1991. Fertilizer and red clover yield. Kormovye-Kultury, 2: 37-38.

Jamriska, P., 1987. Effect of nitrogen fertilization, sowing rate and harvesting time of oats undersown with alfalfa on forage yield and quality. Agrochemia, 27: 71-75.

Jin, W.J., N.K. Cho and C.B. Yang, 1992. The effect of phosphate fertilizer levels on the agronomic characters of soiling cowpeas. J. Korean Soc. Grassland Sci., 12: 193-200.

Mukerjee, A.K., M.A. Roquib and B.N. Chatterjee, 1980. Rice been KI for the scarcity period. Indian Farming, 30: 26-28.

Sinha, M.N. and R.K. Rai, 1990. Phosphorus management and its utilization by berseem (*Trifolium alexandrinum* L.) and residual effect on forage crops. J. Nuclear Agric. Biol., 19: 169-172.

Steel, R.G.D. and J.H. Torrie, 1984. Principles and Procedures of Statistics. 2nd Edn., McGraw Hill Book Co. Inc., New York, pp: 172-177.

Winkleman, G.E., Rohul Amin, W.A. Rice and M.B. Tahir, 1992. Methods, Manual, Soils and Laboratory. Pakistan Agricultural Research Council (PARC), Islamabad, Pakistan.