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Growth and Yield Response of Rice Bean (*Vigna umbellata*) to Different Seeding Rates and Planting Patterns

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Abstract: Studies to evaluate the effect of different planting patterns and seed densities on the growth and yield performance of rice bean were conducted during 1997-98. The planting patterns were 60 cm apart single rows, 90 cm apart double row strips (30/90), 60 cm apart ridge sowing and 90 cm apart bed sowing with seeding densities of 20, 25 and 30 kg ha^{-1}. The results revealed that different growth and yield parameters were significantly influenced by different planting patterns and seed rates. The treatment combination of S_2P_3 (25 kg ha^{-1} seed under 60 cm ridge sowing) produced the highest grain yield of 1191.0 kg ha^{-1} and differed significantly from rest of all the treatment combinations.

Key words: Ricebean, growth and yield characters, seeding rate, plant pattern

Introduction

Rice bean has been identified as multipurpose crop i.e., a pulse, a fodder, green manure or cover crop. It is also adopted to such a higher temperatures and humidity levels, as well as heavy soils that only few crops can tolerate such conditions. This pulse crop is native to south and south east Asia and is cultivated in the same way as the more familiar Asian pulse, the mungbean. In Pakistan, being a new introduction its production technology is still to be standardized. A substantial increase in yield can be ensured simply by maintaining an appropriate plant population through a method of planting. Seed rate and planting pattern are not only the useful requirements but also act as a catalyst for attaining higher returns. Ahlawat *et al.* (1982) reported that increasing seeding rate from 40-80 kg ha^{-1} increased the yield of lentil. However, Aziz *et al.* (1988) found decreased 1000-seed weight and number of pods plant^{-1} with increasing seed rates. While, Ahmad *et al.* (1988) studied the effect of seed rates on mash bean yield and yield attributes and found that moderate seed rates (17.5-25 kg ha^{-1}) were necessary for attaining higher yield. Komatsu *et al.* (1989) concluded that number of pods, number of seeds pod^{-1} and 1000-seed weight were decreased with increasing seeding densities. While, Tripathi and Singh (1989) reported that increasing seeding rates increased dry matter accumulation. Abbas (1990) found that number of branches plant^{-1}, pod plant^{-1}, seed pod^{-1} and 1000-seed weight were affected significantly by different seed rates. However, Zahoor (1991) reported that 1000-seed weight, biological yield, seed yield and harvest index were not significantly influenced by different seeding densities. While, Prasad *et al.* (1994) found that the yield of rice bean (*Vigna umbellata*) was significantly influenced by different planting patterns. Similarly, Rath *et al.* (1996) reported the highest grain crop and straw yield of rice bean when sown in 60 cm row spacing.

Materials and Methods

The studies were conducted at the Agronomic Research Area, University of Agriculture, Faisalabad during 1997-98. Experiment was laid out under split plot arrangements with four replications keeping seed rates in the main and planting patterns in sub plots, measuring 3.6m x 5m. The treatments included in the trial were, seed rates (20, 25 and 30 kg ha^{-1}) and planting patterns (60 cm apart single rows, 90 cm apart double row strips (30/90), 60 cm apart ridge sowing and 90 cm wide bed sowing).
Crop was planted on August, 16, 1997 in a well prepared seed bed with the help of a single row hand drill. A basal dose of N and P (20-50 kg ha^{-1}) was applied at the time of seed bed preparation. All other agro-operations were normal and uniform for all the treatments. The crop was harvested on 15th, January, 1998. Observations on relevant growth and yield parameters were recorded using standard procedures. The data obtained were analyzed according to Fischer's analysis of variance technique and treatments means were compared by using LSD at 5% probability level (Steel and Torrie, 1980).

Results and Discussion

Data pertaining to rice bean growth and yield components as affected by different planting patterns and seed rates are presented in Table 1.

Number of plants plot^{-1}: Seed rates had a highly significant effect on the number of plants plot^{-1}. Significantly maximum number of plants plot^{-1} (574.9) were obtained in 30 kg ha^{-1} seeding rate followed by 25 and 20 kg seed ha^{-1}, respectively. All these treatments differed significantly from one another. These results are in line with those of Ahlawat *et al.* (1982) who reported increased plant population with higher seed rates.
Similarly, the planting patterns also significantly affected the number of plants plot^{-1}. Crop planted with 60 cm apart ridge sowing exhibited significantly maximum number of plants plot^{-1} (488.4) followed by 90 cm apart double row strip (479.7 plants plot^{-1}). While minimum plant population was obtained from 60 cm apart single row technique (470.6). Similar results were also reported by Prasad *et al.* (1994). However, the interactions between these factors (seed rates and planting patterns) were found to be non-significant.

Number of pods plant^{-1}: There was a gradual decrease in pods plant^{-1} with increasing seed rates. Seed rate of 20 kg ha^{-1} produced maximum pods plant^{-1} (40.84) but remained statistically at par with 25 kg ha^{-1} seed rate which produced 38.66 pods plant^{-1}. By contrast, the minimum pods plant^{-1} were produced by sowing @ 30 kg seed ha^{-1}. Lowest seed rate produced less plants per unit area resulting in favourable conditions for space, light, air etc. leading to better pod formation. These results are in conformity with those of Aziz *et al.* (1988).
Similarly, different planting patterns also significantly affected the number of pods plant^{-1}, where 60 cm apart ridge sowing produced maximum number of pods plant^{-1} (38.78) followed by 90 cm apart double row strips and 90 cm wide bed sowing.

Table 1: Growth and yield of Ricebean as influenced by different planting patterns and seed densities

	No. of plant plot^{-1}	No. of plant plot^{-1}	No. of grain pod^{-1}	1000-grain weight (g)	Biological yield (kg ha^{-1})	Grain yield (kg ha^{-1})
I. Seed Rates (kg ha^{-1})						
S_1 = 20	380.50c	40.84a	4.48b	51.47c	3404.00b	780.0b
S_2 = 25	479.68b	38.66a	5.37a	61.18a	3760.00ab	894.4a
S_3 = 30	574.93a	29.25b	5.50a	57.99b	3824.00a	863.6a
LSD 5%						
II. Plant patterns						
P_1 = 60 cm apart single rows	470.58c	31.69c	5.19^{NS}	53.79b	2625.00d	672.8d
P_2 = 90 cm apart double row strips	479.66b	37.90ab	5.07	55.07b	3769.00c	880.5b
P_3 = 60 cm apart ridge sowing	488.41a	38.78a	5.35	62.95a	4016.00b	1096.0a
P_4 = 90 cm apart bed sowing	474.83bc	36.64b	4.85	55.72b	4241.00a	735.0c
LSD 5%						
Interaction (S xP)	NS	*	*	*	**	**

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

Various treatment combinations also significantly differed from one another. Maximum number of pods plant^{-1} (45.01) were produced by seeding @ 20 kg seed ha^{-1} and 60 cm apart ridge sowing but remained statistically at par with S_1P_2 and S_2P_4 treatment combinations. However, minimum number of pods plant^{-1} (25.21) were produced with the treatment combination of S_3P_1 which remained statistically alike S_3P_4 treatment combinations.

Number of grains pod^{-1}: Planting patterns did not significantly affect the number of grains pod^{-1} that varied from 4.87 to 5.35. These results are, however contradictory to the findings of Prasad *et al.* (1994). By contrast the different seed rates had a significant affect on number of grains pod^{-1} The maximum grains pod^{-1} were produced where seed was used @ 30 kg ha^{-1} (5.50) but it remained at par with 25 kg seed ha^{-1}. These results are in agreement with that of Abbas (1990). However, contrary with those of Komatsu *et al.* (1989) who reported decreased number of grains pod^{-1} with increasing seed rates.
Interactive effect of seed rates and planting patterns was also found to be significant. Rice bean sown @ 25 kg ha^{-1} and 60 cm apart ridge sowing produced maximum number of grains pod^{-1}, whereas 20 kg seed ha^{-1} produced minimum (3.92) number of grains pod^{-1}.

1000-grain weight (g): As regards seed rates sowing of rice bean @ 25 kg seed ha^{-1} (S_2) produced maximum 1000-grain weight of 61.19 g and differed significantly from sowing @ 20 kg seed ha^{-1} and 30 kg seed ha^{-1}. These results are in line to that of Ahmad *et al.* (1988) who reported the significant effect of seed rates on different yield attributes.
Similarly, the planting pattern of 60 cm apart ridge sowing produced highest 1000-grain weight (62.95g) and differed significantly from all other planting patterns.
Various treatment combinations also significantly differed from one another. The treatment combination of S_3P_3 produced maximum 1000-grain weight which, however, did not differ significantly from S_2P_3 and S_2P_2 treatment combinations.

Biological yield (kg ha^{-1}): Biological yield was significantly influenced by different seed rates and it was increased with the increase in seed rate. Seeding rate of 30 kg ha^{-1} produced the maximum biological yield (3824.0 kg ha^{-1}) but did not differ significantly from 25 kg ha^{-1} seed rate. Whereas, the minimum biological yield was obtained from 20 kg seed ha^{-1} which was, however, not statistically different from 25 kg seed ha^{-1}. These results are in confirmation with those of Tripathi and Singh (1989) but contrary with that of Zahoor (1991).
As regard planting patterns,the maximum biological yield was obtained in 90 cm apart wide bed sowing (4241 kg ha^{-1}). While the minimum biological yield (2625 kg ha^{-1}) was obtained from 60 cm apart single row. These results are, however, contrary with that of Rath *et al.* (1996) who found 60 cm apart row spacing, the best for higher straw yields. Interactive effect of seed rates and planting patterns on biological yield was also significant. Rice bean sown at 90 cm wide bed sowing and 30 kg ha^{-1} seed rate (S_3P_4) produced maximum biological yield (5876 kg ha^{-1}) and differed significantly from rest of the treatment combinations.

Grain yield (kg ha^{-1}): Seeding rates produced significantly different grain yield. Significantly maximum grain yield of 894.4 kg ha^{-1} was obtained from 25 kg seed ha^{-1} but it did not differ significantly from 30 kg seed ha^{-1}. Similarly, planting patterns had a significant effect on the grain yield. Maximum grain yield was recorded in 60 cm apart ridge sowing (1096 kg ha^{-1}), which differed significantly from other planting patterns.
Various treatment combinations also significantly differed from one another. Maximum grain yield of 1191 kg ha^{-1} was obtained by 25 kg seed ha^{-1} in 50 cm apart ridge sowing (S_2P_3) and differed significantly from rest of other treatment combinations.
From the present studies, it can be concluded that seeding of rice bean @ 25 kg ha^{-1} with 60 cm apart ridge sowing is recommended for achieving higher yields.

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