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Growth, Seed Yield and Grain Protein Content of Ricebean as Affected by Varying Planting Pattern and Interplant Spacing

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ABSTRACT

Effects of different planting pattern (60 cm apart single rows, 90 cm apart double row strips, 60 cm apart ridge sowing) and interplant spacing (10, 20 and 30 cm) on growth, yield and quality of ricebean were studied in an experiment, at the Agronomic Research Area, University of Agriculture, Faisalabad during 1995 and 1996 on a sandy clay loam soil. Number of plants m^{-2}, plant height, number of pods/plant, 1000–grain weight and grain yield/ha were significantly effected by varying planting pattern. Whereas, varying plant density had a significant effect on number of plants m^{-2}, plant height, 1000–grain weight and grain yield per hectare. However, the interactive effect of planting pattern x plant density was only found to be significant on plant height and 1000–grain weight. The treatment P_2D_2 (90 cm apart double row strip x 20 cm interplant distance) emerged to be more suitable because of producing heavier grains resulting in relatively higher seed yield.

Key Words: Ricebean; Planting pattern; Interplant spacing; Growth; Yield

INTRODUCTION

Pulses are cheap source of vegetable protein and are known as poor man's meat in the developing world. The total production of pulses in Pakistan during 1997–98 was 1007.4 thousand tons and total consumption was about 1087.3 thousand tons showing a gap of 79.9 thousand tons which was met through import. Ricebean is an under utilized crop with a potential to become a major source of vegetable in tropics and sub–tropics. Ricebean a native of Southeast Asia (Buskill, 1935) is grown in India chiefly by the natives of the eastern and north eastern regions (Watt, 1971). In Pakistan ricebean has shown its success as grain, fodder or cover crop under experiments. However, its complete production technology is yet to be determined (Ahmad & Ashiq, 1992). Ricebean has a great yield potential and under good management, it produced about 3000 kg seed and upto 8200 kg ha^{-1} dry herbage (Mukherjee *et al.*, 1980). It has high protein content (14–24%) and is rich in amino acids like methionine and tryptophan (Chandel *et al.*, 1978).

Among many agronomic factors responsible for realizing good yields appropriate plant population and its adjustment over the field are of prime importance. Hursca and Oria (1981) reported increased plant height and pod setting with a dense stand (25 plants m^{-2}). Seed yield was maximum at the lowest density (10 plants m^{-2}) in mungbean. Saharia (1981) reported that seed yield of green gram was not significantly affected by growing in rows 22.5, 37.5 or 45 cm apart. The number of branches and pods per plant were higher with wider row spacing. However, Rajput and Verma (1982) reported that the yield of mungbean was higher at 30 x 10 cm than at 20 x 10 cm or 40 x 10 cm spacings. Patel *et al.* (1984) observed mungbean grown in rows 15 or 45 cm apart gave the lowest seed yields than when grown in rows 30 cm apart. Panwar and Sirobi (1987) concluded that yield/ha and number of seeds pod^{-1} increased with increasing plant density whereas yield $plant^{-1}$, number of flowers $plant^{-1}$ and pods $branch^{-1}$ decreased in all cultivars of mungbean under study. Pookpakdi and Pataradilok (1993) reported that increase in plant density increased yield and reduced pods $plant^{-1}$ in mungbean. Prasad *et al.* (1994) reported that yield of ricebean decreased with increasing spacings (30, 45 or 60 cm). Varied response of mungbean to different plant population and scarce reports available regarding ricebean in this respect, necessitated to plan the present investigations for determining a suitable planting pattern and interplant spacing for exploring yield potential of ricebean.

MATERIALS AND METHODS

Experiment was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad during 1995–96 and 1996–97. Crop was sown on a well prepared seed bed in the first week of August, using a seed rate 30 kg ha^{-1}. Three planting pattern viz. 60 cm spaced single rows, 90 cm spaced double row strips, and 60 cm apart ridges and three plant densities viz. 10, 20 and 30 cm inter plant spacing were randomly placed in the experimental plots. A basal dose of fertilizer @ 40–60 kg NP ha^{-1} was applied at sowing. Methyl Parathion @ 500 ml $acre^{-1}$ was sprayed against the attack of white fly at vegetative growth stage. The data collected were analysed by

Fisher's analysis of variance technique using least significant difference (LSD) at 0.05 probability level to compare the differences among the treatment means (Steel & Torrie, 1984). Computer packages MSTAT were used for statistical analysis while Lotus 123 and HARVERD GRAPHIC were used to prepare the graphs.

RESULTS AND DISCUSSION

Crop sown in 60 cm apart flat rows or on ridges produced significantly higher number of plants m^{-2} than the crop grown in 90 cm apart double row strip (Table I). Increasing the interplant distance resulted in a decrease in number of plants m^{-2}. Different combinations of planting pattern and inter plant spacing had non–significant effect on number of plant m^{-2}. Crop sown in 60 cm apart ridges or 90 cm apart double row stirps gave statistically higher and similar plant height. However 60 cm apart single rows planted crop produced as tall plants as 90 m apart double row planted crop. Increasing interplant distance beyond 20 cm reduced plant height. Increased plant height in narrow interplant spacing could be attributed towards the plant competition for resources under these situations leading to taller plants as a result of malnutrition. The interactive effect on the parameter under question was also significant. Crop sown in 60 cm apart single rows at interplant spacing of 20 cm, 90 cm apart double rows with 10 and 20 cm interplant spacing and one sown on 60 cm apart ridges with interplant spacings of 10 and 20 cm produced plants which had statistically similar and greatest heights. Hursca and Oria (1981) also reported that plant height of mungbean was more with a dense stand than in a lower density.

Highest and statistically similar number of pods per plant (Table I) were recorded in plots where crop was sown in 90 cm apart double rows or in 60 cm apart ridges. Number of pods per plant were not affected by changing interplant spacing. Similarly different combinations of planting pattern and interplant spacing remained effective in this regard.

Both planting pattern and interplant spacing individually and in combination significantly affected 1000–grain weight in ricebean (Table I). Crop sown in 90 cm apart double rows with interplant spacing of 20 and 30 cm and also in 60 cm apart ridges with 20 cm interplant spacing produced the heaviest and similar grains. Karwasra and Faroda (1979) reported that

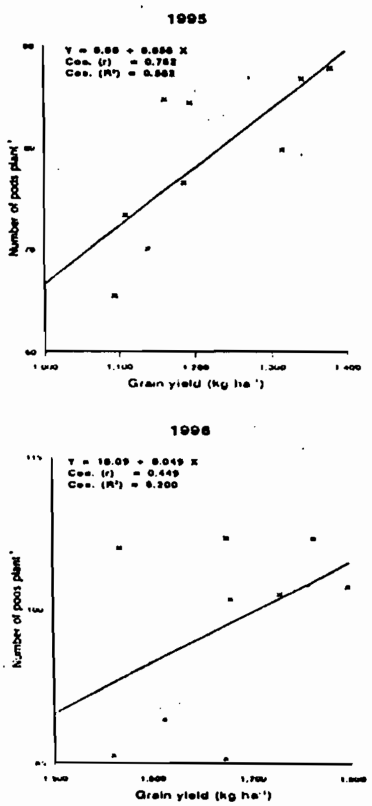
Table I. Effect of planting pattern and plant density on growth, seed yield and quality of ricebean

Treatments	Average of two years (1995/96 & 1996/97)					
	Number of plants (m^{-2})	Plant height (cm)	Number of pods/plant	1000–grain weight (g)	Grain yield (kg ha^{-1})	Grain protein content (%)
a)Planting pattern(P)						
P_1 = 60 cm apart single rows	9.03 a	104.86 b	85.77 b	53.15 b	1401 b	20.97^{NS}
P_2 = 90 cm apart double row strips	8.40 b	107.70ab	90.68 a	55.17 a	1466 a	21.12
P_3 = 60 cm apart ridge sowing	9.00 a	110.50 a	89.50 a	55.10 a	1453 ab	20.61
b)Stand Density(D)						
D_1 = 10 cm interplant distance	12.06 a	109.10 a	78.21	52.34 c	1365 b	20.61
D_2 = 20 cm interplant distance	8.53 b	110.40 a	93.21	56.54 a	1640 a	21.66
D_3 = 30 cm interplant distance	5.84 c	103.60 b	94.31	54.58ab	1425 b	20.43
c) Planting pattern x Stand						
P_1D_1	12.05^{NS}	94.45 e	75.60^{NS}	51.89de	1328^{NS}	20.89^{NS}
P_1D_2	9.15	112.80abc	90.42	51.51bcd	1497	21.71
P_1D_3	5.91	107.20bcd	91.27	53.05cde	1378	20.32
P_2D_1	11.56	115.20ab	81.30	50.78e	1361	20.64
P_2D_2	7.91	109.10abc	95.05	58.78a	1589	21.93
P_2D_3	5.73	98.82 de	95.70	55.97abc	1479	20.78
P_3D_1	12.56	117.70a	77.72	54.35bcd	1406	20.30
P_3D_2	8.55	109.10abc	94.15	56.29ab	1534	21.35
P_3D_3	5.88	104.60cd	95.95	54.72bcd	1419	20.38

1000–grain weight of chickpea increased with increasing inter row spacing because of better light penetration and aeration.

Ricebean planted in 90 cm apart double rows or 60 cm apart ridges gave statistically highest and similar grain yield (1466 and 1453 kg ha^{-1} respectively) (Table 1). However, crop planted in 60 cm apart single rows gave as good yield as planted in 60 cm apart ridges. An interplant spacing of 20 cm gave statistically highest grain yield (1640 kg ha^{-1}). Any decrease/increase in interplant spacing than this one resulted in reduction in yield of ricebean. These results are in line with those of Bajpai *et al.* (1981) who reported that seed yield of green gram was significantly greater when grown at a moderate spacing between rows and plants than either narrow or wider spacings.

Fig. 1. Association of number of pods per plant with grain yield of ricebean as affected by planting patterns and stand density during 1995 and 1996

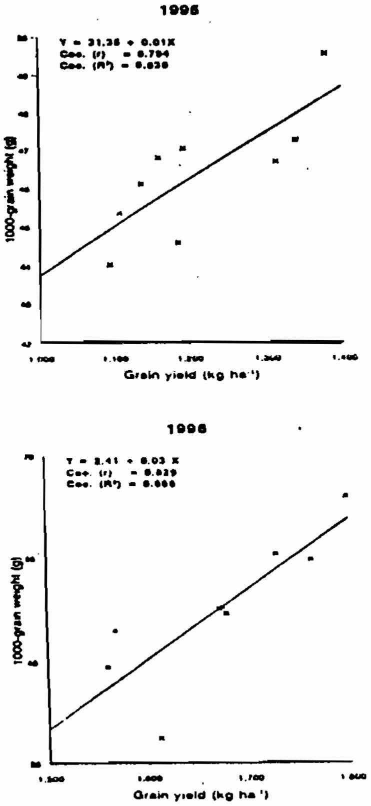


Grain–protein content is considered an important quality characteristic of grain legumes. Data (Table 1) showed that the influence of planting pattern and stand density on grain protein content could not reach to the level of significance. However, crop sown in 90 cm apart double row strips with 20 cm interplant spacing produced relatively maximum protein content (21.93%). Jain and Chauhan (1988) reported that seed protein contents of mungbean were higher in wider rows than in narrow rows.

CORRELATION ANALYSIS

Correlation analysis of planting pattern x interplant spacing interaction showed positive association between number of pods/plant and grain yield ha^{-1} during both the years (Fig. 1). Such association is further supported by the regression model which exhibited sturdy dependence of grain yield ha^{-1} on number of pods/plant.

Fig. 2. Association of number of pods per plant with grain yield of ricebean as affected by planting patterns and stand density during 1995 and 1996



Similarly, correlation analysis showed positive correlation between 1000–grain weight and grain yield ha^{-1} during both the years (Fig. 2). It was further strengthened by the regression model which was indicative of supporting behaviour of 1000–grain weight with grain yield.

CONCLUSION

The results revealed that ricebean grown in 90 cm apart double row strips with 20 cm interplant spacing gave comparatively maximum grain yield.

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