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Effect of Different Planting Pattern on Growth, Yield and Quality of Grain Legumes

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Abstarct

A field experiment to study the effect of two planting patterns (40 cm apart single rows and 60 cm apart double rows) on the growth and yield performance of kharif legumes namely mungbean, mashbean, cowpea and ricebean was carried out during the year 2002. The legumes sown in 60 cm apart double row strips gave significantly higher number of pods plant^{-1}, seed yield and protein contents than 40 cm apart single rows. Whereas, plant density, plant height and number of seeds pod^{-1} were not affected significantly by planting patterns. Based on these findings it is recommended that these legumes should be grown in 60 cm apart double row strips for obtaining higher yields under agro-climatic conditions of Faisalabad.

Keywords: Planting pattern, Growth, Yield, Legume

Introduction

According to the nutritionists, edible legumes, an excellent source of dietary proteins and oils, can play an important role in fulfilling requirements of rapidly increasing population. The pulses contain 20-24% proteins (Nazir, 1996) and can provide a balanced diet when eaten in combination with wheat, rice and other cereals.

Pakistan has made impressive development in agriculture sector but the production of pulses has been stagnant due to the absence of comprehensive national research support. In Pakistan, legumes occupy an area of 1537.5 thousand hectares with production of 902 thousand tones of seed annually and national average yield of 587 kg ha^{-1} (Anonymous, 2000). Among various agronomic factors limiting yield, planting pattern is considered of great importance. Increase in yield can be ensured by maintaining appropriate plant population through different planting patterns.

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Seed yield and yield parameters of mungbean were affected significantly by different planting patterns and maximum seed yield was obtained in 30 cm apart rows (Ali *et al*., 2001). Similarly Qamar and Malik (1999) observed significant effect of row spacing in ricebean and reported that 90 cm apart double row strip produced higher seed yield. Kakar *et al*., (1999) reported that soybean yield was affected significantly by different cropping patterns and a cropping pattern of 45 x 10 cm gave the highest seed yield. However, Sharar *et al*., (2001) reported a non- significant effect of row spacing on the growth and yield of chickpea. Ismail and Hall (2000) found a decrease in seed yield of cowpea with increased spacing. Muchow (1985) examined the competitive response of range of legumes to soil moisture regimes and reported that grain legumes varied significantly from each other in term of phenology and yield. Similarly, David and Nielsen (2001) determined the potential of chickpea, lentil and field pea and reported that grain legumes showed significant differences and chickpea responded better in increased irrigation levels. Keeping this in view the present study was initiated to find out suitable planting pattern for grain legume crops to obtain maximum yield under Faisalabad conditions.

Materials and Methods

A field experiment to determine the comparative production potential of different grain legumes namely mungbean, mashbean, cowpea and ricebean, under different planting patterns i.e. sowing in 40 cm apart single row and 60 cm apart double row strips; was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad, during autumn of 2001. The experiment was laid out in randomized complete block design (RCBD) with factorial arrangement having three replications. The net plot size was 2.4 m x 7m. All the crops were sown on August 3, 2001 using uniform seed rate of 25 kg ha^{-1}. The interplant spacing was maintained as 10 cm. A basal dose of 30 kg N and 60 Kg P_2O_5 ha^{-1} was applied in the form of Urea and Triple Super Phosphate, respectively. All other agronomic practices were kept normal and uniform for all the treatments. Data on growth, yield and quality parameters of all the crops were recorded following

the standard procedure. The data collected was subjected to the Fisher's analysis of variance (ANOVA) technique and the treatment's means were compared by using Duncan's New Multiple Rang test at 5% probability level (Steel and Torrie, 1984).

Results and Discussion

The plant population per plot of different legumes was not affected significantly by different planting patterns (Table-I). This similar plant density might have been because of using a uniform seed rate and maintaining plant to plant distance by thinning.

Plant height was not affected significantly by different planting patterns. This might have been due to the similar plant density and maintaining same plant to plant distance by thinning. The non-significant affect of row spacing on the plant height has also been reported by Sharar *et al.* (2001). However, plants height differed significantly among grain legumes. The maximum plant height was recorded in ricebean whereas minimum plant height was observed in mashbean, which is statistically similar to cowpea. The interaction between these factors was found to be non-significant.

Number of pods per plant was affected significantly by different planting patterns. The 60cm apart double row produced more number of pods per plant than 40 cm apart single row strips in all legume crops. Higher number of pods per plant might have been due to efficient interception of light and utilization of available resources. A significant effect of planting geometry on number of pods per plant has been reported by Ali, *et al*. (2001). Different grain legumes differed significantly for number of pods plant^{-1}. The maximum number of pods plant^{-1} were recorded in ricebean. whereas, the minimum number of pods per plant was recorded in cowpea. The variation in number of pods plant^{-1} might be due to the genetic variability of the grain legumes. These results corroborate the findings of Essa *et al.* (1984). Interaction between planting patterns and grain legumes was also significant. The maximum number of pods was produced in ricebean when sown in 60cm apart double rows while minimum number of pods were found in cowpea at both planting pattern. Only mungbean and ricebean showed similar number of pods at both row spacings under study while other crops showed an increase in number of pods with increased spacing.

Planting pattern showed non-significant effect on the number of seeds per pod. The non-significant effect of row spacing on the number of seeds per plant has also been reported by Ali, *et al*. (2001) and Sharar, *et al*. (2001). But the results are contradictory to those of Aslam *et al*. (1993), who stated that 30 cm spacing gave higher number of seeds per pod in soybean. These contradictory results might have been due to variation in soil fertility, genetic makeup of crop plants and climatic conditions. The grain legumes differed significantly from one another for number of seeds per pod. The maximum number of seeds per pod was given by mungbean, which was followed by cowpea. The minimum number of seeds per pod was recorded in mashbean but it was statistically at par with ricebean. The variation in number of seeds per plant can be attributed to inherent ability of crop plants.

1000-seed weight was affected significantly by different planting patterns. Crops sown in 40 cm apart rows produced significantly higher 1000-seed weight than 60 cm apart double row strips. Significant effect of row spacing on 1000-seed weight has also been reported by Ali, *et al*., (2001). All grain legumes differed significantly for 1000-seed weight and maximum 1000-grain weight was recorded in cowpea. The minimum 1000-seed weight was given by ricebean, which was statistically at par with mungbean (50.22g). The variation in 1000-seed weight of different legumes may be a genetic factor. The results are similar to those of Qamar and Malik (1999).

The crops sown in 60 cm apart double row strip produced significantly higher seed yield than 40 cm apart single rows. The results are in contrast with those of Ali, *et al*., (2001) who reported a decrease in seed yield with increased spacing. The contradiction in results might have been due to variation in genetic makeup and fertility status of soil. Different legume crops differed significantly for seed yield. The maximum seed yield was produced by ricebean against the minimum by mashbean. The differences between seed yield of mashbean and cowpea could not reach to a significant level. The higher seed yield in ricebean might be due to the highest number of plants per plot and more number of pods per plant as compared to other legumes. Similar results were reported by Mukherjee *et al.* (1981). The significant differences among different genotypes of mungbean has been reported by Ali *et al*. (2000) and Ayub *et al*. (1999).

The interaction between grain legumes and planting pattern was also significant. The ricebean crop sown at 40 and 60 cm apart rows produced significantly higher seed yield than all other crops. All the crops except mashbean produced similar seed yield at 40 and 60 cm row spacing. The minimum seed yield was produce by mashbean sown in 40 cm apart single rows.

Different row spacings do not differ statistically for harvest index. Non-significant effect of spacing on harvest index of legumes has also been reported by Sharar *et al.* (2001) and Hussain *et al.* (1998). On the

other hand maximum harvest index was produced by ricebean, which was statistically similar to mungbean whereas, the lowest harvest index was noted by mashbean. These results are in agreement with the finding of Singh *et al.* (1983). The interaction between row spacing and grain legumes was significant. The maximum harvest index was produced by ricebean when sown in 60 apart double row strips. But it was statistically similar to the ricebean sown in 40 apart rows and mungbean sown in 40 and 60 cm row spacing. Only cowpea showed a significant decrease in harvest index with increased row spacing and only mashbean showed a significant increase in harvest index value with increased row spacing.

The effect of row spacing on the protein content of the crops was found significant. The crops sown in 60 cm apart double row strips produced significantly higher protein content than planted in 40 cm apart single rows. The protein contents were not affected significantly by different grain legumes. That varied from 21.26 to 23.87%. These results are supported by the findings of Jain and Chauhan (1988) and Jain *et al*. (1988). The interaction between the grain legumes and row spacing was found to be non-significant.

Table 1: Effect of planting pattern on the number of pods plant^{-1}, seed yield and harvest index of various grain legumes.

Treatments	**Number of pods plant^{-1}**	**Seed yield (kg ha^{-1})**	**Harvest index (%)**
40 cm apart single row (S_1)	28.11 b	3258 b	51.807
60 cm apart double row (S_2)	31.98 a	3460 a	51.57
Grain legumes			
Mungbean (C_1)	25.97 b	3636.5 b	57.54 a
Mashbean (C_2)	33.53 b	2789.0 c	42.64 c
Cowpea (C_3)	13.33 c	2892.5 c	57.25 b
Ricebean (C_4)	47.35 a	4118.5 a	59.34 a
Interaction			
S_1 x $C_!$	25.93 d	3615 b	57.60 a
S_1 x C_2	29.07 d	2592 d	38.33 d
S_1 x C_3	13.13 e	2823 c	52.54 b
S_1 x C_4	44.30 b	4003 a	58.76 a
S_2 x $C_!$	26.00 d	3658 b	57.48 a
S_2 x C_2	38.00 c	2586 c	46.95 c
S_2 x C_3	13.53e	2962 c	41.96 d
S_2 x C_4	50.40 a	4234 a	59.92 a

Means not sharing a letter in common differ significantly at ($P < 0.05$)

Table 2: Effect of planting patterns on the plant height, seeds per pod, 100-seed weight and protein contents of different grain legumes.

	Plant density (m^{-2})	**Plant height (cm)**	**Seeds per pod**	**1000-seed weight (g)**	**Protein content (%)**
Planting Pattern					
40 cm apart single row	395.50 ^{NS}	50.85 ^{NS}	8.61^{NS}	58.65a	22.56b
60 cm apart double row strip	397.58	56.05	8.76	54.9b	23.18 a
Grain legumes					
Mungbean	399.83^{NS}	58.07 b	12.50 a	50.22 c	22.81^{NS}
Mashbean	393.50	33.93 c	6.73 bc	53.28 b	23.71
Cowpea	395.33	44.67 c	8.02 b	73.75 a	23.16
Ricebean	397.50	77.13 a	7.50 b	49.84 c	21.79

Means not sharing a letter in common differ significantly at ($P < 0.05$)

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