The Pharma Innovation Journal 2021; 10(9): 1847-1850

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(9): 1847-1850

www.thepharmajournal.com
Received: 02-06-2021
Accepted: 07-08-2021

D Sekhar
Senior Scientist, Department of Agronomy, Regional Agricultural Research Station, Chintapalli, Andhra Pradesh, India

P Seetharamu
Senior Scientist Department of Entomology, Regional Agricultural Research Station, Chintapalli, Andhra Pradesh, India

L Suryanarayana
Senior Scientist Department of Plant Breeding, Regional Agricultural Research Station, Chintapalli, Andhra Pradesh, India

G Rama Rao
Associate Director of Research, Regional Agricultural Research Station, Chintapalli, Andhra Pradesh, India

Corresponding Author:
D Sekhar
Senior Scientist, Department of Agronomy, Regional Agricultural Research Station, Chintapalli, Andhra Pradesh, India

Effect of sowing time on growth and yield of Rajmash (*Phaseolus vulgaris* L.) varieties in high altitude tribal zone of Andhra Pradesh

D Sekhar, P Seetharamu, L Suryanarayana and G Rama Rao

Abstract
A field experiment was conducted during late *kharif* season of 2018-19 and 2019-20 in sandy clay loam soil of high altitude and tribal zone at Regional Agricultural Research Station, Chintapalli, Andhra Pradesh. The experiment consists of three main plot treatments involving different combinations of sowing windows from second fortnight of August to second fortnight of September with six different varieties.
Among the three sowing dates of rajmash, August second fortnight sowing produced higher yields of 971 kg/ha followed by September first fortnight with 885 kg/ha and lowest yields were recorded during September second fortnight sowing (587.7 kg/ha) and the varieties Amber (1131.3 kg/ha), Utkarsh (954.3 kg/ha) and arun (806.1 kg/ha) varieties performed well sown during August second fortnight.

Keywords: Rajmash, sowing time, performance of varieties, yield, HAT zone

Introduction
Rajmash (*Phaseolus vulgaris* L.) is one of the most important pulse crops of high altitude and tribal zone of Andhra Pradesh. This crop is also known as kidney bean, common bean, French bean, snap bean, etc. Rajmash crop is a good source of protein, carbohydrates, minerals, vitamin A and calcium. Pulse crops supply a major share of protein requirement of vegetarian population. Rajmash is a favorite dish in northern Indian states of the country.
Rajmash is mainly grown in states like Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Uttarakhand, Maharashtra, Andhra Pradesh and West Bengal. It needs moderate climate for its proper growth. The optimum temperature for the proper growth and pod set of rajmash is 16-22 °C (Kalita *et al.*, 2016) [2]. It is highly sensitive to high temperature and frost. High temperature above 30 °C during flowering causes extreme flower drop and reduces grain yield drastically. High temperature may also cause leaf crinkle disease in rajmash (Kalita *et al.*, 2016) [2].
Farmers of high altitude and tribal zone cultivating rajmash crop with traditional varieties with different sowing times and realising lower yields. This crop requires good management practices including sowing time and high yielding varieties. Optimum sowing time plays an important role for getting potential yields. Early or delayed sowing reduces the grain yield of the crop drastically. Sowing time is a major non-monetary input affecting growth and grain yield (Sadhukhan *et al.*, 2008; Patange *et al.*, 2011; Kalita *et al.*, 2016) [5, 4, 2] and is considered an important factor to explore the maximum yield. Genotypes may also differ in the productivity (Patange *et al.*, 2011; Kalita *et al.*, 2016) [4, 2]. The proper growth of a genotype is determined by its growing environment. Different/same genotypes may perform differently under diverse environments. Therefore, performance of genotypes under different sowing windows needs to be tested. Hence, this study was conducted on different sowing times with seven rajmash varieties for obtaining high grain yield in HAT zone of Andhra Pradesh.

Materials and Methods
A field experiment on "Effect of sowing time on growth and yield of Rajmash (*Phaseolus vulgaris* L.) Varieties in high altitude zone of Andhra Pradesh" was carried out two years during *rabi* 2018-19 and 2019-20 at Regional Agricultural Research Station, Chintapalli, Visakhapatnam of Andhra Pradesh. The experimental area is sandy clay loam in texture, low in organic carbon (0.45) and available nitrogen (213 kg/ha), medium in available phosphorus (18.7 kg/ha) and high in available potassium (389 kg/ha).

The experiment consists of twenty-one treatment combinations with three sowing windows S1 – Second fortnight of August, S2 – First fortnight of September and S3 – Second fortnight of September and seven varieties *viz*., V1 – Amber, V2 – Phalguna, V3 – Arun, V4 – Utkarsh, V5 – Uday, V6 – Arka Komal and V7 – CTPL Red in split plot design with three replications. Sowing was done at a spacing of 30 cm row to row and 10 cm between the plants with in the row. The recommended dose of fertilizers (100-60-20 Kg N-PK ha^{-1}) was applied through urea, single super phosphate and muriate of potash, respectively. Entire P2O5 and K2O was applied basally to all the treatments. Nitrogen was applied in two splits doses of 50% basal and 50% at flowering stage. The experimental data collected were statistically analysed by following split plot design.

Results and Discussion

The effect of sowing time on growth and yield attributes: The results of the experiment revealed that the rajmash crop sown on second fortnight of August recorded maximum plant height (30 and 40 cm) during the two years and it was statistically at par with the crop sown on second fortnight of September at High Altitude areas of Andhra Pradesh (Table 1 & 3). Maximum plant height during the second fortnight of August could be due to extended prevalence of sunlight during the growth period which might have stimulated more growth compared to the sowing done in the month of September. The present results are in corroboration with the findings of Singer *et al*. (1996) [8] who reported maximum plant height at the warmest than the coolest environmental condition. A decrease in plant height was observed in both the years in delayed sowing of crop. The decrease in plant height in late sown crop might be due to shorter growing period. Vieira *et al*. (1990) [9] also reported that the reduction of plant height could result from reduction of photosynthetic efficiency of a plant.

Seed yield of rajmash (Table 2) was significantly influenced by time of sowing. The highest seed yield of 849.3 and 971.0 kg per ha was recorded during 2018- 19 and 2019-20 in second fortnight of August sown crop and which was higher to the extent of 28.4 and 40.5 per cent over first and second fortnight of September sown crop during 2018-19, 8.85 and 39.5 per cent during 2019-20, respectively. The lower yield in late sowing was probably because of limited vegetative growth due to the lesser temperature at later stages which cause limited photosynthetic availability to the plants. The results of seed yield are in agreement with Seyum (2014) [7] reported reduced yield in late sown crop due to shortening of vegetative growth of plants. Amit Kaul *et al* (2018) [1] also reported that reproductive period of the plants which are sown late, coincides with the lower temperatures and this cause abscission of many buds and flowers that results in significant decrease in productivity. Yield variations could be attributed to various yield contributing characters (Table 1).

Number of pods per plant were significantly higher with second fortnight of August sowing in both the years and it decreased with delay in sowing. The decrease was as high as 16.6 per cent in second fortnight of September (8.5 pods per plant) and by 7.84 per cent in first fortnight of September (9.4 pods per plant) when compared to second fortnight of August sown crop. Higher length of the pod, a greater number of seeds per pod, number of seeds per plant and 100 seed weight were recorded when crop was sown on second fortnight of August. Saini and Negi (1998) [6] also reported better performance of yield components in early sown crop of rajmash. The late sowing dates had short growing periods and might be produced less leaf area. The amount of photosynthesis is a function of the total leaf area and the solar radiation intercepted (Poehlman, 1991). This might be the reason for decreased pods per plant and grain yield in late sown crop. This result is in agreement with the works of Yoldas and Esiyok (2007) [10], who obtained the lowest yield during the time of late sowing due to a short vegetation period of the crop. The pod number, length of pod and 100-seed weight decreased thereafter with delayed sowing.

Growth and yield as affected by varieties: The results presented in Table 1 to 4 revealed that all the varieties differed significantly for plant height. The significantly taller plants (32.3 and 36.9 cm) were recorded in Arun variety as compared to Uday, Utkarsh, Amber varieties, respectively. Differential response of varieties to plant height might be due to their genetic character and adaptability to growing environment. Interactive effect of sowing dates and varieties were found to be non significant in both the years. Maximum number of pods per plant, length of the pod, number of seed per pod, and number of seeds per plant were significantly higher in Amber, Utkarsh varieties, but the seed wight per plant were significantly more in Arun and Phalguna varieties along with Amber variety. Pandey *et al*. (1978) [3] stated that the pod yield of French bean increased mainly due to higher pod number per plant and pod weight per plant. 100-seed weight is another important character in rajmash. The variety Uday recorded significantly higher 100-seed weight in both the years (49.3 and 48.9 g, respectively) than the genotype Arun (46.0 and 39.3 g, respectively). It was mainly due to boldness of seed in Uday as compared to Arun and other varieties.

The maximum seed yield (890.8 kg/ha and 1131.3 kg/ha, respectively) was recorded in both the years followed by Utkarsh (887.6 kg/ha and 954.3 kg/ha). These two varieties were on a par with each other in two years of study followed by Arun variety (745.5 and 806.0 kg/ha). Remaining varieties are at par with the Amber and Utkarsh varieties in both the years. The lower seed yield was recorded with Arka Komal and CTPL Red varieties.

Table 1: Performance of Rajmash varieties under different sowing windows during 2018-19

Treatment	Plant height at harvest (cm)	No. of pods per plant	Pod length (cm)	No. of seeds per pod
Main plots (Sowing windows)				
D1 – August II FN	30.3	10.2	10.6	4.2
D2 – Sept. I FN	28.2	9.4	10.0	3.7
D3 – Sept II FN	20.8	8.5	9.5	3.6
S.Em±	1.87	0.63	0.25	0.14
CD (P = 0.05)	7.36	2.49	0.99	NS
CV(%)	27.6	26.1	9.89	-
Sub Plots (Varieties)				
V1 – Amber	26.5	11.6	7.4	3.2
V2 – Phalguna	24.0	8.9	9.8	4.1

V3 – Arun	32.3	8.9	11.8	3.7
V4 – Utkarsh	26.6	11.4	9.8	4.0
V5 – Uday	29.7	8.1	9.1	2.5
V6 – Arka Komal	21.9	8.1	11.7	4.4
V7 – CTPL Red(Local)	24.1	8.4	10.6	4.8
S.Em±	1.45	0.62	0.21	0.13
CD (P = 0.05)	4.18	NS	NS	NS
CV(%)	19.2	-	-	-
Interaction				
S at M				
S.Em±	2.90	1.24	0.42	0.26
CD (P = 0.05)	8.36	NS	NS	NS
M at S				
S.Em±	3.20	1.27	0.45	0.27
CD (P = 0.05)	6.86	NS	NS	NS

Table 2: Performance of Rajmash varieties under different sowing windows during 2018-19

Treatment	No.of seeds per plant	Seed weight per plant (g)	100 seed weight (g)	Yield (kg/ha)
Main plots (Sowing windows)				
D1 – August II FN	39.2	15.0	39.1	849.3
D2 – Sept. I FN	37.6	12.9	36.4	608.1
D3 – Sept II FN	34.1	9.66	36.4	505.3
S.Em±	2.60	1.19	0.61	47.3
CD (P = 0.05)	10.2	4.65	2.40	185.9
CV(%)	26.9	36.8	6.41	28.1
Sub Plots (Varieties)				
V1 – Amber	41.1	15.7	41.6	890.8
V2 – Phalguna	38.0	12.1	32.0	641.4
V3 – Arun	35.4	14.8	46.0	745.5
V4 – Utkarsh	40.8	13.7	36.0	887.6
V5 – Uday	24.2	9.6	49.3	439.9
V6 – Arka Komal	35.2	10.3	30.5	415.1
V7 – CTPL Red(Local)	44.0	11.5	25.7	559.5
S.Em±	3.86	1.45	0.76	79.7
CD (P = 0.05)	11.1	4.18	2.20	229.5
CV(%)	35.6	40.2	7.17	42.4
Interaction				
S at M				
S.Em±	7.72	2.90	1.53	159.5
CD (P = 0.05)	NS	NS	NS	NS
M at S				
S.Em±	7.38	2.86	1.50	150.3
CD (P = 0.05)	NS	NS	NS	NS

Table 3: Performance of Rajmash varieties under different sowing windows during 2019-20

Treatment	Plant height at harvest (cm)	No. of pods per plant	Pod length (cm)	No. of seeds per pod
Main plots (Sowing windows)				
D1 – August II FN	40.0	12.4	11.7	4.60
D2 – Sept. I FN	33.0	10.0	10.1	4.45
D3 – Sept II FN	31.0	9.23	10.4	4.18
S.Em±	1.10	0.07	0.15	0.25
CD (P = 0.05)	6.10	NS	0.83	NS
CV(%)	13.3	-	5.86	-
Sub Plots (Varieties)				
V1 – Amber	33.2	9.11	8.22	3.76
V2 – Phalguna	31.6	10.9	10.6	4.0
V3 – Arun	36.9	10.2	12.5	4.96
V4 – Utkarsh	33.8	12.4	10.3	4.18
V5 – Uday	36.4	9.31	10.0	3.28
V6 – Arka Komal	33.4	9.01	13.3	5.13
V7 – CTPL Red(Local)	39.4	12.8	10.3	5.56
S.Em±	1.26	0.36	0.26	0.16
CD (P = 0.05)	3.65	NS	0.76	NS
CV(%)	13.4	-	9.14	-
Interaction				
S at M				
S.Em±	2.71	0.76	0.56	0.34
CD (P = 0.05)	7.88	NS	NS	NS
M at S				

S.Em±	2.71	0.69	0.53	0.40
CD (P = 0.05)	5.68	NS	NS	NS

Table 4: Performance of rajmash varieties under different sowing windows during 2019-20

Treatment	No. of seeds per plant	Seed weight per plant (g)	100 seed weight (g)	Yield (kg/ha)
Main plots (Sowing windows)				
D1 – August II FN	35.4	13.1	37.4	971.0
D2 – Sept. I FN	34.9	12.4	33.3	885.0
D3 – Sept II FN	31.1	11.4	32.4	587.7
S.Em±	0.97	0.42	0.44	46.6
CD (P = 0.05)	5.37	2.32	NS	259.0
CV(%)	12.1	14.4	-	24.2
Sub Plots (Varieties)				
V1 – Amber	27.4	11.6	36.4	1131.3
V2 – Phalguna	38.5	14.4	34.1	686.2
V3 – Arun	33.8	13.7	39.3	806.1
V4 – Utkarsh	33.7	12.2	34.7	954.3
V5 – Uday	22.8	9.80	48.9	634.9
V6 – Arka Komal	34.8	11.5	30.0	751.9
V7 – CTPL Red(Local)	45.7	12.9	27.2	737.6
S.Em±	0.82	0.59	0.71	42.8
CD (P = 0.05)	2.37	1.71	NS	124.2
CV(%)	9.04	17.9	-	19.6
Interaction				
S at M				
S.Em±	1.76	1.27	1.53	92.5
CD (P = 0.05)	NS	NS	NS	NS
M at S				
S.Em±	1.89	1.23	1.45	97.2
CD (P = 0.05)	NS	NS	NS	NS

Conclusions

Based on the results, it can be concluded that Amber, Utkarsh varieties produced significantly higher grain yield as compared to Arun and other varieties. None of the interaction effects involving dates of sowing and genotypes were significant for growth components, yield components and yield of rajmash. Thus, the results revealed that Amber, Utkarsh and Arun varieties could be used for cultivation and second fortnight of August is the optimum time for sowing the crop in the high altitude and tribal zone of Andhra Pradesh.

Acknowledgments

The senior author is highly thankful to ANGRAU, Lam, Guntur, A.P for providing facilities to carry out the experiment.

References

1. Amit Kaul, Charanjeet Kaur, Guriqbal Singh. Performance of Kidney bean (*Phaseolus vulgaris* L.) under different sowing dates in sub-mountainous area of Punjab. Legume Research 2018;41(5):745-749.
2. Kalita H, Deka N, Guha B, Deka UK, Sadhukhan R. Effect of dates of sowing and spacing on rajmah (*Phaseolus vulgaris*) varieties under the climatic conditions of Central Brahmaputra Valley Zone of Assam. J Crop Weed 2016;12:64-68.
3. Pandey RK, Sexaena MC, Singh VB. Growth analysis of blackgram genotypes. Indian J. Agril. Sci 1978;48:466-473.
4. Patange MJ, Lad NG, Dhage SJ. Effect of sowing dates on growth and yield of French bean (*Phaseolus vulgaris* L.) varieties during kharif season. Adv Res J Crop Improv 2011;2:158-60.
5. Sadhukhan R, Bhowmick MK, Biswas PK. Performance of rajmash (*Phaseolus vulgaris* L.) under varying dates of sowing in West Bengal. J Crop Weed 2008;4:42-44.
6. Saini JP, Negi SC. Effect of cultivar and date of sowing on growth and yield of French bean (*Phaseolus vulgaris*) under dry temperate condition. Indian J Agron 1998;43:110-113.
7. Seyum EG. Influence of plant spacing and date of sowing on yield and yield components of two snap bean (*Phaseolus vulgaris* L.) varieties in Jimma, Southwestern Ethiopia. Merit Res. J. Agric Science and Soil Sci. 2014;2(7):086-095.
8. Singer SM, Helmy YI, Sawan OM, El-Abd SO. Effects of plastic tunnels and sowing dates on growth and productivity of bean varieties grown in calcareous soil conditions. Egypt J. Horticulture 1996;23(2):95-99.
9. Vieira HJ, Bergamaschi H, Amgelocci LR, Libardi L. Performance of tow bean cultivars under two soil water availability regimes. II. Stomata1 resistance to vapour diffusion, transpiration flux density and water potential in the plant. Pesquisa Opecubria Brasileira 1990;24(9):1045-1053.
10. Yoldas F, Esiyok D. Effects of sowing dates and cultural treatments on growth, quality and yield of processing beans. Pakistan J Biol. Sci. 2007;10:2470-2474.