IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 2 Ver. II (Feb. 2015), PP 12-15
www.iosrjournals.org

Response of Pigeonpea Varieties to Time of Sowing During Rabi Season

G.Krishna Reddy[1], P.Maheshwara Reddy[2], P.Lavanya Kumari[3] and T.Giridhara Krishna[4]

[1] Principal Scientist(Agronomy), [2]Scientist(Agronomy), [3]Scientist(Statistics) and [4]Assicuate Director of Research , Regional Agricultural Research Station, Tirupati, Chittoor District, Andhra Pradesh, India.
Corresponding author's e-mail.id.:drgkrishnareddy@gmail.com

Abstract: *Pigeonpea is one of the major crops which attract the farmers with its significant yields despite its demand in market. Moreover, full potential from Pigeonpea can be exploited by selecting suitable variety and optimum time of sowing during* Rabi *. But the information on the optimum date of sowing and suitable variety for Pigeonpea (Cajanus cajan (L.)) as post rainy season crop is meagerly available in literature. Hence, the present experiment is aimed to identify the optimum date of sowing and high yielding suitable Pigeonpea variety for* Rabi. *In this connection, a field experiment on 'Response of Pigeonpea varieties to time of sowing during* Rabi*' is carried out by considering four dates of sowing viz., September second fortnight(D_1), October first fortnight(D_2), October second fortnight(D_3) and November first fortnight(D_4) and three varieties viz., LRG-41(V_1), TRG- 22(V_2) and ICPL- 85063(V_3) using a Randomized Block Design with factorial concept in three replications for three successive years from 2010 to 2013. From the results, it can be inferred that TRG-22 and LRG-41 are better among the varieties suitable for post-rainy season. The second fortnight of September is identified as an optimum time of sowing during post-rainy season..*

Keywords: Rabi *Pigeonpea, date of sowing, varieties and seed yield.*

I. Introduction

Pulses are major sources of proteins among the vegetarians in India, and complement the staple cereals in the diet with proteins, essential amino acids, vitamins and minerals. They contain 22-24% protein, which is almost twice the protein available in wheat and thrice that of rice. Pulses provide significant nutritional and health benefits, and are known to reduce several non-communicable diseases such as colon cancer and cardiovascular diseases (Yude *et al*, 1993; Jukanti *et al*, 2012). Pulses can be grown on range of soil and climatic conditions and play important role in crop rotation, mixed and inter-cropping, maintaining soil fertility through nitrogen fixation, release of soil-bound phosphorus, and thus contribute significantly to sustainability of the farming systems

India is producing 14.76 million tons of pulses from an area of 23.63 million hectare, which is one of the largest producing countries in the world. However, about 2-3 million tons of pulses are imported annually to meet the domestic consumption requirement. Thus, there is need to increase production and productivity of pulses in the country. To achieve target of additional production of pulses, it is necessary to concentrate efforts on five most important pulse crops depending upon their contribution in national production viz., chickpea (39%), pigeonpea (21%), mungbean (11%), urdbean (10%) and lentil (7%). (Shetty *et al*., 2013).

Pigeonpea is usually grown as Kharif crop under rainfed condition. However, Rabi Pigeonpea had a potential for high seed yield. The productivity of Pigeonpea was found to be very low under rainfed condition. However, the demand for Pigeonpea dal is increasing with premium price. Introduction of Pigeonpea under Rabi situation is compelled to initiate an experiment on Pigeonpea to study the feasibility of Pigeonpea cultivation during Rabi. Several workers reported that the yields of Rabi Pigeonpea are high as compared to Kharif Pigeonpea. However, the flowering in Pigeonpea should not coincide with hot weather as this may lead to severe flower drop resulting in low yields. Hence, this study is envisaged to find out optimum time of sowing and Pigeonpea variety suitable for Rabi.

II. Review Of Literature

Narayanan and Sheldrake (1978) observed that Rabi Pigeonpea is a potential crop and reported that October sown pigeon pea gave good seed yield as compared to normal sown pigeon pea. They also observed that the duration of Rabi Pigeonpea was reduced by 40 days as compared to normal sown crop (180 days) and the pest incidence was minimum. The results are in conformity of Sinha and Bhattacharya (1982). Most of the pulses in India are grown in low fertility, problematic soils and unpredictable environmental conditions. Drought and heat stress may reduce seed yields by 50%, especially in arid and semi-arid regions. Narayana and Scheldrake (1979) recorded the highest seed yield of 17.1 q ha^{-1} from C_{11} variety of Pigeonpea during Rabi.

Laxminarayana (2003) reported that September 15th sown Pigeonpea had recorded the highest seed yield compared to later dates of sowing at Agricultural Research Station, Madhira during 1998-99.

Bapi Reddy etal (1991) reported that optimum time of sowing for Rabi Pigeonpea was second fortnight of September and LRG – 41 is best variety on sandy loam soils of Tirupati. Islam *et al*.,(2008) reported from West Bengal that earlier sowing (starting from October) had resulted in more seed yield of Pigeonpea compared to rest of dates beyond October. Similar results were also recorded in Pigeonpea by Patel *et al* (2000) and Laxminarayana (2003). Venugopal *et al*., (1998) reported that seed yield of Pigeonpea was decreased when dates of sowing advanced from 5th November to 5th December at Bapatla.

Govinda Reddy *et al* (1991) recorded 31.8 and 66.8 percent less seed yield of Pigeonpea respectively in 30th October and 14th November sown crop compared to 15th October sowing and attributed this decline is due to higher temperatures at pod development stage that led to high respiration rate and their by reduced amount of photosynthates to be translocated for developing grain. Panse and Jana (1990) from West Bengal reported similar results that delayed sowing from September to November resulted in lowest growth attributes as well as seed yield of Pigeonpea.

III. Materials And Methods

The soil was sandy loam with average pH (6.85), low in organic carbon (0.40) medium in available in Phosphorus (45 kg ha^{-1}) and potassium (163 kg ha^{-1}). The treatments are four dates of sowing viz September second fortnight, October first fortnight, October second fortnight and November first fortnight and three varieties viz., LRG- 41, TRG- 22 and ICPL- 85063. The experiment was laid out in randomized block design with factorial concept replicated thrice. The fertilizers and weed free condition was maintained by spraying of pre emergence herbicide i.e., Pendimethalin @1.0 kg a.i per ha (Pendimethalin@6ml/liter of water). The spacing adopted was 60 cm X 20 cm. Protective irrigations were given if the dry spell exceeds 20 days by check basin method. Prophylactic plant protection measures were taken as against the leaf webber and leaf eating caterpillars and crop was harvested when the 95% of pods matured during all the years under study.

Modalities of the experiment are indicated below.

a) Treatments:

Time of sowing	**Varieties**
D_1 = September, II FN	V_1 = LRG- 41
D_2 = October, I FN	V_2 = TRG- 22
D_3 = October ,II FN	V_3 = ICPL- 85063
D_4 = November, I FN	

b) Replications : Three
c) Design : RBD with factorial concept.
d) Spacing : 60 cm x 20 cm
e) Varieties : As per treatment
f) Fertilisers : 40 kg N : 50 kg P_2O_5 ha^{-1}
g) Irrigation : As and when required
h) Plot size : 5.4 m x 5.0 m
i) Statistical Analysis

Mean and standard deviations are used to represent variety wise data for different dates of sowing in three years of duration. Two-way ANOVA and Duncan's Multiple Range test has been applied to identify the optimum date of sowing and suitable variety of Pigeonpea in this study. Statistical tools are applied with the help of SPSS version 20 and results are concluded at respective levels of significances. Graphical representation has been made for significant results.

IV. Results And Discussion

Mean and standard deviations of observed data according to dates of sowing with three varieties for the years 2010-11, 2011-12 and 2012-13 are shown in the table 3.1. Further, a pooled data of seed yield (three years put together) is also represented with the help of mean and standard deviations to have clear understanding about the impact of the date of sowing and suitable variety of Pigeonpea in post- rainy season.

Table 3.1: Seed Yield (Kg/ha) of Pigeonpea as per dates of sowing and varieties during Rabi 2010 -13

Date of sowing	Variety	2010-11 Mean ± Sd	2011-12 Mean ± Sd	2012-13 Mean ± Sd	Pooled Seed yield (three years)
September II FN (D_1)	*LRG - 41*	1434.1 ± 158.4	933 ± 62.6	331.3 ± 193.7	899.7 ± 126.9
	TRG - 22	1308.9 ± 607.9	504.3 ± 144.7	170.3 ± 119.7	661 ± 123.1
	ICPL - 85063	861 ± 158.3	655.7 ± 16.3	451.3 ± 235.7	656 ± 114.3
	Total	**1201.3 ± 416 a**	**697.7 ± 204.3 a**	**317.7 ± 204.4 a**	**738.9 ± 160.1 a**
October I FN (D_2)	*LRG - 41*	1028.1 ± 223.4	797.7 ± 42.9	46.7 ± 9	624.3 ± 81.7
	TRG - 22	1522.4 ± 385.3	790 ± 84.3	74.7 ± 82.5	796 ± 122.2
	ICPL - 85063	1088.4 ± 161.3	588 ± 112.9	64.7 ± 23.4	580.7 ± 59.4
	Total	**1213 ± 332.6 a**	**725.2 ± 126.6 a**	**62 ± 44.8 b**	**667 ± 126.5 a**
October II FN (D_3)	*LRG - 41*	907 ± 98	728.3 ± 69.3	533 ± 298.1	722.7 ± 151.5
	TRG - 22	1009.7 ± 281.3	495.3 ± 142.7	388 ± 327.5	631 ± 107.9
	ICPL - 85063	947.3 ± 65.2	688.7 ± 111.2	333.3 ± 148.4	656.3 ± 52.4
	Total	**954.7 ± 158.9 a**	**637.4 ± 145.1 a**	**418.1 ± 250 a**	**670.0 ± 105 a**
November I FN (D_4)	*LRG - 41*	364.1 ± 92.3	243.7 ± 43.3	184 ± 151	263.7 ± 22.5
	TRG - 22	965.6 ± 171.1	274.3 ± 34	191.7 ± 176.1	477.0 ± 8.5
	ICPL - 85063	279.2 ± 198	266 ± 12.3	101.7 ± 68.4	215.7 ± 49.2
	Total	**536.3 ± 352.5 b**	**261.3 ± 31.4 b**	**159.1 ± 128.4 b**	**318.8 ± 123.6 b**
Total	*LRG - 41*	933.3 ± 419.9 a	675.7 ± 275.7 a	273.8 ± 250.3 a	627.6 ± 259.2 b
	TRG - 22	1201.6 ± 412.7 b	516 ± 213.5 b	206.2 ± 207.7 a	641.3 ± 147 b
	ICPL - 85063	794 ± 347.5 a	549.6 ± 187.9 b	237.8 ± 207.9 a	527.2 ± 200.7 a
	Total	**976.3 ± 419.9**	**580.4 ± 232.8**	**239.2 ± 218.2**	**598.7 ± 207.9**

(Mean and standard deviations of three replicates)

During Rabi, 2010-11, seed yield was significantly influenced by time of sowing and varieties. Among times of sowing, October first fortnight (D_2) recorded seed yield of 1213 kg ha^{-1} which was closely followed by September second fortnight(D_1) (1201kg ha^{-1}) which were on par with each other. These treatments were superior to November first fortnight (D_4) crop. Among the varieties tested, cultivar TRG - 22 gave the highest seed yield of 1202 kg ha^{-1} as compared to LRG - 41 (933 kg ha^{-1}) and ICPL - 85063 (794 kg ha^{-1}).

During Rabi, 2011-12, the seed yield was significantly influenced by date of sowing and varieties. The highest seed yield was recorded when the crop was sown in October first fortnight. There was reduction in seed yield when sowing was delayed beyond October first fortnight. Among the varieties tested, the variety LRG - 41 gave seed yield of 676 Kg ha^{-1} which was significantly superior to ICPL - 85063 (550 Kg ha^{-1}) and TRG - 22 (516 Kg ha^{-1}).

During Rabi, 2012-13, low yields were recorded in three varieties as the crop was severely affected by wilt. As the crop was subjected to cloudy weather at the time of flowering also caused more flower drop initially followed by it was partially affected by wilt at the time of harvest maturity might be the probable reason for realizing the lowest seed yield by the different varieties of Pigeonpea during 2012-13. Hence, variations among varieties could not be identified significantly. Yields are noted between 206 to 274 kg ha^{-1}among three varieties.

The pooled data of 2010-11, 2011-12 and 2012-13 revealed that the highest seed yield of 739 kg ha^{-1} was recorded when sown in September second fortnight (D_1) and there was decrease in seed yield when sowing was delayed beyond September second fortnight. The decrease in seed yield was significant up to November first fortnight. The varieties differed significantly with respect to seed yield per ha. The varieties *LRG - 41* and *TRG - 22* were significantly superior to *ICPL - 85063* with respect to seed yield/ha. These observations on yield were validated with the help of two way ANOVA and summarized in table-3.2.

Table-3.2: Summary of Two-way ANOVA

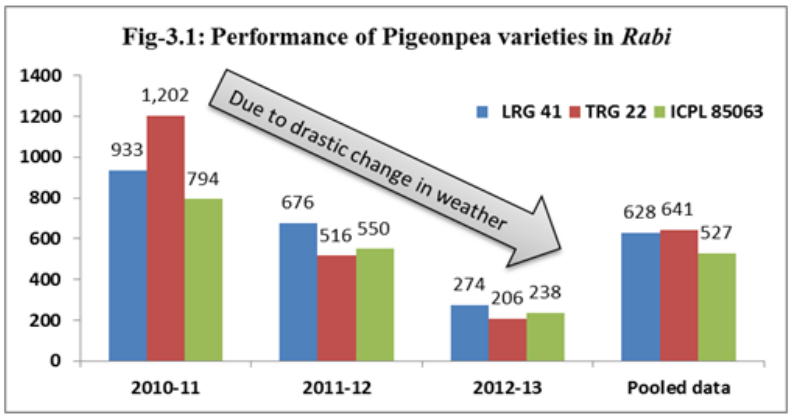
Years	2010-11	2011-12	2012-13	Pooled
Source	F-value	F-value	F-value	F-value
Replication	0.979	0.292	0.089	0.198
Date of Sowing	16.81**	54.10**	6.433**	51.40**
Variety	7.80**	10.97**	0.387	6.91**
Date of Sowing * Variety	1.769	6.30**	0.808	5.32**

** Significant at 1% level.

Two-way ANOVA has been carried out to know the significant impact of varieties, dates of sowing and their interaction on the yield of Pigeonpea in Rabi. This analysis has been done for three years separately and for pooled data of three years and results is exhibited in table 3.2. From the results it can be concluded that replication has not shown any influence which indicates that experiment has done in proper way using proposed design. Further, date of sowing found significant in terms of seed yield during *rabi* season for three years 2010-11, 2011-12 and 2012-13 as well as in pooled data of three years. But varieties have shown significant impact on yields in two years 2010-11, 2011-12 and also in pooled analysis of three years but not in the year 2012-13 for which the reason might be the severe wilt due to drastic changes in weather. Interestingly, interaction effect of date of sowing and variety is observed only in the year 2010-11 and the same is reflected in the pooled analysis also whereas the years 2011-12 and 2012-13 failed to exhibit the interaction effect.

Pigeonpea is a short day plant (Odongo *et al*,1991). The day length starts declining from July onwards in northern hemisphere with steeper fall from October onwards. With delay in sowing, flowering was induced earlier resulting in less vegetative growth and earliness in maturity resulting in low seed yield. The results confirm those of Sinha and Battacharya (1982) who reported that duration of Pigeonpea decreases with delay in sowing from 22nd July to 22 September.

Among different dates of sowing, September second fortnight (D_1) had recorded the highest average seed yield 739 kg ha^{-1} over the rest of dates of sowing for all varieties put together. Further, irrespective of dates of sowing TRG - 22 has recorded the highest yield in the year 2010-11 and LRG - 41 has noted the highest yield in the year 2011-12 whereas both varieties recorded yields at same level in the year 2012-13 . But according to pooled data of three years revealed that variety TRG-22 raised to the first place with average seed yield of 641.3 kg ha^{-1} though the experiment is exposed to irregular weather fluctuations in 2012-13. The next better performance is observed in LRG - 41 with mean seed yield of 627.6 kg ha^{-1} whereas ICPL - 85063 is recorded the lowest seed yield of 527.2 kg ha^{-1}. These findings can be viewed in fig-3.1.



V. Conclusion

In any field experiment, date of sowing plays a vital role in producing optimum yields which causes irrevocable yield loss even if one or two days of delay or early in sowing. Generally, yields vary according to varieties in the same crop. Many studies revealed the influence of date of sowing, variety and their interaction effect with regard to seed yields. Present study emphasizes the same with the help of Pigeonpea experiment in Rabi with three varieties and four dates of sowing. Among them, it can be recommended that sowing of Pigeonpea varieties TRG-22 (V_2) and LRG-41 (V_1) in September second fortnight (D_1) resulted in better yields even in unfavourable weather conditions in post-rainy season.

References

[1]. Bapi Reddy T, Chandrasekhara Reddy S and T Yellamanda Reddy (1991). Performance of Pigeonpea Varieties in Post rainy season Journal of Research APAU 19(1) 25-27.
[2]. Govind Reddy M, Ghosh, B.C and Sudhakar N (1991).Studies on scheduling of irrigation to winter pigeonpea. Indian Journal of Agronomy 36(1):109-111
[3]. Islam S Nanda MK and AK Mukherjee (2008). Effect of date of sowing and spacing on growth and yield of Rabi pigeonpea (*Cajanus cajan (L.) Millsp*.) Journal of Crop and Weed 4(1): 7-9
[4]. Jukanti AK, Gaur PM, Gowda CLL and ChibbarRN(2012). Nutritional quality and health benefits of chickpea (Cicer arietinum L.): A review. British Journal of Nutrition. 108, S11-S26.
[5]. Laxminarayana P (2003). Response of Rabi redgram to dates of sowing and row spacings. Annals of Agricultural Research. New series 24(1) : 187-189
[6]. Narayan, A and Sheldrake,A.R. (1979). Pigeonpea (Cajanus cajan) as winter crop in peninsular India. Experimental Agriculture 15: 91-95
[7]. Odongo JCW, Ong CK and Sharma MM (1991) An analysis of the effect of date of sowing on the flowering of pigeonpea genotypes using a photothermal concept. Journal of Experimental Botany (In press).
[8]. Panse AM and Jana PK (1990). Effect of dates of sowing and growth patterns of pigeonpea (Cajanas cajan (L) Millsp) in winter season. Madras Agricultural Journal 77 (5 & 6): 208-211.
[9]. Patel NR Mehta AN and Shekh AM (2000) Radiation absorption, growth and yield of pigeonpea cultivars as influenced by sowing dates. Experimental Agriculture 36 (3) : 291-301.
[10]. Shetty PK, Ayyappan S and Swaminathan (eds) MS (2013). Climate Change and Sustainable Food Security, ISBN: 978-81-87663-76-8, National Institute of Advanced Studies, Bangalore and Indian Council of Agricultural Research, New Delhi.
[11]. Sinha, AC and Battacharya, KK (1982). Effect of variety, spacing and dates of sowing on the yield components of pigeonpea (Cajanus cajan (L). Millsp). Indian Agriculturist 26(4):315-317.
[12]. Venugopal NV Bapuji Rao B, Hanumantha Rao Y and Lakshmi GV (1998) Influence of sowing time and irrigation on Rabi pigeonpea. The Andhra Agricultural Journal 45 (3 and 4) : 231-233.
[13]. Yude C, Kaiwei H, Fuji L, Jie Y. (1993). The potential and utilization prospects of kinds of wood fodder resources in Yunnan. Forestry Research 6, 346-350.