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Yield response of redgram genotypes in rainfed arid regions of Andhra Pradesh

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Abstract
A field experiment was conducted to evaluate yield response of redgram varieties in alfisols of scarce rainfall zone under rainfed conditions for three consecutive years during kharif, 2013-14 and 2014 -15 at Agricultural Research Station, Ananthapuramu of Andhra Pradesh. Number of pods plant^{-1} was significantly influenced by varieties. Variety WRG 53 registered more number of pods plant^{-1} which was however comparable with PRG 158 and LRG 30 and significantly superior over other varieties tested. Among the varieties tested, WRG 53 recorded highest seed yield (353 Kg ha^{-1}) which in turn on par with PRG 158 (330 kg ha^{-1}) and PRG 100 (304 kg ha^{-1}) significantly superior to other tested varieties. Number of seeds per pod, seed yield and harvest index were positively and significantly correlated with number of pods per plant

Keywords: yield, redgram genotypes, rainfed arid

Introduction
Redgram is the major pulse crop grown in India, predominantly, during kharif season both as a sole crop and as an intercrop, though found in wide range of agro-ecological situations. Its deep rooting and drought tolerant characters makes it a successful crop in the areas of low and uncertain rainfall. The plants owe a large measure of its popularity to the fact that it possesses valuable properties as restorative of nitrogen to the soil and adds lot of organic matter to the soil through enormous leaf shedding and thus, redgram finds a promising place in crop rotation and crop mixtures. Its deep rooting system helps in extracting the nutrient and moisture from deeper soil layers, thus making it suitable for rainfed conditions.

In India, it is grown in an area of 3.86 m ha with an annual production of 2.90 m tonnes and productivity is 751 kg ha-1 (Anon., 2011) [1]. India accounts for 90 per cent of the redgram area and production of the world. It is mainly grown in states of Maharashtra, Uttar Pradesh, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu and these states constitute about 90 per cent of the cultivated area in India. In dry farming areas of Andhra Pradesh, rainfall is not only scanty but also erratic. Thus soil moisture becomes the most limiting factor in production of redgram. The area and production of redgram in Andhra Pradesh is 4.63 lakh ha and 3.02 lakh tonnes respectively, but the productivity of redgram remained stagnant for many years with a seed yield of 455 kg ha^{-1} (Ministry of Agriculture, 2014) [8].

Sowing time determines the time available for vegetative growth before the onset of flower in g which is mainly influenced by photoperiod. Most of the varieties of pigeonpea are sensitive to photoperiod. Sowing time has a prominent influence on both vegetative and reproductive growth phages and determines the plant height, number of branches, height at which branching starts, flowering and pod bearing habits. The yield of redgram is limited by a number of factors such as agronomic, pathogenic, entomological, and genetic and also their interaction with the environment.

Anantapur District is such that it does not get the full benefit of either of the monsoons. The district is in the rain shadow area and the normal rainfall is 545 mm. Fifty-one out of ninety-four years have experienced below mean rainfall in Anantapur district. Kharif is the major crop season in Anantapur District. Of the 9.75 lakh hectares of gross cropped area in the district, 7.94 lakh hectares, that is, 81 percent of gross cropped area gets cultivated with groundnut + intercropping system during the kharif season. Around 50 to 60 thousands ha area is under sole redgram. Only two varieties of redgram seeds, LRG 30 and LRG 41, were distributed by the agricultural department till today. The main reason for the poor performance of redgram crop dryland regions is cultivating the local varieties.

Varieties cultivated by the farmers are low yielding and susceptible to one or the other biotic and abiotic stresses. The higher redgram yield per unit area per unit time can be enhanced by introducing newly evolved redgram varieties with high yielding potential. The information on the comparative performance of newly developed varieties is lacking in order to recommend to the farmers. Keeping these facts in view, the present experiment was conducted during to study the performance of redgram varieties in alfisols under rainfed situations.

Materials and Methods

A field experiment was conducted to evaluate yield response of redgram varieties in alfisols of scarce rainfall zone under rainfed conditions for three consecutive years during kharif, 2013-14 and 2014 -15 at Agricultural Research Station, Ananthapuramu of Andhra Pradesh. The soil of the experimental site was red sandy loam with shallow depth, low in organic carbon (0.34%) and low in available nitrogen (129 kg ha^{-1}), medium in available phosphorous (32 kg ha^{-1}) and potassium (221 kg ha^{-1}). The experiment was laid out in randomized block design with three replications. The treatments consisted of nine varieties viz., T_1: TRG 33, T_2: WRG 53, T_3: BRG 2, T_4: PRG 158, T_5: PRG 100, T_6: LRG 41, T_7: LRG 30, T_8: TRG 38 and T_9: PRG 176. The experimental field was prepared by working with a tractor drawn disc plough and then tractor drawn cultivator was drawn along the field. Healthy seeds of redgram varieties with good germination percent (95%) used for sowing purpose. Sowing was taken up as per the treatments. The seeds were sown by dibbling in furrows at a depth of 5 cm. The furrows were covered immediately after sowing and compacted sufficiently for better germination. Thinning was done at 15 DAS by retaining one healthy seedling $hill^{-1}$. The recommended dose of 20 and 100 kg N and P_2O_5 ha^{-1} was applied through urea and single super phosphate respectively. Thinning and gap filling was done wherever necessary, weeding and hoeing were taken up depending on the intensity of weeds at critical stages of crop weed competition. Two hand weedings were done with the help of star weeder in interrows and with hand hoes in the intrarows and all other cultural practices were kept normal and uniform for all treatments.

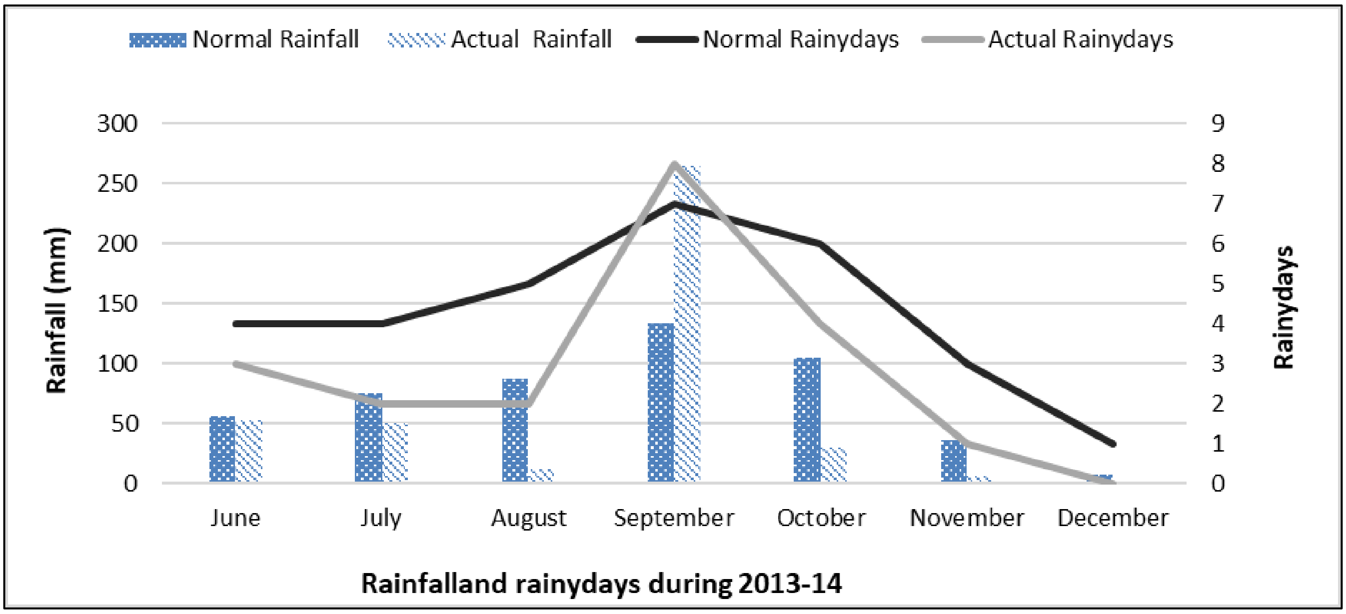
Results and Discussion

Rainfall and crop performance

In 2013-14, annual rainfall received (431.8 mm in 23 rainy days) was – 24.6 % of normal annual rainfall (573 mm). All varieties were sown on 8.6.2013. All tested varieties were harvested on 9.1.2014 except PRG 176 which was harvested on 5.12.2013 (Table 1). Crop duration of varieties was ranged from 178 to 216 days, rainfall during crop period was 378 mm in 17 rainy days. In 2014-15, annual rainfall received (290.8 mm in 26 rainy days) was – 48.9 % of normal annual rainfall (570 mm). All varieties were sown on 3.6.2014. All tested varieties were harvested on 23.1.2015 except PRG 176 which was harvested on 9.12.2014 (Table 2). Crop duration of varieties was ranged from 169 to 235 days, rainfall during crop period was 299.2 mm in 19 rainy days.

Table 1: Rainfall and rainy days during crop growth period, 2013-14

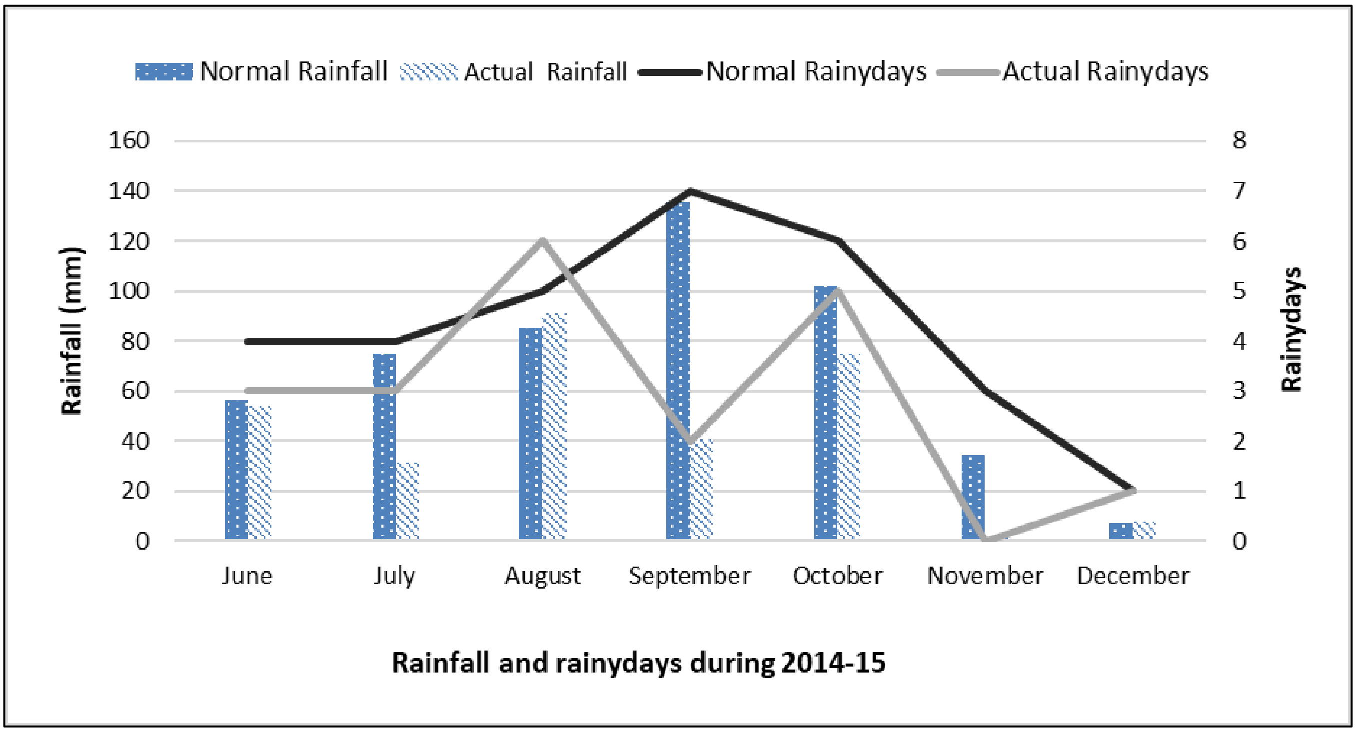
Particulars	TRG 33	WRG 53	BRG 2	PRG 158	PRG 100	LRG 41	LRG 30	ICPH 40	TRG 38	Asha	PRG 176
Date of sowing	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13	8.6.13
Date of harvesting	9.1.14	9.1.14	7.1.14	9.1.14	9.1.14	9.1.14	9.1.14	9.1.14	7.1.14	9.1.14	5.12.13
Crop duration	216	216	214	216	216	216	216	216	214	216	178
Rainfall during crop period (mm)	378	378	378	378	378	378	378	378	378	378	378
Number of rainy days during crop period	17	17	17	17	17	17	17	17	17	17	17
Normal annual rainfall (mm)	573	573	573	573	573	573	573	573	573	573	573
Actual annual rainfall (mm)	431.8	431.8	431.8	431.8	431.8	431.8	431.8	431.8	431.8	431.8	431.8
Normal rainy days during the year	34	34	34	34	34	34	34	34	34	34	34
Actual rainy days during the year	23	23	23	23	23	23	23	23	23	23	23



Rainfall and rainy days during crop growth period, 2013-14

Table 2: Rainfall and rainy days during crop growth period, 2014-15

Particulars	TRG 33	WRG 53	BRG 2	PRG 158	PRG 100	LRG 41	LRG 30	ICPH 40	TRG 38	Asha	PRG 176
Date of sowing	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14	3.6.14
Date of harvesting	20.1.15	20.1.15	20.1.15	20.1.15	20.1.15	20.1.15	20.1.15	20.1.15	20.1.15	20.1.15	9.12.14
Crop duration	232	232	232	232	232	232	232	232	232	232	169
Rainfall during crop period (mm)	299.2	299.2	299.2	299.2	299.2	299.2	299.2	299.2	299.2	299.2	290.4
Number of rainy days during crop period	19	19	19	19	19	19	19	19	19	19	19
Normal annual rainfall (mm)	570	570	570	570	570	570	570	570	570	570	570
Actual annual rainfall (mm)	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8	290.8
Normal rainy days during the year	34	34	34	34	34	34	34	34	34	34	34
Actual rainy days during the year	26	26	26	26	26	26	26	26	26	26	26



Rainfall and rainy days during crop growth period, 2014-15

Redgram varieties were influenced by plant height at harvest. Maximum plant height was recorded by WRG-53 which was comparable with WRG 27 and TTB 7 and significantly superior to other tested varieties. Growth rate in redgram was slower during the first 60 days and later it was rapid. Tirumala Rao (2011) [2] observed that maximum plant height was recorded by WRG-53 closely followed by LRG-41 and PRG-158. Seedling growth is slow in early stage of growth might be due to negative drymatter accumulation. This was followed by a relatively short exponential phase and later the linear growth phase is for longer period during which drymatter increases are at a constant rate for longer periods. The end result is that plant tends to fill the space available to them. Further, the growth points are in the apical meristem and apical growth tends to produce length which require an added source of growth hormones and this is the result of interaction of numerous internal growth influencing factors mostly those under genetic control. Gardner *et al*. (1988) [6].

Number of branches per plant was not significantly influenced by different varieties. PRG 100 recorded more number of branches plant^{-1} followed by ICPL 85063 and PRG 158. The lower number of branches per plant were registered in WRG 53. Tirumala Rao (2011) [2] noticed that LRG-41 recorded more number of branches plant^{-1} and lower number of branches per plant were registered in PRG-158.

Number of pods plant^{-1} was significantly influenced by varieties. Variety WRG 53 registered more number of pods plant^{-1} which was however comparable with PRG 158 and LRG 30 and significantly superior over other varieties tested. The taller plants, more number of primary and secondary branches plant^{-1} in WRG 53, PRG 58 and LRG 30 might have contributed for more number of pods plant^{-1}. These results were contradictory to Tirumala Rao (2011) [2] who reported that LRG-41 variety registered the highest number of pods plant^{-1} over WRG-53 and PRG-158. The probable reasons for lower number of pods plant^{-1} in other tested varieties might be due to lack of pollination, fertilization, abortion of fruits and flowers is common in cleistogamous legumes. Gardner *et al*. (1988) [6] observed that these abortions are believed to be caused by deficiency of organic nutrient resulting from intra plant competition. Similar results were also reported by Srinivasan *et al*. (1997) [12]. The fruit growth and development as normally indicates by fertilization is referred to as fruit set. Fruit set is associated with a number of physiological events including rapid fruit growth and flower senescence. Nicholas (1971) [9] observed that the growth substances viz., ethephon and 2, 4-D accelerated the senescence of flower in conjunction with fruit development probably by stimulating the production of IAA which frees bound ethylene in flower (Gardner *et al*., 1988) [6].

Number of seeds pod^{-1} was not influenced by varieties. However, the varieties, LRG-30, TRG 33, PRG 100 and TRG

38 registered numerically higher number of seeds pod^{-1}. Number of seeds pod^{-1} is mostly regulated by the genetic makeup of the varieties and hence, the non significant differences were observed among the varieties. Similar results were also reported by Dhingra *et al*. (1980) [5]. Tirumala Rao (2011) [2] noticed that LRG-41 and WRG-53 registered numerically higher (4) seeds pod^{-1} and PRG-158 variety registered 3 seeds pond^{-1}.

Test weight was significantly influenced by varieties. Among the varieties tested, WRG 27 registered higher test weight which in turn comparable with TRG 22 and TRG 59 and significantly superior over other varieties tested. These results were contradictory to Tirumala Rao (2011) [2] who reported that LRG-41 registered significantly higher test weight and the remaining two varieties i.e. PRG-158 and WRG-53 were on par with each other. Seed weight increases due to rapid deposition of starch endosperm. At the end of the seed filling period, a steady state (physiological maturity) will be reached at which time, growth increments are in balance with metabolic loss increments. The period of seed growth for crop plants varies from about 20-40 days depending on genotype and environment, especially temperature (Gifford and Evons, 1981) [7]. The difference in yield attributes largely depends on inheritable characteristics of the variety. Similar results were also reported by Reddy *et al*. (1984) [10].

Among the varieties tested, WRG 53 recorded highest seed yield (353 Kg ha^{-1}) which in turn on par with PRG 158 (330 kg ha^{-1}) and PRG 100 (304 kg ha^{-1}) significantly superior to other tested varieties. Lowest seed yield (41 kg ha^{-1}) was with BRG 1. Tirumala Rao (2011) [2] reported that LRG-41 recorded significantly highest seed yield and the lowest seed yield was with PRG-158. The crop duration plays an important role in its productivity. Generally longer the duration higher would be the yielding ability. It is an indicative of better yield potentiality of the varieties coupled with other desirable yield components of an ideal type. Significantly higher seed yield might be due to their reaction to the available soil moisture during pod filling and developmental stages. Similar results were also reported by Ahlawat *et al*. (1975) [4]. Longer duration varieties recorded much longer vegetative phase and produced more leaves which in turn produced a large amount of photosynthates resulted higher seed yield. Further, higher number of pods plant^{-1} might have contributed for the higher yields in WRG 53, PRG 158 and PRG 100. Similar results were also reported by Chauban and Singh (1981) and Ahuja (1984) [3].

Among the varieties tested, WRG 53 variety recorded significantly highest stalk yield followed by WRG-27 and the lowest stalk yield (862 kg ha^{-1}) was recorded in LRG 41. These results were contradictory to Tirumala Rao (2011) [2] who reported that LRG-41 variety recorded significantly highest stalk yield followed by WRG-53 and the lowest stalk yield was recorded in PRG-158. The difference in the stalk yield might be due to difference in the vegetative growth of the varieties. The variety with higher vegetative growth registered more stalk yield as compared to other varieties. The highest stalk yield recorded with WRG 53 variety because of its indeterminate growth habit and more number of branches. These results are in accordance with the findings of Singh *et al*. (1985) [11]. Plant development is a combination of a host of complex process of growth and differentiation that leads to a dry matter production. WRG 53 variety offered more time for photosynthesis and the more was the photosynthates available for differentiation and hence more drymatter production.

Among the varieties tested, PRG 158 recorded the highest harvest index (18.8) followed by PRG 100 (18.5) and the lowest harvest index were recorded in ICPL 85063. The harvest index speaks of the conversion efficiency of non grains in to grain portion by turning up nutrient uptake as well as utilization. It is an indicative of better yield potentiality of a variety coupled with other desirable yield components of an ideal plant type. The highest harvest index in PRG 158 and PRG 100 could be due to its highest seed yield and stalk yield. Tirumala Rao (2011) [2] who reported that LRG-41 recorded the significantly highest harvest index followed by WRG-53 and the lowest harvest index was with PRG-158.

Correlation between yield components and yield of redgram varieties

Number of seeds per pod, seed yield and harvest index were positively and significantly correlated with number of pods per plant (Table 2). Test weight was negatively correlated to number of pods per plant. There was positive correlation between number of seed per pod and seed yield. There was positive correlation between seed and stalk yield. Harvest index was significantly and positively related with seed and stalk yield.

From the above results it can concluded that among the varieties tested, WRG 53, PRG 158 and PRG 100 were found suitable for red soils of scarce rainfall zone under rainfed conditions.

Table 1: Yield attributes and yield of redgram varieties (Mean of 2 years)

Variety	Plant height (cm)	Number of pods per plant	No. of seeds per pod	Test weight (g)	Seed yield (kg/ha)	Stalk yield (kg/ha)	HI
TRG 33	148.4	123	3.15	10.6	115	1187	11.9
WRG 53	152.6	161	3.07	9.4	214	1670	8.6
BRG 2	138.7	110	3.25	10.8	146	1156	13.2
PRG 158	144.3	138	2.97	9.7	198	1637	9.4
PRG 100	148.3	122	2.78	8.9	242	1386	11.9
LRG 41	147.5	108	2.81	9.5	81	963	5.4
LRG 30	162.0	146	3.31	9.4	136	1396	10.2
TRG 38	142.9	115	3.29	10.2	119	1325	5.0
PRG 176	99.5	150	2.88	9.8	219	970	18.4
S.Em +	15.5	13.8	0.43	0.51	21.3	51.6	--
CD at 5%	51.2	39.8	NS	1.52	60.3	146.5	--

Table 2: Correlation coefficient between yield components and yield of redgram varieties (Mean of 2 years)

Parameter	Plant height (cm)	No. of pods per plant	No. of seeds per pod	Test weight (g)	Seed yield (kg/ha)	Stalk yield (kg/ha)	Harvest Index
Plant height (cm)	1						
No. of pods per plant	0.631*	1					
No. of seeds per pod	0.538*	0.728*	1				
Test weight (g)	-0.171	-0.106	0.413	1			
Seed yield (kg/ha)	0.485*	0.813*	0.368	-0.323	1		
Stalk yield (kg/ha)	0.323	0.167	-0.027	-0.438	0.343	1	
Harvest Index	0.165	0.662*	0.334	-0.047	0.706*	0.056	1

*= Significant at 5 % level

References

1. Anonymous. Low productivity problems of pulses. Surv. Indian Agric., Hindu Publ., 2011, 65-67.
2. Thirulama Rao A. Performance of redgram cultivars under transplanted conditions. M.Sc. Ag Thesis submitted to Acharya N. G. Ranga Agricultural University, Hyderabad 2011.
3. Ahuja KN. Response of pigeonpea to plant density and phosphate fertilization. Indian Journal of Agronomy. 1984;29(4):528-532.
4. Ahlawat IPS, Saraf CS, Singh A. Studies on the performance of pigeonpea varieties to dates of planting and row spacing. Indian Journal of Agronomy 1975;20(3):245-247.
5. Dhingra KK, Singh S, Tripathi HP. Phenological behaviour and yield of pigeonpea genotypes under different planting and row spacings. Paper presented in International workshop on pigeonpea crop at ICRISAT 1980.
6. Gardner FP, Pearce RB, Mitchell RL. Physiology of Crop Plants. 187-315. scientific publishers, Jodhpur 1988.
7. Gifford RJ, Evons LT. The induction of flowering, Ithaca: Cornell University press 1981, 310-319.
8. Ministry of Agriculture. Government of India, New Delhi 2014.
9. Nicholas K. J. Horticultural Sciences 1971;46:323-332.
10. Reddy TY, Reddy PM, Reddy JB, Rami Reddy S, Sankar Reddy GH. Studies on suitable varieties of groundnut for normal and delayed sowing under rainfed conditions. Indian Journal of Agronomy 1984;29(1):55-60.
11. Singh G. Effect of date of sowing and plant population on growth and yield of arhar genotypes. M. Sc (Ag) Thesis submitted to Punjab Agricultural University, Ludhiana. Singh, G., Mavi, H. S and Dhingra, K. K. 1985. Effect of time of sowing on growth and yield of Pigeonpea cultivars. Haryana Agricultural University Journal of Research 1980;15(4):427-430.
12. Srinivasan K, Ramaswamy M, Vairavan K. Spatial requirement of short duration redgram genotypes grown in alfisols. Madras Agricultural Journal 1997;84(7):390-391.