International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume:03, Issue:01

STUDIES ON PIGEONPEA PRODUCTIVITY IN CONTEXT TO DATE OF SOWING

ARUNKUMAR, M. M. DHANOJI, J. R. PATIL

Department of Crop physiology
University of Agricultural Sciences, Raichur-584104, India
College of Agriculture, Raichur

ABSTRACT

A field experiment was conducted to study the physiological basis of variation in pigeonpea productivity under rain fed situations at College of Agriculture, Raichur during the year 2013-14. The pigeonpea crop was sown on three different dates *i.e.* 10^{th} July, 1^{st} August and 20^{th} August in order to create natural thermo variability during crop growth . Significantly higher seed yield was recorded with early sown crop(10^{th} July, 2052.40 kg ha^{-1}) over the late sown crop (1^{st} August,1290.01 kg ha^{-1} and 20^{th} August (894.70 kg ha^{-1}). The higher yield of early sown crop may be attributed to higher pods per plant (627.02), pod weight per plant (162.46 g $plant^{-1}$), 100 seed weight (10.87 g), plant height (184.31 cm), total dry matter (403.78 g $plant^{-1}$), number of primary branches (21.63) and number of secondary (48.50), stem thickness (8.23 cm) and more number of days to attain physiological maturity (165.87). Further, Low yield of Pigeonpea under late sown condition may be attributed to reduced crop duration due to short day nature of plant and was expressed in terms earliness in maturity. However, among the genotype studied cv. Asha (1670.14 kg ha^{-1}) recorded significantly higher seed yield over other three genotypes . It might be due to longer duration of the crop growth and ascribed to higher number of pods per plant, pod weight per plant, 100 seed weight, plant height, total dry matter, and stem thickness, number of primary and secondary branches.

Keywords: Date of sowing, genotype, Pigeonpea, Plant height, Physiological maturity, Total dry matter

INTRODUCTION

Pigeonpea (*Cajanus cajan* L. Millsp.) is one of the most important leguminous perennial crops cultivated as annual in semi arid tropical and subtropical regions. India has the distinction of being world's largest producer and consumer of pigeonpea. About 90 per cent (3.75 million

 Copyright © IJAER 2017, All right reserved

ISSN: 2455-6939

Volume:03, Issue:01

hectare) of global pigeonpea area is in India, contributing to 90 per cent of production (3.1 Million tonnes) with productivity of 799 kg $ha^{-1.}$ The productivity of Pigeon pea in northern Karnataka which is called as a Dal Bowl of Karnataka is far below (539kg/ha) than the state average (556kg/ha), national average(799kg/ha) and world average (844 kg/ha (Anon., 2012). The probable reasons for poor productivity seems to be due to the fact that, Pigeonpea is being grown under rain fed situation and has been a highly risky venture with vagaries of monsoon, the interplay of other abiotic and biotic factors particularly, initial moisture stress, diurnal variation in temperature coupled with frost and foggy weather during reproductive growth phase and terminal drought. In such a situations of uncertainty, intra and inter annual variability in weather causes substantial fluctuations in pigeonpea productivity leading to the instability in production more so with climate change.

Pigeonpea is a *kharif* season crop and the optimum date of sowing recommended is first fort night of June. Under delayed onset of monsoon situation delays sowing beyond second fortnight of July in this region. The initial vegetative growth takes place during the *Kharif* season and floral initiation to end of grain filling phase occurs in (*Rabi* season) winter season and pod filling phase of the crop is generally suffers from terminal stress which causes damage to the crop., In context of climate change, it has been revealed that the pulses, pigeonpea in particular, have the potential to maximize the benefits of elevated CO_2 arising out of climate change (effects) by matching the stimulated photosynthesis with increased nitrogen fixation. However, such positive results illustrate the importance of pigeonpea as a crop for food and nutritional security under the climate change scenario. Generally climate change is expected to trigger the changes in terms of phenology and physiology of the pigeonpea crop. In view of this ,to know the effect of thermo variables on performance and was simulated through sowing the crop at different dates.

MATERIAL AND METHODS

The experiments were conducted during *kharif* season of 2013-14 at College of Agriculture, Raichur on black loamy soil. The trial was laid out in split plot design with three dates of sowing as a main plot *viz.,* 10^{th} July, 1^{st} and 20^{th} August and four genotypes as a subplot *viz.,* BSMR-736, TS-3R, Asha and Maruti with three replications. The crop was raised following recommended package of practices UAS-Raichur and was adequately protected against pest and diseases. The observations on number of pods per plant fully developed pods were separated from five plants and were counted and the average was taken. The pods from all five randomly tagged plants from each treatment were weighed separately on analytical balance and average of mean pod yield expressed in g $plant^{-1}$. Seed samples of 100 seeds were collected from the produce of each treatment separately and weight of 100 seeds was expressed as test weight in grams. Plant height from the base of the plant at ground level to the growing tip of the plant was

 Copyright © IJAER 2017, All right reserved

ISSN: 2455-6939

Volume:03, Issue:01

recorded from five tagged plants and the mean plant height was worked out and expressed in centimeter. Five plants were uprooted at randomly in boarder rows of each treatment and partitioned into stem, leaf and reproductive parts. These samples were oven dried at 70 ^{o}C in hot air oven for 48 hours till a constant weight. The total dry matter production per plant was obtained with the summation of dry weight of all plant parts and was expressed on per plant basis (g plant^{-1}). Maximum stem thickness of five representative plants in each treatment was recorded by using varniear calipers at physiological maturity stage and the average was expressed in centimeter as stem thickness. The number of branches emerging directly from main stem of five tagged plants was counted and the average was expressed as number of primary branches per plant. The number of branches emerging from primary branches was counted and the average of five plants was expressed as number of secondary branches per plant. The number of days taken by the plants to attain the 80 per cent of pod maturity were counted and recorded as days to physiological maturity stage. This stage characterized by pods turning brownish in color, completely ceasing of vegetative growth and plant parts starts drying.

RESULTS AND DISCUSSION

The early sown (July 10$^{th)}$ crop recorded significantly higher mean of seed yield (2052.40 kg ha^{-1}) over the 1st(1290.01 kg ha^{-1}) and 20th August(894.70 kg ha^{-1})sown crop (Table 1). Statistically higher seed yield with July 10th early sown crop may be ascribed to higher yield traits and morpho-physiologcal growth parameter, *viz.,* number of pods per plant (627.34), pod weight per plant (232.09 g plant^{-1}), 100 seed weight (10.87 g), plant height (184.31 cm), total dry matter (403.78 g plant^{-1}), stem thickness (8.23 cm), number of primary (21.63) and secondary (48.50) branches and more days to attain physiological maturity (165.87 days). Increased number pods per plant and pod weight per plant may be attributed to optimum and profuse vegetative growth resulting in profuse flowers and sink in early sown crop due to longer vegetative growth phase and was evident from higher dry matter, branches, plant height, stem thickness and total dry matter into seeds as compare to late sown crop Ravindranath reddy *et al*. (1997). These results are in good agreement with (Chandra *et al*. 1983) who reported effect of sowing on grain yield increases when sowing was taken up before July 15th and late sowing cause's considerable reduction in yield due to photoperiodicity and excessive soil moisture stress which coincides with the reproductive growth.

 Copyright © IJAER 2017, All right reserved

ISSN: 2455-6939

Volume:03, Issue:01

Table 1. Seed yield and yield components of pigeonpea as influenced by date of sowing

Date of sowing	Seed yield (kg ha^{-1})	Pods per plant	Pod weight per plant (g)	100 seed weight (g)	Physiological maturity
10th July	**2052.40**	**627.02**	**162.46**	**10.87**	**165.87**
1st August	**1290.01**	**475.45**	**119.28**	**10.11**	**163.10**
20th August	**0894.70**	**233.14**	**84.25**	**9.21**	**161.07**
S.Em (±)	37.71	11.51	4.40	**0.71**	**1.45**
C.D @ 5 %	123.53	45.41	17.30	**NS**	**NS**
Genotype					
BSMR-736	**1482.51**	**510.31**	**135.88**	**9.51**	**177.70**
TS-3R	**1087.50**	**334.02**	**93.70**	**10.08**	**141.75**
Asha	**1670.14**	**547.53**	**139.72**	**10.76**	**178.78**
Maruti	**1409.34**	**387.74**	**116.75**	**9.21**	**155.19**
S.Em (±)	57.39	13.23	2.81	**0.62**	**1.78**
C.D @ 5 %	170.36	39.44	8.33	**NS**	5.27

The cv. Asha produced significantly higher seed yield (1670.14 kg ha^{-1}) followed by BSMR-736 (1482.51 kg ha^{-1}), over Maruti (1409.34 kg ha^{-1}) and TS-3R (1087.50 kg ha^{-1}). The increased mean yield of cv. Asha may be attributed to yield traits and more days to physiological maturity. The difference in seed yield of pigeonpea varieties was also reported by Ravindranath reddy *et al.* (1997). The significant reduction in the seed yield of cv. TS-3R and Maruti can be traced back to significant reduction in yield traits like number of pods plant^{-1}, seed weight per plant and 100 seed weight plant height, stem thickness total dry matter as compared to cv. Asha. Similarly, difference in number of pods plant^{-1}, number of seeds pod^{-1} and 100 seed weight of pigeonpea varieties were observed by Puste and Jana (1996).

In the present study, numerically higher 100 seeds weight is recorded with 10th July sown crop (10.87 g) followed by 1st (10.11 g) and 20th (9.21 g) August sown crop (Table 1). The reduction in test weight of late sown pigeonpea was mainly attributed due to reduction in dry matter

 Copyright © IJAER 2017, All right reserved

ISSN: 2455-6939

Volume:03, Issue:01

accumulation in leaves which might not have supplied the required assimilates. Thus, due to lack of assimilates the seed might not have developed fully and resulted in smaller in size and hence lower test weight. On the other hand, cv. Asha (10.76 g) recorded higher 100 seed weight followed by TS-3R. Results are in line with the findings Govind reddy *et al*. (1991) who reported 100 seeds weight was decreased by 3 and 11 per cent when sowing was delayed from 15th October to 30th October and 14th November.

The maximum stem thickness of the plant is considered as an indicator of vegetative sink capacity. The final grain yield in pigeonpea largely depends on stored food in vegetative sinks and for the one or the other reason, the current photosynthesis contribution to yield is very meager. However, the vegetative sink capacity is measured in terms of stem thickness, total dry matter, plant height, primary and secondary branches per plant. Significantly higher stem thickness (8.23 cm), total dry matter (403.78 g plant^{-1}), plant height (184.31 cm) primary branches per plant (21.63), secondary branches per plant (48.5) were recorded with 10th July sowing over 1st and 20th August late sowing. Increased mean value of stem thickness, total dry matter and plant height branches with early sowing may ascribe to longer crop duration particularly vegetative growth phase. Among the genotypes, Asha, recorded significantly higher mean value for stem thickness (7.67 cm), total dry matter (347.39 g plant^{-1}) plant height (169.16 cm), primary branches (19.65), secondary branches per plant (38.83) followed by BSMR-736 over TS-3R. The higher mean values for stem thickness and branches per plant may be attributed to accumulation of more assimilates due to longer crop duration.

It is observed that 10th July sown crop recorded significantly more days to attain physiological maturity (165.87 days) followed by 1st and 10th August sowing. This may be due to the fact that, pigeonpea crop is photo period sensitive and exposure to favorable short day photoperiod makes plants to switch into reproductive.

In context to thermo variable factor, (Table 3) The lower mean minimum temperature coupled with higher mean diurnal variation in temperature particularly at flowering to pod formation stage is associated with 20th August sown crop. It seems to be major reason for poor yield as low temperature comes in the way of proper translocation to seeds and was evident from reduced 100 seed weight in late sown crop. Similarly, higher mean value for diurnal variation in temperature coupled with terminal moisture stress during bud initiation to pod initiation phase might have forced the crop to complete the life cycle and resulted in the drastic yield reduction and was expressed in terms of reduced yield traits in late sown crop particularly 20th August sown crop. Similarly reduced grain filling duration in pigeonpea in late sown crop due to moisture stress was realized (Kaul, J. H. and Sekhon (1996.).

 Copyright © IJAER 2017, All right reserved

Table 2. Morpho-physiological parameter of pigeonpea as influenced by date of sowing

Date of sowing	Plant height (cm)	Stem thickness (cm)	Number of primary branches	Number of secondary branches	Total dry matter (g plant$^{-1)}$
10th July	**184.34**	**8.23**	**21.63**	**48.50**	**403.78**
1st August	**163.71**	**7.22**	**19.01**	**32.00**	**283.32**
20th August	**136.51**	**5.11**	**10.53**	**17.31**	**149.57**
S.Em (±)	1.18	0.06	0.61	**2.61**	**0.87**
C.D @ 5 %	4.51	0.24	2.41	**10.34**	**3.43**
Genotype					
BSMR-736	**162.83**	**7.60**	**17.18**	**35.23**	**323.43**
TS-3R	**155.35**	**5.89**	**15.37**	**24.56**	**195.56**
Asha	**169.16**	**7.67**	**19.65**	**38.38**	**347.39**
Maruti	**158.99**	**6.34**	**16.12**	**32.41**	**249.74**
S.Em (±)	1.28	0.05	0.53	**1.25**	**1.33**
C.D @ 5 %	3.80	0.15	1.60	**3.54**	3.96

 Copyright © IJAER 2017, All right reserved

ISSN: 2455-6939

Volume:03, Issue:01

Table -3 Mean minimum maximum and diurnal variations in temperature during different phenological stages of pigeonpea as influenced by date of sowing

	Mean Minimum temperature (^{0} C)			Mean Maximum temperature (^{0} C)			Mean Diurnal variation (^{0} C)		
Date of sowing / **phases**	10th July,	1st August,	20th August	10th July,	1st August,	20th August	10th July,	1st August,	20th August
Vegetative stage	22.38±0.29	22.15±0.06	21.75±0.17	31.40±0.20	31.55±0.06	31.28±0.05	9.03±0.10	9.40±0.08	9.53±0.13
Flower bud to flower initiation	21.63±0.21	19.33±1.33	15.73±2.55	30.83±0.10	30.33±0.21	30.50±0.08	9.20±0.18	10.98±1.16	14.78±2.50
Flower to pod initiation	18.03±0.26	17.00±2.20	14.73±1.47	30.38±0.29	30.83±0.10	30.03±0.68	12.35±0.48	13.83±2.24	15.03±2.00
Pod to 50 % podding	17.23±0.67	15.65±0.99	15.65±1.39	30.78±0.56	29.98±0.84	29.53±0.54	13.55±1.10	14.35±0.91	13.88±1.37
50 % podding to maturity	13.70±1.49	15.98±1.73	17.20±0.27	29.70±0.75	30.35±0.54	30.78±0.71	16.00±1.09	14.38±1.53	13.58±0.57

 Copyright © IJAER 2017, All rights reserved

ISSN: 2455-6939

Volume:03, Issue:01

REFERENCES

1 Govindreddy, M., Ghosh, B. C. and Sudhakar, N., 1991. Studies on scheduling of irrigation to winter pigeonpea. *Indian J. Agron.,* 36: 109-111.

2 Kaul, J. H. and Sekhon, H. S., 1975, Response of pigeonpea to dates of planting and phosphorus levels. *Indian J. Agr.,* 20 (4): 376 - 377.

3 Puste, A. M. and Jana, P. K., 1996, Response of pigeonpea cultivars to spacing. *Indian Agri.,* 40: 53-56.

4 Ravindranath reddy, B., Maheswara reddy, P., Pratap kumar Reddy, A. and Sahadeva reddy, B., 1997, Evaluation of pigeonpea cultivars for adoption to post rainy season. *The Andhra Agri. J.* 44: 102-103.

 Copyright © IJAER 2017, All right reserved