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Crop weather relationship in pigeonpea (*Cajanas cajan* L.)

M. Ratnam, S. Rajamani, M. Sreekanth and E. Narayana
Regional Agricultural Research Station, Lam, Guntur-34, Andhra Pradesh

ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Lam farm, Guntur, Andhra Pradesh, to study the crop weather relationship in pigeonpea under Krisha agro climatic conditions of Andhra Pradesh during kharif and rabi 2014-15 with two newly developed redgram genotypes viz., LRG 52 and LRG 104. The two varieties were sown from 2nd FN of June to 1st FN of October, total sowings adopted were eight at fortnightly intervals. The crop sown on 2nd FN of June received maximum rainfall and maximum temperature followed by sowings during 1st and 2nd FN of July and the lowest with 1st FN of October. Maximum sunshine hours (5.7 hrsd^{-1}) recorded with 1st FN of October sowing, whereas early sowings received comparatively low sunshine hours. Due to variation in agro-climatic environment under different sowing windows, days to 50 % flowering, plant height, number of pods plant^{-1}, yield were affected greatly. Weather parameters viz., total rainfall received with plant yield, maxuimum temperature with days to 50 % flowering, maximum number of sunshine hours day^{-1} with number of pods plant^{-1} and plant yield were found positive significant correlation, with the two newly developed redgram genotypes.

Key words: Agro climatic environment, weather parameters, correlation Coefficient, GDD, HUE

I. INTRODUCTION

Pigeonpea is a quantitative short day plant which responds well to varying agro-climatic conditions. In most of the upland areas of Krishna zone redgram is grown as *kharif* and *rabi* crop. Maharastra is the leading state in area and production. It is being cultivated due to the advantage of growing on marginal and sub marginal lands with residual moisture. Red gram is a protein rich staple food. It contains about 22 percent protein, which is almost three times that of cereals. Most of Indians are vegetarian, in vegetarian diet tur dall occupies 90 % followed by chickpea. The daily requirement of human being is around 80 grams day^{-1} but per capita availability is only 30 grams. Due to increasing population the demand for pulse has been increased and it would be the doubled. The production and productivity and per capita availability in our country is very low due to non availability of high yielding varieties, lack of technology, unfavourable biotic and abiotic factors and cultivation under poor and marginal soils under rainfed conditions. Though it can withstand high temperature but threshhold limit is 13.0^{o}C. Hence, India is importing pulses to a worth of Rs. 13,350 crores from Myanmar, Bangladesh and East African countries (Anonymous,2014). To improve the production and productivity in our country evaluation of suitable high yielding redgram verities for location specific agroclimatic conditions is required to meet the present demand. In this context, the response of newly developed redgram genotypes LRG 52 and LRG 104 is to be studied in agroclimatic environment of Krishna zone. Therefore, present investigation was initiated to study the crop weather relationship in redgram under Krishna agro-climatic zone of Andhra Pradesh, India during *kharif* and *rabi.*

II. MATERIALS AND METHODS

Field experiment was conducted at Regional Agricultural Research Station, Lam, which was 8 km away from Guntur town and 64 km to the north-west of the Bay of Bengal. It is approximately 1,600 km to south of the national capital, New Delhi and 30 kilometers south-east of new state capital, Amaravathi. Guntur is located at 16^{0}22^{1} N 80^{0}16^{1} E with average elevation of 33 meters

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from M S L and situated on the plains. The Guntur region is one of the most fertile areas in India, with the river Krishna flowing to the north of the district, the area has many farmlands. The climate was sub-tropical with major part of rainfall concentrated June to September (SW monsoon) and October to December (NE monsoon). The mean annual rainfall was around 900-1000 mm in 52-54 rainy days. The experiment was conducted during 2014-15 at Regional Agricultural Research Station (RARS), Lam under Krishna agro climatic zone of Andhra Pradesh. The soils of the experimental area were broadly classified as black cotton soils (vertisols) with neutral to slightly alkaline in reaction (pH 7.9 to 8.1), low to medium in organic carbon content (0-0.51%), low in available N (230 $kgha^{-1}$), medium to high in available P (59 $kgha^{-1}$) and medium to high in available K (150-500 $kgha^{-1}$). The treatments consist of eight sowing dates and two genotypes replicated three times in RBD. Daily data on rainfall, T max., T min., RH_1&$_2$, sunshine hours, evaporation and wind speed (agro meteorological data) was collected during crop growth period i.e., from sowing to harvest from Agricultural Meteorological Field Unit (AMFU) of RARS, Lam. The weather parameters mean maximum, mean minimum temperatures, mean relative humidity, rainfall, sunshine hours, wind speed and pan evaporation were correlated with days to 50 % flowering, plant height (cm), number of pods $plant^{-1}$ and seed yield of redgram.

III. RESULTS

Agro-climatic environment

Agro-climatic indices prevailing during crop growth have been shown in Table.1. The highest amount of rainfall 693.9 was received by the first date of sowing (2nd FN of June) followed by second date of sowing (1st FN of July) and there after gradual decrease in the amount of rainfall received (from D3 to D 8). Pigeonpea requires an optimum rainfall around 500 mm which was received in five sowing windows i.e. 2nd FN June (D1) to 2nd FN of August (D5). The mean maximum and mean minimum temperature received by all sowing windows are on par with the optimum temperature required by pigeonpea (optimum maximum 30-35 ^oC and optimum minimum 19-23 ^oC). Sunshine hours received during crop growth ranged from 4.1 to 5.7, 1st FN of July (D2) received lowest SSH and 1St October (D8) sowing received maximum SSH. Maximum GDD and HUE was recorded with 2nd FN June to 2nd FN July (D1 to D3).

Table 1 Agro-climatic environment during crop growth

Date of sowing	Total rainfall (mm)	Mean Temp ^oC		SSH	Humidity		G D D ^oC	H U E	
		Tmax.	T min	Day^{-1}	Mor	eve		LRG104	LRG52
D1 : 2nd FN June	693.9	34.5	19.3	4.3	79	55	31.2	7049.2	6245.6
D2 : 1st FN July	685.6	32.7	19.4	4.1	87	61	29.4	6412.1	6497.4
D3 : 2nd FN July	626.3	31.9	20.1	4.2	96	77	29.0	7101.4	6001.3
D4 : 1st FN Aug	485.3	31.5	18.8	4.8	91	61	27.9	4904.8	4890.9
D5 : 2nd FN Aug	468.1	31.3	18.6	4.6	92	60	27.6	5012.2	5183.3
D6 : 1st FN Sept	337.5	31.2	18.8	5.3	93	60	27.6	4763.8	4164.8
D7 : 2nd FN Sept	293.3	31.1	18.9	5.3	93	60	27.6	4964.5	4204.1
D8 : 1st FN Oct	64.9	31.6	19.7	5.7	93	57	28.5	4734.1	4389.8

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Yield components and crop weather relation

Variation in sowing windows of pigeonpea under Krishna agro-climatic zone influenced the days to 50% flowering, plant height, number of pods plant$^{-!}$, pod yield plant^{-1}. Redgram genotypes LRG 104 and LRG 52 were sown from 2nd FN of June to 1st FN of October. Among the sowing windows, 2nd FN of June and 1st & 2nd FN of July sowings received highest amount of rainfall, mean maximum and mean minimum temperature, GDD, HUE and Lower sunshine hours and humidity compared to latter sowings. Experiment resulted indicated that maximum plant height, number of pods plant^{-1}, yield plant^{-1} was recorded with June and July sowings. (Table 1& 2). Favourable weather parameters like maximum rainfall, optimum temperature range, GDD and HUE during the crop season resulted in arriving higher yield plant $^{-1}$ for the first three sowing windows even though lower SSH were received. The SSH day^{-1} had less influence on yield for the crop when sown during *kharif*. These results were in conformation with Patel *et al*., (1997) and Singh and Singh (2000).

The yield plant^{-1} was reduced from 4th sowing window (1st FN Aug) onwards up to last sowing i.e., 1st FN October, where as less variation for plant yield was recorded for the above sowings in terms of yield. This may be due to low receipt of rainfall from 4th sowing window onwards which below 500 mm. Thought lowest rainfall received in the last sowing window (1st October) which is ten times less first sowing window (693.9 mm). the variation recorded in terms of rainfall does not reflected in term of plant yield. pigeonpea is naturally drought tolerant legume which will survive with minimum amount rainfall received during the crop growth. The crop sown in the last sowing window thrived well with an yield of 50 % to the fist sowing crop this clearly indicates that pigeonpea crop resists under low rainfall conditions for attaining considerable yield

Table 2. Agroclimatic environment vs yield parameters

Date of sowing	Days to 50% flowering		Height at maturity (cm)		No of pods/plant at maturity		Per plant yield (g)	
	LRG-104	LRG-52	LRG-104	LRG-52	LRG-104	LRG-52	LRG-104	LRG 52
D1 : 2nd FN June	132	123	210.8	186.6	548	427	226.3	200.5
D2 : 1st FN July	120	110	200.6	176.9	551	413	218.1	221.0
D3 : 2nd FN July	109	100	192.3	168.1	543	407	245.3	207.3
D4 : 1st FN Aug	100	98	185.3	160.8	410	356	175.8	175.3
D5 : 2nd FN Aug	100	98	178.6	152.6	403	333	181.6	187.8
D6 : 1st FN Sept	98	95	170.1	155.1	396	307	172.6	150.9
D7 : 2nd FN Sept	98	95	168.9	152.9	365	308	180.2	152.6
D8 : 1st FN Oct	98	94	168.6	136.5	322	301	166.4	154.3

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Crop weather relationship was carried by correlation studies. Correlation coefficient between yield and its components and agrometeorological parameter were estimated and parameters showing statistically significant. (Table 3). Total rainfall had positive significant with number pod plant^{-1}, plant height and yield plant^{-1}. The sowing dates which received maximum rainfall recorded higher yields than the sowing dates with lesser rainfall. This clearly rainfall is the prime parameter among all othe weather parameters influences yield. sowing windows viz., 2nd FN June, 1st & 2nd FN July recorded higher yields than the other sowing windows. Maximum temperature had significant influence with days to 50 % flowering followed by plant height. The first three sowing windows attained maximum temperature during crop period resulted higher yields the sowing windows which received high rainfall incombination with high mean maximum temperatures recorded higher yields than sowing dates with lower values of weather parameters. Pigeonpea is a photo and thermo sensitive plant maximum temperature had direct influence on days to 50 % flowering and the favourable temperature range may influence flowering behavior. Based the on the study sowing of pegionpea during June and July is ideal for obtaining higher yields due to favourable weather received for those days in coastal Andhra Pradesh.

Table . 3 Correlation coefficients between yield and agro-meteorological parameters

Parameter	Varieties	T R fall	Max	Min	SSH	Relative humidity (%)		Evapo ration	Wind speed
			^{0}C	^{0}C	hrs/day	Mor.	Even.	mm/day	kmph
Days to 50 % flowering	LRG 104	0.596	0.940	0.115	0.531	0.729	0.009	0.587	0.689
	LRG 52	0.559	0.956	0.035	0.467	0.857	0.052	0.451	0.573
Plant height (cm)	LRG 104	0.808	0.786	0.104	0.764	0.561	0.008	0.663	0.762
	LRG 52	0.874	0.664	0.029	0.728	0.520	0.011	0.543	0.651
No. of pods at Maturity	LRG 104	0.883	0.527	0.081	0.865	0.261	0.145	0.766	0.815
	LRG 52	0.848	0.636	0.199	0.847	0.352	0.089	0.791	0.852
Per Plants Yield (g)	LRG 104	0.665	0.410	0.399	0.715	0.107	0.320	0.932	0.918
	LRG 52	0.788	0.373	0.156	0.922	0.178	0.132	0.614	0.637

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