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INFLUENCE OF SOWING DATES ON THE PHENOLOGY AND TRANSPIRATION RATE IN PIGEONPEA

K. BALAKRISHNAN[1] and N. NATARAJARATNAM[2]

Six pigeonpea cultivars were grown under three different dates of sowing (21-2-84, 21-6-84 and 21-9-84) to examine the effects of environmental influence on phenology and transpiration rate. Transpiration rate was measured at selective stages of crop growth. Phenological observation were also recorded. Dry matter accumulation (DMA) and seed yield were recorded at harvest stage.

Days to first flower opening, 50% flowering and harvest were reduced progressively from February to September planting. Earlier flowering with shorter crop duration was observed in September sowings.

Transpiration rate increased upto 50% flowering and thereafter declined. It was more in February sown crops as compared to others. It had positive and significant association with DMA and seed yield in all the stages of crop growth with the highest correlation at 50% flowering stage.

Pigeonpea is one of the important dry land pulse crop in India. Its productivity is very low as compared to other pulses. Generally, the productivity is built through the various physiological processes that are taking place in different stages of crop cycle (Yoshida, 1972). Proudction of a large amount of biomass is one among the many determinants of the grain Productivity (Upretty *et al*, 1979). Earlier studies in pigeonpea also revealed that the DMA is an important factor which decides the productivity (Ahlawat *et al*, 1981; Ekshringe *et al*, 1983). As it is a quantitatively shorter day plant, the DMA in pigeonpea is mainly regulated by phenological and physiological processes through the variations in the environmental factors (Wallis *et al.*, 1980). Transpiration rate is one among the many physiological factor deciding the DMA and seed yield. Information on the transpirationin rate pigeonpea is scanty (Rameshbabu *et al.*, 1982; Onium, 1983). So, an attempt has been made in the present study to find out the influence of sowing dates on the DMA and seed yield as influenced by phenology and transpiration rate.

Department of Crop Physiology, Tamil Nadu Agricultural University Coimbatore - 641 003.
Present Address

1. Assistant Professor, Agricultural college Killikulam Vallanad 627 252.

2. Dean, Agricultural College Karikal Pondicherry State.

Table 1. Meteorological observations (Monthly total and mean)

Year and Month	Temperature (°C)				Relative humidity (%)				Rainfall (mm)		Sunshine hours		Evaporation (mm)		Solar radiation			
	Maximum		Minimum		07-22		14-22								(Cal cm² min¹)		Day length (Hours)	
	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	No. rainy days	Total	Mean	Total	Mean	Total	Mean	Total	Mean
1984																		
February	858.5	29.6	592.0	20.4	2612	90.0	1435	49.0	53.8	3	182.5	6.3	112.0	4.4	6018.6	207.53	342.16	11 48
March	997.9	32.1	613.5	19.9	2695	86.9	1256	40.2	121.7	6	263 2	8.4	130.0	4.2	7130.2	230.0	315 23	12.06
April	1021.6	34.0	685.4	22.8	2676	89.2	1353	45.1	53.8	5	247.5	8.3	150.2	5.0	6954.0	231.80	372.50	12.25
May	1107 6	35.7	729 0	23.5	2595	83.7	1201	38.7	53.4	5	292.6	9 4	193.0	6.2	7803.6	251.72	393.15	12.51
June	926.7	30.8	687 7	22.9	2230	74.0	1604	53.0	41.0	4	100 9	3.3	198.2	6.6	6144.8	204 82	383.10	12.46
July	939.5	30.3	699.4	22.3	2495	80.4	1718	50.4	43.5	4	137.8	4.4	171.0	5.1	6382.0	205.87	392.24	12.39
August	976 6	31.5	676.5	21.8	2471	80.0	1539	50.0	8.1	1	196.5	6.3	224.4	7 2	7036.0	226.96	384.09	12.23
September	954.2	31.8	653.0	21.7	2551	85.0	1516	50.0	82 6	6	204.8	6.8	150.4	5.3	6598 0	219.93	364 30	12.06
October	916.4	29.6	624.2	20.1	2713	87.0	1709	55 0	290.3	9	233.8	8.0	119.2	3.8	6949 4	224.17	368.17	11.52
November	877.6	29.2	598 2	19.9	2658	89.0	1600	53.0	86.2	5	217.7	7.2	94.8	3.1	6160.2	205.34	348 50	11.30
December	900.0	29.0	516.4	16.6	2800	90.0	1422	45 0	40.5	2	287.7	9.2	120 0	3.8	6918.2	223.16	357.20	11.37
1985																		
January	892.0	28.7	591.4	19.1	2776	89.0	1588	51.0	70.4	4	228.9	7 1	109 8	3.5	6297 8	203.15	358.27	11.33
February	905.0	32.3	532.0	19.0	2256	81.0	980	35.0	—	—	245.4	8.9	145 2	5.1	6614.4	36.20	330.22	1147

MATERIALS AND METHODS:

The experiment was conducted in Tamil nadu Agricultural University, Coimbatore with six pigeonpea cultivars comprised of three long duration (CORG 11, PLS 361/1, and SA 1) and three short duration (CO 5. CORG 5 and UPAS 120) cultivars in three different sowing dates viz, 21-2-84, 21-6-84, and 21-9-84. The experiment was laid out under irrigated conditions thrice in a Randomised Block Design. Fertilizer was basally applied at the rate of 20:40:0 (NPK) as urea, superphosphate and muriate of potash respectively at the time of to sowing. The seeds were given *Rhizobium* treatments before sowing. During the growth period, the plants were found to be free from wilt and root rot diseases.

The meterological observations during the whole cropping period (21-2-84 to 26 2 85) were collected and the monthly total and mean were presented (Table 1). The data on day length 11°N latitude were calculated based on the monthly dew register and summaries, C. F. Casella and Co., Ltd., London.

Transpiration rate was measured at 50th day after sowing, first flowering (First flower opening), 50% flowering and harvest stages in a

Table 2. Phenological Observations

Date of Sowing	Cultivars	Days at First Flowering	Days at 50% Flowering	Days at Harvest	Date of Harvest
	CO 5	68	86	123	22.6 84
	CORG 5	71	92	134	3.7.84
21.2.84	UPAS 120	64	83	120	19.6.84
	CORG 11	130	162	210	17.9 84
	PLS 361/1	138	169	218	25.9.84
	SA 1	141	178	224	1.10.84
	CO 5	66	78	117	15.10.84
	CORG 5	65	79	121	19.10.84
21.6 84	UPAS 120	59	69	109	7.10 84
	CORG 11	117	134	179	16.12.84
	PLS 361/1	121	136	182	19.12.84
	SA 1	124	139	186	23.12.84

	CO 5	64	73	112	10.01.85
	CORG 5	63	74	118	16.1.86
21.9.84	UPAS 120	57	66	103	1.01.85
	CORG 11	89	104	147	14.02.85
	PLS 361/1	92	110	154	21.02.85
	SA 1	96	112	159	26.02.85

fully expanded young trifoliate leaf from the top of the plant (Rawson and Constable, 1980) with the use of LI-1600 Auto Steady State Porometer, LI-COR, Lincoln, Nebraska, 68504-USA Five plants from each replications were selected to attain DMA and seed yield. Correlation coefficients were worked out accroding to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION :

Phenology :

Pigeonpea phenology is highly susceptible to the variations in the environmental factors because of its quantitatively short day nature (Spence and Fordham 1973). The present study also confirms the above findings that the days at first flowering 50% flowering and crop duration were drastically altered by sowing dates (Table 2). The reduction in crop duration in September 21 sown crop was due to the reduction in the vegetative phase. This was mainly attributed to the low temperature, cool climate and shorter day length prevailed during the particular (21 6-84 to 26-2-85) period. Abrama, 1975; Gowda and Kaul, 1982; Wallis *et al.*, 1980). The longer crop duration in February 21 sown crop was mainly due to the favourably high temperature, sunshine solar radiation, low relative humidity and comparativey longer day length bserved during that particular period.

TRANSPIRATION :

Transpiration rate increased as time trend upto 50% flowering and thereafter declined (Table 3). It was significantly altered by sowing dates. It decreased progressively from February sown crop to September sown crop. Comparatively, higher transpiration rate in February sown crop was mainly coincided with the high temperature, solar radiation, evaporation and low Relative humidity prevailed during that cropping period (Table 1). Transpiration rate also varied among cultivars. This varation mainly stemmed from the differences in the ability of individual cultivars to absorb moisture from the soil and to convert water into water vapour (Kakde, 1985).

CROP PRODUCTIVITY :

The DMA as a measure of assimilate efficiency decreased from

February 21 to September 21 sown crop (Table 4). Apart from the favourable environmental conditions in the February sown crop, the longer crop duration was also responsible for the high amount of DMA. Since high DMA is one of the pre-requisites for yield productivity in pigeo pea similar to that of DMA. Comparatively (Balakrishnan, 1986), the seed yield also followed the trend higher seed yield and DMA was noticed in the long duration cultivars than the short duration cultivars.

Table 3. Influence of Sowing Dates on the Transpiration Rate (Ug. cm^{-2} S^{-1})

Sowing Dates	CULTIVARS	STAGES			
		50th Day After sowing	First flowering	50% flowering	HARVEST
	CO 5	39.74	40.89	43.26	19.61
	CORG 5	46 42	44 85	45.16	21.45
21-2-84	UPAS 120	47.21	48.91	47.31	22.60
	CORG 11	46.40	37 96	48.40	31.66
	PLS 361/1	44.10	45.31	47.61	27.60
	SA 1	43.20	44.62	46.81	24.85
	MEAN	44.52	45.42	46.43	23.63
	CO 5	36.23	37.21	37.50	22.81
	CORG 5	37.17	38.26	39.21	24.85
21-6-84	UPAS 120	38.87	38.92	38.98	27.43
	CORG 11	39.97	40.24	39.54	28.37
	PLS 361/1	36.30	36.60	37.26	29.14
	SA 1	36.50	37.40	38.92	30.14
	MEAN	37.51	38,11	38.57	27.12
	CO 5	39.97	32.47	30.80	20.84
	CORG 5	37.63	38.74	30.67	20.65
21-9-84	UPAS 120	37.47	38.40	30.73	22.45
	CORG 11	37.17	39.00	31.36	18.17
	PLS 361/1	35.10	36.00	30.29	23.19
	SA 1	34.93	30.21	28.80	19.67
	MEAN	37.05	35.80	30.44	20.83

	SE	CD
CULTIVAR	0.346	0.979 **
SOWINGS	0.245	0.963 **
SEASON X CULTIVAR	0.599	1.697 **

Table 4. Effect of sowing dates on DMA and seed yield

Season	Cultivars	DMA $(G \cdot m^{-2})$	Seed Yield (g- plant)
	CO 5	391.3	41.20
	CORG 5	428.7	47.90
SUMMER	UPAS 120	267.3	33.58
(21.2.84)	CORG 11	5695.1	60.60
	PLS 361/1	6114.1	178.75
	SA 1	6287.1	186.68
	MEAN	3197.3	108.12
	CO 5	170.5	28 90
	CORG 5	203.0	30 60
	UPAS 120	125.3	24.80
KHARIF	CORG 11	600.7	29.60
(21.6.84)	PLS 361/1	683.8	50.40
	SA 1	668.9	59.10
	MEAN	408.7	37.23
	CO 5	91.7	13 40
	CORG 5	98.2	16.74
	UPAS120	71.3	10.07
REABI	CORG	24.17	35.87
(21.9.84)	PLS 361/1	19.8	25.67
	SA 1	283.6	73.16
	MEAN	167.7	23.15

	SE	CD	SE	CD
CULTIVAR	25.97	58.66**	0.953	2.872*
SEASON	18.37	41.66**	0.674	2.031**
CULTIVR X SESON	44.98	101.62**	1 651	4.976**

Correlation coefficient was worked out by pooling the all the three dates of sowing between crop productivity and seed yield (Table 5). It revealed that there was a linear relationship between transpiration rate and crop productivity. The highest correlation was obtained at 50% flowering both in DMA ($r=0.6394^{**}$) and seed yield (0.6815**). It is well evident from this study that the transpiration rate is a measure of physiological potential, which is directly related to crop productivity. Similar relationship in pigeonpea was obtained by earlier findinge (Onium, 1983).

In Summary, the present study pointed out that the phenology of pigeonpea is highly variable under different enviromental conditions Earlier flowering and shorter crop duration was achieved under cool climate coupled with shorter day length. Seed yield was dependent on the DMA and crop duration. A linear relationship could be obtained between both seed yield and DMA with transpiration rate.

Table 5. Correlation of Transpiration with DMA and Seed Yield

Transpiration rate ($ug\ cm^{-2}\ S^{-1}$)	DMA	Seed yield
50th day after sowing	0.5466**	0.5194**
First flowering	0.5715**	0.5914**
50% flowering	0.6394**	0.6815**
Harvest	0.5758**	0.4748**

** Significant at 0.05% probability.

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INTERCROPPING IN RAINFED *RAGI*

M. N. BUDHAR[1] and N. GOPALASWAMY[2]

Field experiments were conducted for two years (1982-1983) under rainfed conditions at Regional Research Station, Paiyur to identify the suitable intercrops. Lablab, redgram maize, sorghum, soybean and greengram as intercrops in *ragi* each at 4:1, 6:1 and 8:1 ratio was compared with pure crop of *ragi*. *Ragi* as pure crop gave higher grain yield than in intercropping system. Intercropping systems gave higher net income than the sole crop. Raising *ragi* with greengram at 4:1 ratio gave the highest net income (Rs. 2374/ha) compared to pure crop of *ragi* (Rs. 1991/ha).

Intercropping is a potential agronomic practice that can increase the productivity per unit of land and offer an insurance when the season is unfavourable. The success of any intercropping system would depend upon crop compatibility. Hence it is important to select the intercrops carefully on the basis of their mutual competition and benefit of association. *Ragi* (*Eleusine coracana*) is grown in an area of 1.29 Lakh hectares in the northwestern region of Tamil Nadu, comprising Dharmapuri and Salem districts. About 85 percent of this area is rainfed. These districts have the benefit of both south-west and north-east monsoon rains, the distribution being respectively 50 and 35

1. Assistant Professor } Department of Agronomy, Tamil Nadu.
2. Associate Professor } Agricultural University, Coimbatore-3.