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GROWTH ANALYSIS IN PIGEONPEA (*Cajanus cajan* (L.) Millsp) AS INFLUENCED BY DATE OF SOWINGS

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An experiment conducted with pigeonpea in three different dates namely 21-2-84 (summer), 21-6-84 (monsoon) and 21-9-84 (winter) revealed that significant higher LAI and CGR was noticed in summer sowings. The Dry Matter Accumulation (DMA) was found to be also maximum in summer sowings. It was mainly influenced through the longer croppings period and also higher LAI and CGR. It was also evident from this study that CGR in pigeonpea was more influenced by LAI rather than NAR.

Plant growth analysis is considered to be standard approach to the study of plant growth and productivity (Wilson, 1981). Such a study in pigeonpea has also been carried out by number of workers (Keatinge and Hughes, 1980 ; Pandey, 1980). These studies have been carried out to compare the performances of the varieties based on the growth analysis. However, studies on the effect of environmental factors as regulated by different date of sowing are limited in pigeonpea. So, the present study was aimed at to find out the effect of date of sowing in the growth analysis components such as LAI, CGR and NAR in pigeonpea.

MATERIALS AND METHODS

An experiment was laid out under field conditions during the year 1984-85. Six pigeonpea cultivars comprised of three short duration (Co 5, CORG 5 and UPAS 120) and three long duration (CORG 11, PLS 361/1 and SA 1) were selected for the study. Sowings were taken at three different dates namely 21-2-84, 21-6-84 and 21-9-84. Design adopted was Randomised Block Design with three replications. Uniform irrigation, plant protection and cultural practices were followed in all the three sowing dates. Five plants from each replications were removed at 30, 40 and 50 days after sowing and also at first flowering, 50% flowering and harvest stages. The leaf area was measured in LI-COR 3100 conveyer belt leaf area meter. The Leaf Area Index (Williams, 1946) and Net Assimilation Rate based on leaf weight (Williams, 1946) and Crop Growth Rate (Watson, 1958) were calculated at respective stages. The total dry matter accumulation at the harvest stage was also measured and expressed as g m^{-2}.

RESULTS AND DISCUSSION

Leaf Area Index

Data on Leaf Area Index (LAI) (Table 1) revealed that it increased as the age of the crop advanced upto 50% flowering and declined thereafter. Summer sowing recorded (21-2-84) significantly higher LAI than the monsoon (21-6-84) and winter (21-9-84) sowings. The favourable high temperature, solar radiation and sunshine

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Table 1. Leaf Area Index (LAI)

Treatments (Date of sowings)	Cultivars	Stages (Days after sowing) 30	40	50	First flowering	50% flowering	Harvest
	Co5	0.038	0.22	1.20	3.15	3.52	2.16
	CORG 5	0.037	0.25	1.21	3.02	3.12	2.65
	UPAS 120	0.037	0.13	0.81	1.37	1.45	0.80
21-2-84	CORG 11	0.026	0.13	0.70	19.9	22.6	13.2
	PLS 361/1	0.034	0.18	0.98	24.2	27.5	18.1
	SA 1	0.029	0.16	0.99	23.6	27.3	17.0
	CO 5	0.054	0.14	0.29	0.83	1.16	0.73
	CORG 5	0.048	0.11	0.34	1.01	1.46	0.79
	UPAS 120	0.043	0.09	0.25	0.43	0.53	0.29
21-6-84	CORG 11	0.044	0.12	0.29	4.25	4.46	2.87
	PLS 361/1	0.038	0.11	0.28	3.56	4.34	2.81
	SA 1	0.049	0.12	0.26	3.84	4.47	2.72
	CO 5	0.021	0.07	0.22	0.47	0.56	0.32
	CORG 5	0.022	0.06	0.19	0.39	0.46	0.30
	UPAS 120	0.023	0.05	0.15	0.23	0.32	0.19
21-9-84	CORG 11	0.016	0.05	0.19	1.67	2.15	1.62
	PLS 361/1	0.023	0.07	0.23	1.65	2.05	1.71
	SA 1	0.019	0.07	0.23	1.74	2.53	1.56
			SE	CD			
	Cultivar		0.13	0.37			
	Sowing		0.09	0.26			
	Cultivar x sowing		7.23	8.65			

hours which prevailed during that period may be responsible for such high LAI. Similar findings were also reported at ICRISAT. It was started that summer sowing recorded higher LAI than the rabi sown crop (Anon., 1982). The long duration cultivars recorded higher LAI than the short duration cultivars in all three sowings. The enormously high LAI in long duration cultivars in summer sown crop (First and 50% flowering) was due toits spacing 45 x 45 cm coupled with longer cropping period. Wallis *et al.* (1975) also reported LAI between 13 and 16 from Australian cool climatic conditions.

Net Assimilation Rate

Data on Net Assimilation Rate (NAR) were presented in Table 2. As expected, it decreased as time trend in all the three sowing. Significant difference could be noticed among cultivars and sowings. Short duration cultivars recorded higher NAR than the long duration cultivars only in the reproductive phase in all the three sowings. This cultivar differences could be ascribed from its duration as well as perennial nature of the long duration in cultivars (Sheldrake, 1984). In the vegetative phase, (30-50 days) summer sowing recorded higher NAR

Table 2. Net Assimilation Rate (g. g^{-1} - day^{-1})

Treatments (Date of sowings)	Cultivars	Stages (Days after sowing) 30-40	40-50	50-First flowering	First flowering to 50% flowering	50% flowering to harvest
	CO 5	0.2835	0.3418	0.1679	0.0875	0.0408
	CORG 5	0.2573	0.3225	0.1585	0.0991	0.0479
	UPAS 120	0.2332	0.3759	0.2155	0.0777	0.0269
21-2-84	CORG 11	0.2910	0.3320	0.0634	0.0285	0.0025
	PLS 361/1	0.2552	0.3466	0.0342	0.0245	0.0013
	SA 1	0.2516	0.5246	0.0718	0.0193	0.0006
	CO 5	0.2617	0.2129	0.2378	0.1428	0.1103
	CORG 5	0.2458	0.2317	0.2338	0.1260	0.0902
	UPAS 120	0.1813	0.0287	0.3587	0.2191	0.2089
21-6-84	CORG 11	0.2344	0.2157	0.1898	0.0323	0.0359
	PLS 361/1	0.2412	0.2326	0.1800	0.1373	0.0293
	SA 1	0.1851	0.2202	0.1882	0.1124	0.0404
	CO 5	0.1930	0.1970	0.1520	0.2380	0.1820
	CORG 5	0.2030	0.0960	0.1910	0.3130	0.1920
	UPAS 120	0.2020	0.2420	0.1720	0.4150	0.2460
21-9-84	CORG 11	0.2120	0.2450	0.1680	0.0870	0.0590
	PLS 361/1	0.2190	0.2370	0.1520	0.0690	0.0290
	SA 1	0.1890	0.2340	0.1470	0.1250	0.0440
			SE	CD		
	Cultivar		0.0016	0.0046		
	Sowing		0.0011	0.0032		
	Cultivar x Sowing		0.0028	0.0080		

than the other sowings, whereas the reproductive phase in the winter sowing recorded higher NAR than the others. These variations could account for outgrowth of new leaves and also associated with fluctuations temperature. The low temperature in the winter sowings might have reduced the respiratory loss and thereby higher conservation of photosynthates and thus high NAR.

Crop Growth Rate

Crop Growth Rate (CGR) increased upto first flowering and declined thereafter (Table 3). The significant higher CGR in summer sowing might have stemmed from the higher LAI rather than NAR. It is well known fact that CGR is a product of NAR and LAI. Similar to LAI, long duration cultivars recorded higher CGR than the short duration cultivars. This was clearly evident in the reproductive phase. Similar variations at cultivar level in CGR has also been reported by earlier workers (Sheldrake and Narayan, 1979). It is a well established phenomenon that CGR in pigeonpea is more dependent upon the LAI rather than NAR. The CGR in pigeonpea is also influenced by environmental factors. The higher

Table 3. Crop Growth Rate (g. m^{-2} - day^{-1})

Treatments (Date of sowings)	Cultivars	Stages (Days after sowing) 30-40	40-50	50- First flowering	First flowering to 50% flowering	50% flowering to harvest
	CO 5	1.68	11.22	18.97	14.61	6.65
	CORG 5	1.69	10.85	16.97	15.98	6.86
	UPAS 120	1.08	8.77	16.61	8.34	4.36
21-2-84	CORG 11	1.11	6.57	130.17	38.10	2.97
	PLS 361/1	1.29	8.19	129.10	33.84	1.59
	SA 1	1.12	8.91	128.63	29.22	0.78
	CO 5	1.04	2.73	7.34	10.94	6.79
	CORG 5	1.12	3.44	9.27	14.15	7.32
	UPAS 120	0.67	2.52	7.67	6.59	6.32
21-6-84	CORG 11	0.80	2.20	14.70	6.68	5.94
	PLS 361/1	0.83	2.29	13.14	29.36	5.90
	SA 1	0.68	2.09	19.42	23.34	7.69
	CO 5	0.52	1.39	2.52	6.99	5.66
	CORG 5	0.50	0.61	2.76	8.14	5.38
	UPAS 120	0.44	1.44	1.91	6.78	4.65
21-9-84	CORG 11	0.42	1.44	6.72	10.04	6.29
	PLS 361/1	0.50	1.63	6.18	8.09	3.32
	SA 1	0.43	1.38	5.95	16.11	5.81
		SE	CD			
	Cultivar	0.24	0.69			
	Sowing	0.17	0.49			
	Cultivar x Sowing	0.42	1.19			

Table 4. Crop duration and dry matter accumulation

Treatments (Date of sowings)	Cultivars	Dry matter accumulation (g. m^{-2})	Crop duration (days)
	CO 5	391.3	123
	CORG 5	428.7	134
21-2-84	UPAS 120	267.3	120
	CORG 11	5695.1	210
	PLS 361/1	6114.1	218
	SA 1	6032.1	224
	CO 5	170.5	117
	CORG 5	203.0	121
21-6-84	UPAS 120	125.3	109
	CORG 11	600.7	179
	PLS 361/1	638.8	182
	SA 1	668.9	186
	CO 5	91.7	112
	CORG 5	98.2	118
	UPAS 120	71.3	103
21-9-84	CORG 11	241.7	147
	PLS 361/1	219.8	154
	SA 1	283.6	159
		SE	CD
	Cultivar	25.9	58.7
	Seasons	18.3	41.5
	Cultivars x Season	44.9	101.6

temperature, solar radiation and sunshine hours favour for higher CGR through its influence on LAI and photosynthesis.

Dry Matter Accumulation and Crop duration

As it is a quantitatively short day plant, the duration of the crop varies depending upon the date of sowing. The duration decreases progressively from summer sowing to winter sowing (Table 4). This was mainly due to the decreasing day length and cool climate prevailed during the winter season. The dry matter accumulation (DMA) also decreased progressively from summer to winter sowings. The longer cropping period associated with favourable climatic conditions in summer sowing was the probable reason for the high DMA summer sowings. Chauhan *et al.* (1982) also reported that April planting, recorded more DMA than the December plantings. The dry weight of the later was only a tenth of the former.

From this study, it could be concluded that the summer sowing resulted in significantly higher DMA than the other sowings. This was mainly stemmed through the LAI and CGR. It was also evident that CGR is more nfluenced by LAI rather than NAR. A clear cut difference could be noticed between short and long duration cultivars. The duration of the crop was decreased when sowing was taken in June and September months.

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