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HEAT UNIT EFFICIENCY IN PIGEONPEA

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An experiment conducted in pigeonpea under three different date of sowing revealed that the heat unit efficiency was higher in the February 21 sowing than the June 21 and September 21 sowings. Seed yield had positive and significant association with heat unit efficiency on flowering and harvest stages. This study also suggests that heat unit efficiency can be used as a measure of crop efficiency for heat use under varying agroecological situations.

Crop production is mainly depends upon the climatic requirement of the particular crop. Temperature had been know to affect the adaptability of a crop (Wallis, *et al.*, 1980). Crop productivity was also inhibited at temperature higher than optimum (Gilmore and Rogers. 1958). The efficiency of temperature utilisation or heat use is also varied depending upon the variety and also locations. Rajput (1980) calculated the heat unit efficiency for soybean and compared the performances of the varieties sown under different dates with respect to utilisation of heat in terms of degree days during the crop growth. So far, this kind of approach in pigeonpea is very limited. So, the present study was aimed at to find out the heat unit efficiency of pigeonpea cultivars sown under different seasons.

MATERIALS AND METHODS

The experiment was laid out under field conditions in Millet Breeding Station, Tamil Nadu Agrl. University, Coimbatore. Six pigeonpea cultivars comprised of three (150-180 days) long duration (COR G 11, PLS 361/1 and SA 1) and three (105-120 days) short duration (CO.5, CORG. 5 and UPAS 120) cultivars were selected for the study. The trial was conducted in three different sowing dates viz., 21-2-84, 21-6-84 and 21-9-84 in a Randomised Block Design with three replications. The total dry matter accumulation (DMA) was recorded at 30th day after sowing, flowering and harvest stages. Growing degree days (GDD) or effective heat unit was calculated as per the method suggested by Iwata (1984). This is an arithmatic accumulation of daily

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mean temperature above certain threshold temperature.

$$\text{Degree days} = \frac{(\text{Maximum} + \text{Minimum})}{2} - \text{base temperature}$$

The temperature 15° C was considered as base temperature (Johansen, 1984) for pigeonpea for calculating the degree days. The maximum and minimum daily temperatures were observed in the Meteorological observatory located in the Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore-3. The heat unit efficiency (HUE) was calculated as follows (Rajput, 1880).

$$\text{Heat unit efficiency} = \frac{(\text{DMA (g.m-2)}}{\text{GDD}}$$

The recorded seed yield or harvest stage was subjected to simple correlation with heat unit efficiency.

RESULTS AND DISCUSSIONS

Data on growing degree days (GDD), dry matter accumulation (DMA) and heat unit efficiency (HUE) were presented in Table 1. The GDD ncreased steadily from 30th day after sowing to harvest. The long duration cultivars exhibited higher GDD in flowering and harvest stages. Similar trend was also noticed in the case of DMA. The high amount of DMA in the long duration cultivars was due to its longer cropping period (150-210 days) in all the three sowings. Dry matter yield as high as 23 t ha-1 had also been reported from Australia for a long duration cultivars Cv. UQI (Akinola and Whiteman, 1974). GDD and DMA were decreased progressively from 21-2-84 sowing to 21-9-84 in both type of cultivars except at 30th day where the highest GDD was obser ved 21-6-84 sown crops followed by 21-2-84 and 21-9-84. This might be due to the high mean temperature prevailed during that period.

With regard to HUE, it increased as the age of the crop advanced except in the 21-2-84 sown crops where the cultivars UPAS 120, CORG 11, PLS 361/1 and SA 1 recorded declining trend at harvest stage. The HUE as a measure of amount of GDD required to produce unit amount of DMA, is mainly depended upon the daily mean temperatures during the cropping period (Uchijma, 1975). In the present study also, the high DMA, GDD and HUE could be related to the comparatively higher mean temperature 27.65° C in 21-2-84 than the 21-6-84 (26.8° C) and 21-9-84 (24.43° C).

Correlation of HUE with seed yield revealed that the association was found to be positively significant in all the stages of corp growth except at 30th day ($r = 0.2661$). The highest significant association ($r = 0.9882^{**}$) was noticed at harvest stage followed by flowering phase ($r = 0.0833$). A Similar correlation in pigeonpea was also obtained earlier by chi-chu wang (1979).

Table 1. Heat Unit Efficiency

Date of sowing	Cultivar	30th day GDD [days]	30th day DMA [g m^{-2}]	30th day HUE	Flowering GDD [days]	Flowering DMA [g m^{-2}]	Flowering HUE	Harvest GDD [days]	Harvest DMA [g m^{-2}]	Harvest HUE	Seed yield [g plant^{-1}]
	CO 5	319.2	3.87	0.0121	811.6	473.49	0.5834	1552.5	982.87	0.6329	41.20
	COR G 5	319.2	4.13	0.0129	855.6	486.09	0.5681	1685.7	1110.02	0.6585	47.90
	UPA S 120	319.2	3.77	0.0118	758.4	334.93	0.4416	1518.1	655.04	0.4315	33.58
21.2.84	COR G 11	319.2	2.71	0.0085	1639.6	10497.54	6.4025	2569.9	11859.95	4.6155	160.60
	PLS 361 / 1	319.2	3.54	0.0110	1735.0	11463.27	6.6036	2665.7	12590.58	4.7232	178.75
	SA 1	319.2	3 40	0.0107	1773.0	11801.17	6.6560	2729 9	12918.59	4.7323	186.68
	CO 5	347.5	3.13	0.0090	768.9	161.54	0.2101	1343 0	543.74	0.4049	28.90
	COR G 5	347.5	2.79	0.0080	756.9	187.47	0.2477	1375.0	636.52	0.4629	30.60
	UPA S 120	347.5	4.22	0.0121	704.4	105.22	0.1494	1264.0	423.85	0 3353	24.80
21.6.84	COR G 11	347.5	3.06	0.0088	1343.0	1018.13	0.7581	1902.5	1402.96	0.7374	29.60
	PLS 361 / 1	347.5	2.97	0.0085	1375.0	967.25	0.7038	1922.2	1679.60	0.8738	50.40
	SA 1	347.5	3.65	0.0105	1406.8	968.73	0.6886	1947.3	1680.59	0.8630	59.10
	CO 5	307.6	2.68	0.0087	646.4	57.13	0.0884	1046.6	340.86	0.3257	13.40
	COR G 5	307.6	2.57	0.0084	636.3	49.72	0.0781	1097.8	376.43	0.3429	16.74
	UPA S 120	307.6	2.33	0.0076	590.8	34.53	0.0584	962.4	267.50	0.2779	10.07
	COR G 11	307.6	2.09	0.0068	838.4	283.06	0.3376	1374.6	704.49	0.5129	35.87
	PLS 361 / 1	307.6	2.28	0.0074	857.9	283.06	0.3299	1456.5	573.73	0.3939	25.67
	SA 1	307.6	2.50	0.0081	886.9	249.42	0.3319	1504.3	825.47	0.5487	37.16
	SE	—	—	—	—	—	—	—	—	—	1.651
	CD	—	—	—	—	—	—	—	—	—	4.976

The present study pointed out that the crop growth is mainly depended upon the effective utilization of heat or temperature prevailed during the cropping period. The HUE clearly differentiated the efficiency of the cultivars under different sowing dates. The seed yield was also found to have significant association with HUE. So, this HUE can be used as a measure of crop efficiency under varying agroecological niche.

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