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HEAT UNIT EFFICIENCY IN RICE

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ABSTRACT

The experiment conducted with thirty rice cultivars revealed that there are cultivar differences in drymatter, grain yield, growing degree days and heat unit efficiency. The heat unit efficiency depended upon the duration, drymatter and prevailing temperature. The cultivar IET 7590 and IET 7301 were screened for their better heat unit efficiency for dry matter and grain yield, respectively. This study suggests that the heat unit efficiency can be used as a measure of crop efficiency for temperature utilisation.

Crop productivity mainly depends upon the climatic requirement of the particular crop. Temperature had been known to affect the growth and yield of rice (Yoshida, 1973). Crop growth was inhibited at temperature higher than optimum. The efficiency of temperature utilization or heat use is a function of production efficiency of a crop at particular location. Balakrishnan and Natarajaratnam (1986) calculated the heat unit efficiency for redgram 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 rice has not been attempted. Hence, the present study was aimed at to find out the heat unit efficiency of rice cultivars grown under, Coimbatore conditions.

MATERIALS AND METHODS

The experiment was laidout under the field conditions in Paddy Breeding Station, Coimbatore. Thirty rice cultivars were evaluated in a randomised block design with three replications in samba season. The total dry matter production and the grain yield were recorded at harvest. Growing degree days (GDD) or effective heat unit was calculated as per the method suggested by Iwata (1984). This is an arithmetic accumulation of daily mean temperature above the threshold temperature where, the Degree days: $\frac{(\text{Maximum} + \text{Minimum})}{2}$ - base temperature. The warmth of 13°C was considered as a base temperature (Yoshida, 1981) for rice for calculating the degree days. The maximum and the minimum daily temperatures were observed in the meteorological observatory in the central farm, Tamil Nadu Agricultural University, Coimbatore-3. The monthly mean observations are presented (Table 1). The heat unit efficiency (HUE) was calculated as follows (Rajput. 1980).

Heat unit efficiency =

$$\frac{\text{Dry matter production } (g/m^2)}{\text{Growing degree days}}$$

RESULTS AND DISCUSSION

The total drymatter production and grain yield differed significantly among varieties (Table 2). The highest dry matter of 1737 g/m^2 was recorded in

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Table 1. Meteorological observations during the growing period

Months	Temperature (°C)		Sunshine duration (hrs)	Evaporation (mm/day)	Solar radiation (Cal/cm2/day)
	Max.	Min			
From August 16	32.4	23.0	6.2	7.7	208.1
September	33.2	22.7	7.4	6.7	232.8
October	30.9	22.7	6.0	4.0	191.8
November	29.3	21.3	6.1	3.6	192.8
December	27.8	20.4	5.2	2.8	164.1
January	28.7	17.0	8.0	3.9	210.6
Upto February 16	32.7	19.6	9.6	5.9	237.9

IET 7590. The cultivar IET 7301 recorded the highest grain yield of 573 g/m^2. The accumulated degree days (Growing degree days) from sowing to harvest varied among cultivars depending upon the duration. The cultivars with 145 days duration (Co 38, ASD 5, ASD 11) recorded the higher growing degree days (GDD) of 1722 than the other cultivars. The heat unit efficiency for dry matter production and the grain yield ranged from 0.105 to 1.128. The highest heat unit efficiency of dry matter was (1.128) recorded in IET 7590. The cultivar IET 7301 recorded the highest heat unit efficiency (0.372) for the grain yield. The heat unit efficiency as a function of temperature utilisation for productivity

Table 2. Heat unit efficiency in rice cultivars

Cultivars	Dry matter production (g/m2)	Grain yield (g/m2)	Heat unit Efficiency			Duration (days)
Co 30	1612	419	1652	0.976	0.254	140
Co 36	776	173	1652	0.469	0.105	140
Co 38	1305	385	1722	0.758	0.224	145
Co 42	1357	382	1595	0.851	0.239	135
Co 43	1402	542	1595	0.879	0.329	135
Co 44	1357	479	1595	0.851	0.300	135
TNAU 4372	1422	522	1477	0.963	0.353	125
" 80030	1483	453	1540	0.963	0.294	130
" 80042	1380	480	1540	0.896	0.312	130
" 831520	1188	448	1477	0.804	0.303	125
" 831521	1357	522	1477	0.919	0.535	125
IR 20	1596	541	1477	1.081	0.366	125
IR 42	1450	257	1652	0.878	0.156	140
IR 54	1420	535	1540	0.922	0.347	130
IR 62	1475	422	1595	0.925	0.265	135
IR 64	1232	335	1430	0.862	0.234	120
IET 7301	1438	573	1540	0.934	0.372	130
" 7303	1406	569	1540	0.913	0.369	130
" 7590	1737	514	1540	1.128	0.334	130

Table 2 contd

Cultivars	Dry matter production (g/m2)	Grain yield (g/m2)	Heat unit Efficiency			Duration (days)
AS 781/1	1478	388	1540	0.959	0.252	130
AD 9408	974	279	1477	0.659	0.257	125
ADT 38	1083	275	1652	0.656	0.166	140
ASD 5	1322	264	1722	0.768	0.153	145
ASD 11	1519	227	1722	0.882	0.132	145
Bhavani	1425	320	1540	0.925	0.208	130
Ponni	1488	448	1595	0.933	0.281	135
White Ponni	1586	429	1595	0.994	0.269	135
Paiyur 1	1304	294	1595	0.818	0.184	135
PY 1	1448	288	1595	0.908	0.181	135
MDU 2	1548	543	1477	1.048	0.368	125
Mean	1385.6	412.9	1571.5	0.884	0.265	137.2
SE	34.486	20.097	--	--	--	--
CD	57.592	47.463	--	--	--	--

depends upon the duration, ability to accumulate drymatter and the climatic conditions prevailed during the cropping season (Uchijma 1975). The highest heat unit efficiency for the grain yield in IET 7301 is due to its conversion efficiency of dry matter to the grain yield rather than its duration. The highest heat unit efficiency for drymatter in IET 7590 is attributed to its efficient accumulation of drymatter rather than its duration.

The present study indicates that the crop growth depended mainly upon the effective utilisation of heat or temperature prevailed during the cropping period. The HUE differentiates the efficiency of the rice cultivars grown under a particular environment. The HUE can therefor be used as a measure of crop efficiency under varying agroecological niches.

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