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Relative temperature disparity and rice yield across seasons in Tamil Nadu*

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ABSTRACT

Relative temperature disparity (RTD) and rice grain yield of *Kuruvai* (June-September), *Samba* (September- December) and *Navarai* (January – April) seasons of Tamil Nadu were related. For computing RTD, mean monthly maximum and minimum temperatures and rice grain yield were collected for twenty years (1980-1999). In general, RTD values had a positive relation with rice grain yield. In *Kuruvai* season, there was a good correlation at reproductive stage (r=0.601**) and maturity stage (r=0.727**). As against this, in *Samba* season, correlation was obtained only between RTD of reproductive stage (r=0.470**) and rice yield. During *Navarai* season, the RTD values were higher than that of *Kuruvai* and *Samba* seasons and positive correlation was obtained only at maturity stage (r=0.478**).

Key words: Rice, RTD, grain yield

Diurnal variation of temperature has profound influence on rice growth and its yield. Temperature influences the duration of tillering and tiller production and ultimately the final grain yield of rice (Lalitha *et al.*, 2000). Rice yields from equator to higher latitudes increased by one to five tons ha^{-1} (Vexkull, 1967). A temperature factor relative temperature disparity (RTD) correlated satisfactorily with the rice yields in different regions of Japan and the RTD values ranged between 20 and 40. In this study, RTD values of three seasons were correlated with rice grain yield obtained at Aduthurai (Tamil Nadu).

MATERIALS AND METHODS

The study area Aduthurai is situated at 11° 1' N latitude and 79° 32' E longitude, 19 m above mean sea level with an annual rainfall of 1181 mm, maximum temperature of 32.5°C, minimum temperature of 23.5 °C, relative humidity 0700 LMT of 80 per cent, relative humidity 1400 LMT of 58 per cent, wind speed of 9.9 km hr^{-1} and sunshine hours of 7.6.

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Table 1: Mean RTD values and CV percent (1980 –1999)

Month	Mean RTD	CV %
January	30.3	14.2
February	34.1	13.6
March	34.6	12.8
April	31.0	7.5
May*	29.8	6.8
June	27.5	9.7
July	26.8	5.9
August	26.1	6.4
September	26.7	10.0
October	24.1	6.1
November	22.9	8.7
December	25.0	12.7

* - Not accounted in the study

For computing RTD (Vexkull, 1967), mean monthly maximum and minimum temperatures were collected for twenty years (1980-1999) from Tamil Nadu Rice Research Institute, Aduthurai.

$$RTD = \frac{(Max. - Min.)\ Temp.\ (°C)}{Average\ Max.\ Temp.\ (°C)} \times 100$$

Data on rice grain yield for the *Kuruvai* (June- September), Samba (August-January) and *Navarai* (January-April) seasons were collected for the study period of twenty years. RTD was computed stage wise for rice in respect for three seasons. Correlation was made between stagewise RTD and rice grain yield.

RESULTS AND DISCUSSION

RTD was maximum in March (34.6) and February (34.1) with a minimum (Table 1) during the months of October (24.1) and November (22.9). Rice grain yield was higher in *Kuruvai* seasons followed by *Navarai* and *Samba* seasons (Table 2). Considering the CV, dependability was greater for *Navarai* season followed by *Kuruvai* and *Samba* seasons. The co-efficient of variation (CV %) for RTD was within 10 per cent for *Kuruvai*, 14 per cent for *Samba* and within 13 per cent for *Navarai* seasons (Table 3).

Table 2: Mean rice yield and CV percent (1980-1999)

Season	Rice yield (kg ha^{-1})	CV %
Kuruvai	5132	19
Samba	4055	26
Navarai	4609	18

The results indicated in general, that RTD values had positive relation with rice grain yield. When the stagewise values were correlated, there was strong correlation between RTD and rice grain yield at reproductive stage ($r = 0.60^{**}$) and at maturity ($r=0.72^{**}$). From the results it was apparent that the higher RTD during the reproductive and maturity stages indicate increased the rice yield, but do not show any influence of RTD during the early stages (Vegetative) of crop growth.

In respect of *Samba* season, the RTD was in the order of maturity >reproductive > vegetative stages and the maximum value fell within 30.3. As against observation made in *Kuruvai*, in *Samba* season,

Table 3: Duration of rice growth stages, RTD values and its correlations (r)

Growth stages	*Kuruvai* season				*Samba* season				*Navarai* season			
	Duration	RID	CV%	rvalue	Duration	RID	CV%	rvalue	Duration	RID	CV%	rvalue
Vegetative stage	55	27.2	6.8	0.27^{ns}	90	25.0	6.3	0.32^{ns}	60	32.2	11.8	0.26^{ns}
Reproductive stage	30	26.1	6.4	0.60**	30	25.1	12.7	0.47**	30	34.4	12.9	0.36^{ns}
Maturity stage	30	26.7	10.1	0.72**	30	30.3	14.3	0.37^{ns}	30	31.0	7.5	0.47**

* P= 0.05 % ; ** P=0.01 % ; NS= Non significant

correlation was obtained between RTD of reproductive stage (r=0.47**) and rice yield. During *Navarai* season, the RTD values were higher than that of *Kuruvai* and *Samba* seasons and this was in order of reproductive > vegetative > maturity stages. Positive correlation obtained only at maturity stage (r= 0.47**). The result showed that the *Navarai* crop attained grain filling and maturity stage during the month of April, which had higher RTD value.

The higher RTD value is an indication of a higher mean maximum temperature and relatively low mean minimum temperature. Morachan *et al.* (1974) reported that in general the rising temperature from planting to flowering and gradual lowering of temperature towards ripening is helpful for efficient translocation of photosynthates to grains (Sink).

Summarizing, the study shows that higher RTD at reproductive and maturity stages of *Kuruvai* seasons indicate normal and above normal yields while for *Samba* and *Navarai* seasons, RTD at reproductive and maturity stages corresponds to higher rice productivity respectively.

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