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DURATION OF RICE AS INFLUENCED BY SEASONS AND METEOROLOGICAL ELEMENTS

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Growth duration of rice has been considered to be important especially when associated with sowing time. The increasing emphasis on multiple cropping with short duration varieties will increase the need for the production of growth duration from probable seasonal climatic conditions as an aid to crop management. For photo insensitive varieties the duration of the crop is mainly influenced by temperature of the growing season. A longer duration in rabi and shorter duration in kharif was reported by Chatterjee *et. al* (1969). Chatterjee, *et al* (1970) also observed that in rainy season tillering period lasted only 40-45 days as against 50-55 days in dry cool season. Among the temperature components minimum air temperature exhibited stronger negative correlation with growth duration (Vergara *et. al* 1970). However the information regarding the influence of temperature components particularly water temperature are rare in tropical conditions. An investigation was under taken to evaluate the influence of different growing seasons and temperature components such as minimum and maximum air temperature, minimum and maximum soil water interface temperature and temperature summation on the growth duration of the rice crop.

Materials and Methods

A monthly sowing experiment was conducted at Central Rice Research Institute, Cuttack for 1972 and 1973. Four rice cultivars were sown in all the months except September, October and November. These sowing months were left out because of the severe cold experienced by the crop sown during these months. The crop growth period was divided into vegetative reproductive and ripening phases and the temperature data was recorded during the phases of crop growth. Since all the four varieties behaved more or less uniformly in different sowing months, only the data pertaining to one variety i. e. Vijaya were taken for correlation studies. Correlation coefficients were worked out with duration of each phase of Vijaya and temperature components.

The maximum and minimum air temperature were obtained from the meteorological observatory situated very near the experimental field. The soil water interface temperature was measured by inserting the bulb of the thermometer in the soft wet mud of the field. The temperature summation is calculated as day degrees (C) from sowing to harvest from the mean temperature. (Owen 1971)

Table 1

Duration of vegetative and ripening phases of four rice varieties (average of 1972 and 1973)

Sowing month	VARIETY							
	Bala		Ratna		Vijaya		Jayanti	
	Veg. phase	Rip. phase	Veg. phase	Rip. phase	Veg. phase	Rip. phase	Veg. phase	Rip. phase
Jan.	51	29	67	31	81	32	77	31
Feb.	50	28	66	31	79	31	76	30
Mar.	47	27	64	30	77	30	74	30
Apr.	44	28	60	30	75	30	69	30
May	43	27	64	30	79	29	73	30
June	44	26	63	29	78	30	70	29
July	43	27	60	33	74	34	70	32
Aug.	40	33	55	37	72	39	67	36
Dec	51	31	69	32	87	36	86	34

Results and Discussion

The duration of vegetative and ripening phases of four cultivars are presented in table 1. Since there is no difference in duration of reproductive phase for the crop sown in different sowing months this aspect is not taken for discussion,

Duration of vegetative phase

From Table 1 it is seen that duration of all four varieties is being considerably influenced by sowing time. The duration is longest in December sowing when the cool temperature prevailed during most parts of the Vegetative phase. As the sowing month advances the duration gradually gets reduced since the temperature at this phase is increasing (Figs. 1 and 2). The correlation coefficients worked out with duration of different phases and temperature components (Table 2) on Vijaya have shown that minimum air temperature is negatively correlated with duration of vegetative phase. It is also seen that air temperature range at this period is positively correlated with its duration.

Another factor of special significance evidenced from Table 2 is that the minimum soil water interface temperature shows the highest correlation than maximum soil water interface temperature or minimum air temperature at vegetative phase. This signifies that duration of the vegetative phase is more related to minimum soil water interface temperature than the minimum ambient temperature.

In order to substantiate this aspect, partial correlation coefficients were worked out with duraton of the vegetative phase, minimum air and soil water interface temperature (Table 3). It is seen that when the influence of soil water interface temperature on the duration is removed the 'r' value of duration with minimum air temperature reduces from 1 per cent level to $ per cent level of significance. Where as even after eliminating the effect of

Table 2

Correlation coefficient matrix showing relationship between duration of different phases and meteorological elements

Factor	Phase	Duration from	
		Sowing to panicle initiation	Flowering to harvest
1. Maximum air temperature	P	—0.1118	—0.2104
2. Minimum air temperature	P	—0.5935**	—0.4004
3. Maximum air temperature	PIII		—0.3546
4 Minimum air temperature	PIII	—	—0.6133**
5. Air temperature rangt	PI	0.6008 **	
6. Maximum soil water interface temperature	PI	0.7040**	
7. Minimum soil water interface temperature	PI	—0.7612**	—
8. Maximum soil water interface temperature	PHI	—	—0.3841
9. Minimum soil water interface temperature	PHI	—	—0.4112

- Significantat 1 % level PI - Vegetative phase PIII - Ripening phase

Table 3

Partial correlation coefficients between duration from sowing to panicle initiation (1) with minimum air temperature (2) and minimum soil water interface temperature (3) at PI

Factor	r value
12	−0.5935**
13	−0.7612**
23	0.3764
12.3	0.5110*
13.2	0.7212**

PI - Vegetative phase - Significant at 5% level ** - Significant at 1% level

Table 4

Temperature summation (°C) and duration from sowing to harvest of four rice varieties (average of 1972 & 1973)

Sowing month	Bala		Ratna		Vijaya		Jayanthy	
	Temp. sum.	Duration	Temp. sum.	Duration	Temp. sum.	Duration	Temp. sum.	Duration
Jan.	2834	98	3172	118	3692	140	3618	131
Feb.	3035	96	3628	116	4024	134	3773	126
Mar.	3159	90	3412	110	4007	131	3832	125
Apr.	3142	88	3449	112	3986	131	3703	121
May	3005	86	3432	115	3917	131	3736	123
June	2855	86	3241	112	3774	129	3419	120
July	2891	86	3137	112	3578	131	3484	124
Aug.	289	90	3019	114	3477	138	3262	136
Dec.	2855	99	2946	121	3828	149	3919	144

minimum air temperature on duration still the minimum soil water interface temperature retains a very high correlation value. The relationship between minimum soil water interface temperature and duration of vegetative phase is also presented in Figs. 2. It is seen that when the minimum soil water interface temperature is lowest during the sowing months of January and December the duration is longest and vice versa.

Duration of the ripening phase

The data presented in Table 1 on the duration of ripening phase of 4 varieties go to show that the duration is longer in August sowing for all the 4 varieties when the minimum air temperature at this stage is the lowest (fig. 1). The duration gets reduced in January and December sowings when the temperature registers an increase. It may be further seen from Table 2 that the duration of the ripening phase is negatively correlated with minimum air temperature at this stage. Vergara *et al* (1969) opined that ripening phase duration ranges from 30—35 days in tropics and may be longer if the crop is harvested in temperature climate. As the temperature is lower the translocation of photosynthates to the grain takes place at a slower rate and hence the maturity period is delayed proportionately (Best, 1962). However the soil water interface temperature at this stage does not seem to have any influence on the duration of this phase. Maturity of the crop is affected mainly by the climate above ground and water; temperature probably has no influence on the duration of the ripening phase.

Temperature summation and duration

The total duration of the crop and the temperature summation during the respective sowing months presented in Table 4 for the four varieties shows that the duration of the crop varies in different monthly sowings within a particular variety. It is also seen that the temperature summation behaves independently of the duration in the different sowing months. The temperature summation is almost the same in all the sowing months except probably in the hot months of February to May when slightly higher value is observed. This shows that a particular variety will reach maturity only if exposed to a minimum heat requirements. This is also probably the reason for the long vegetative phase in the sowings of December, January and February as compared to sowings of May, June and July.

With reference to the relationship between duration of the varieties and the temperature summation it is seen that with increase in the duration of the varieties, the temperature summation also increases. Thus the temperature summation for the shortest duration Bala varies from 2800 to 3200°C while the longest duration variety Vijaya gives a range of 3500 to 4000°C. This means that varieties with a shorter duration have a low temperature

summation. Tanaka *et. al.* (1964) reported that in tropics temperature summation exceeded 5000 day degrees (C) for a crop of about six months duration and the temperature summation for individual variety is to be determined by the duration of each variety rather than any temperature requirements.

Summary

From a field experiment conducted at Central Rice Research Institute during 1972-73 it is seen that duration of rice crop is found to be mainly influenced by temperature. The duration of vegetative and ripening phases are prolonged under conditions of low night temperature. It is further noticed that a particular variety will reach maturity only if exposed to a minimum heat requirement. The temperature summation varies with the duration of a variety, a long duration variety is having a higher temperature summation than a short duration variety.

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സംഗ്രഹം

കട്ടക്കിലുള്ള കേന്ദ്ര നെല്ലഗവേഷണകേന്ദ്രത്തിൽ 1972–73–ൽ നടത്തിയ പരീക്ഷണത്തിൽ നെല്ലിന്റെ മൂപ്പ് പ്രധാനമായും താപനിലയെ ആശ്രയിച്ചിരിക്കുന്നു എന്നു് വ്യക്തമായി. രാത്രിയിലെ കുറഞ്ഞ താപനില ചെടിയുടെ കായിക ദശയുടേയും നെന്മണി പാകമാകുന്ന ദശയുടേയും ദൈർഘ്യം വർദ്ധിപ്പിക്കുന്നതായി കണ്ടു. ഒരു പ്രത്യേക ഇനം നെല്ലു് അതിനുവേണ്ട ഏറ്റവും കുറഞ്ഞ നിശ്ചിത താപ rat^aicraajftn ലഭിക്കുന്നതിനു് വിധേയമാക്കിയെങ്കിൽ മാത്രമേ മൂപ്പെത്തുകയുള്ളു. ആകെ വേണ്ട താപ ആവശ്യകത ഇനത്തിന്റെ മൂപ്പിനെ അനുസരിച്ചു് വ്യത്യാസപ്പെടുന്നു. മൂപ്പു കൂടിയ ഇനങ്ങൾക്കു് മൂപ്പുകുറഞ്ഞ ഇനങ്ങളെ അപേക്ഷിച്ചു് കൂടിയ മൊത്തതാപ അളവു് ആവശ്യമാണു്.

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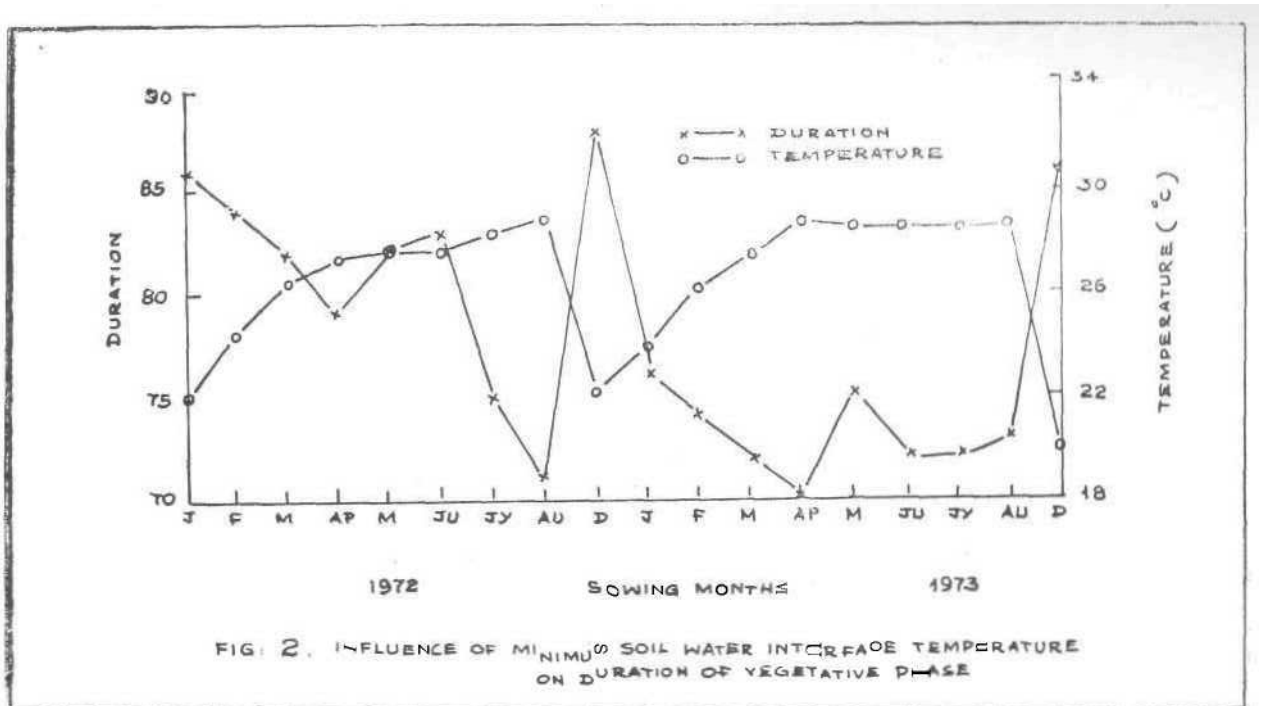

FIG: 2. INFLUENCE OF MINIMUM SOIL WATER INTERFACE TEMPERATURE ON DURATION OF VEGETATIVE PHASE

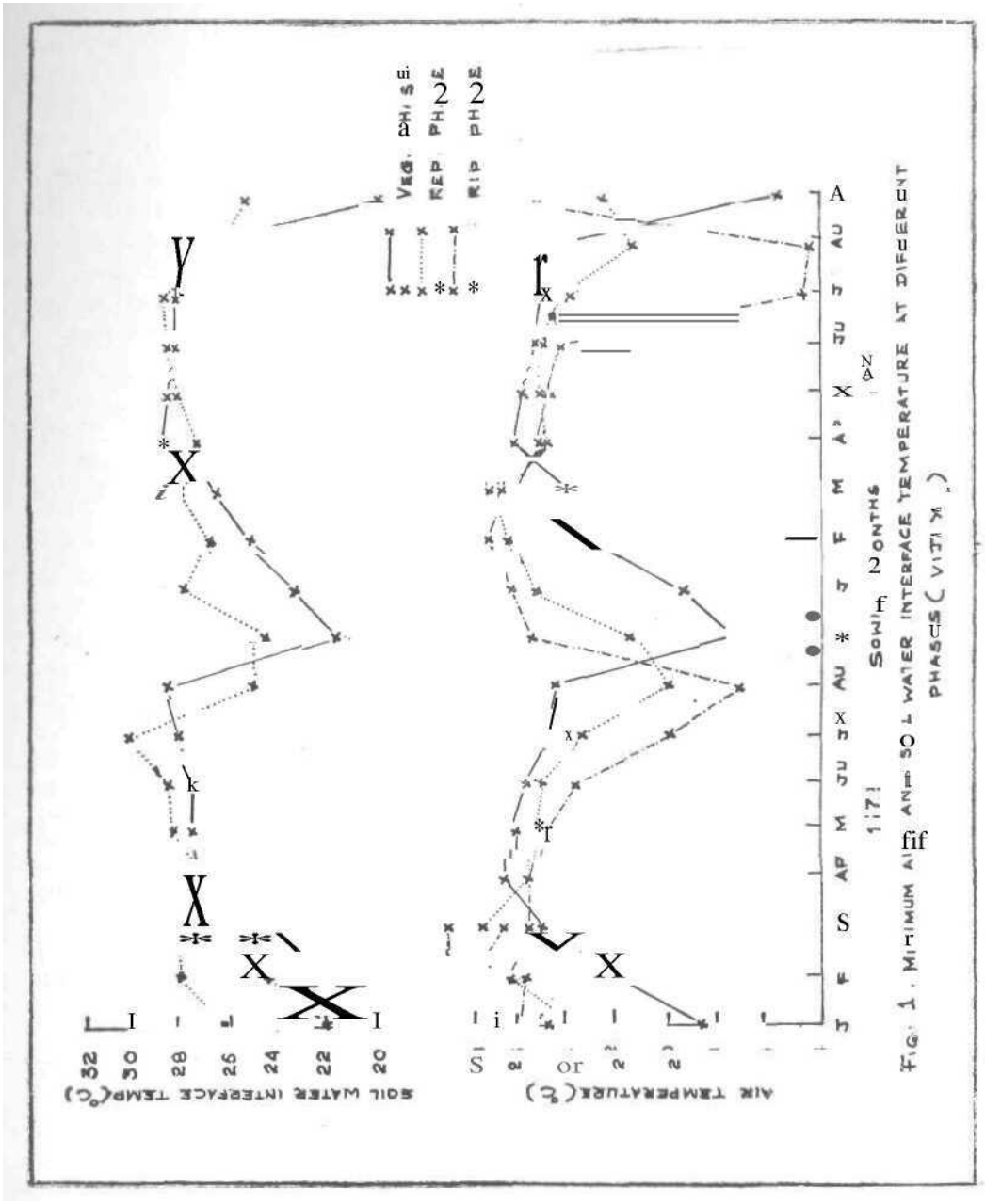

FIG. 1. MINIMUM AIR AND SOIL WATER INTERFACE TEMPERATURE AT DIFFERENT PHASES (WITH ...)

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