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INFLUENCE OF CLIMATOLOGICAL FACTORS ON EVAPOTRANSPIRATION (ET) OF RICE

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It is well known that the ET is the sum total of the influence of climatological factors. Its components such as transpiration (T) and evaporation (E) are influenced by radiation, temperature, saturation deficit and wind. According to Penman (1948) ET of a crop is governed primarily by meteorological factors when plant cover is adequate and moisture supply is not limiting with soil and plant factors playing only a relatively insignificant role. With abundant water supply ET is a physical phenomenon governed by the incident energy at a place and it is not a physiological process. Nakagawa (1969) from Japan argued that E and T need not be separated under field conditions and they must be considered together since energy is used for either of the two processes only once. While reviewing the works on ET, Vamadevan (1970) opined that the relationship observed between ET and climatological factors in one region may not be applicable in another region due to completely different sets of conditions of climate, soil and agronomic practices. Comparatively little work has been done to relate actual ET to climatological factors or other cultural conditions (Vamadevan, 1971). For scheduling of irrigation in rice crop such studies will be very useful.

Materials and Methods

The ET was measured by using galvanised iron tanks having 50 cm diameter and 80 cm depth embedded in the centre of rice field (Rao *et al.* 1974). Various meteorological parameters such as air temperature, relative humidity, wind velocity and sunshine hours were obtained from the meteorological observatory situated very near to the experimental field. Soil water interface temperature was measured by inserting the bulb of the thermometer in the soft wet mud and taking the reading insite. This was recorded at 7 A M. and 2 P M. and the mean worked out. Solar radiation was measured by a solarimeter placed near the experimental field and expressed as gm cal / cm^2 ay. All these meteorological observations were averaged over 5 days interval.

Results and Discussion

The correlation coefficients worked out with ET and other meteorological factors are presented in Table 1. It is seen that during *rabi* ET exhibits a positive relationship with most of the meteorological factors, while during *kharif*, such association is obtained with only a single constituent and that too only in one year. It is particulary seen that solar radiation, air temperature and soil water interface temperature are highly and consistently correlated with ET in both the years.

Table 1

Correlation coefficients between evapotranspiration (mm) and meteorological factors.

Sl. No.	Factor	Rabi 1972	Kharif 1972	Rabi 1973	Kharif 1973
1.	" Air temperature (°C)	0.8816 **	0.34426	0.6259 **	0.1171
2.	Relative humidity (%)	0.2446	0.1617	0.1077	0.3985
3.	Wind velocity Km/hr.	0.8015 **	0.0871	0.4461	0 3197
4.	Sunshine hour-/day	0.1861	00135	0.1573	0.53S1 *
5.	Soil water interface temperature (°C)	0.8686 **	0.0342	0.6896 **	0.2600
6.	Pan evaporation (mm)	0 9230 **	0.0233	0.5860 *	0.0-66
7.	Solar radiation (g-cal/cm2/day)	0.8050 **	0 1509	0.8562 **	0 0740

Significant at 5% level ** Significant at 1 % level.

The correlation coefficient matrix of ET with these three factors is presented in Table 2. It is seen from the matrix that air temperature and soil water interface temperature are very highly correlated with each other. Another feature seen is that ET is correlated equally well with both air and soil water interface temperature. Air temperature data are invariably available in most of the meteorological observatories. So its relationship with ET are worked out and presented in Fig. 1

It is seen from fig. 1. that ET is correlated with air temeprature to a significant extent. The role of temperature is considered to be associative and not causative. Similar relationship of air temperature and solar radiation was observed at Los Banos. The pan evaporation is also reported to be significantly correlated with ET at Los Banos (IRRI, 1968)

The relationship between ET and solar radiation has also been worked out and presented in fig. 2. The equation has been developed from the data pertaining to 1972 and 1973 because correlations were consistant and significant for both the years.

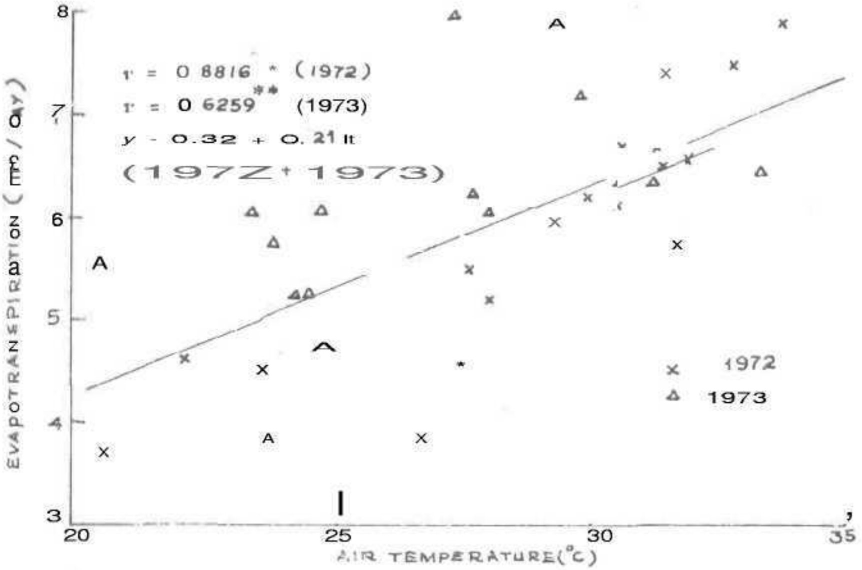
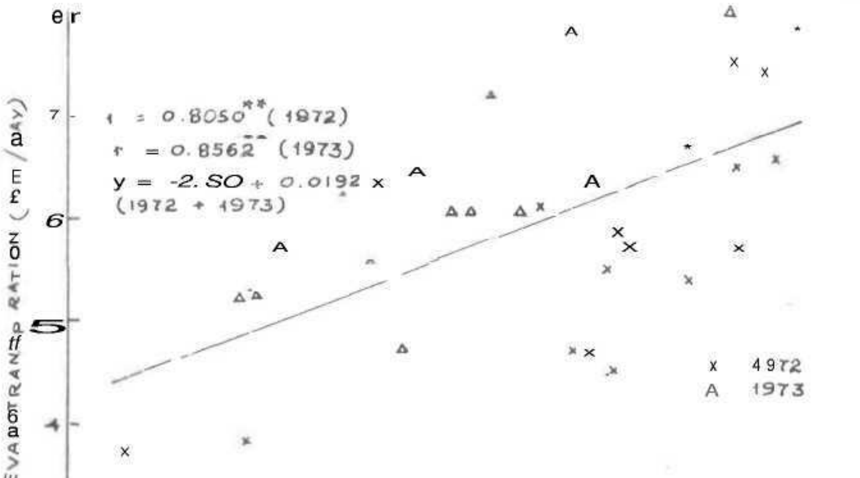


FIG: 1 RELATIONSHIP BETWEEN EVAPOTRANSPIRATION AND AIR TEMPERATURE



PIG: 2. RELATIONSHIP BETWEEN EVAPOTRANSPIRATION AND SOLAR RADIATION

Table 2

Correlation coefficient matrix of ET with air temperature, solar radiation and soil water interface temperature

Factor	Year	Air temp.	Solar radiation (g-cal/ cm2/day	Soil water interface temp. (^{0}C).
	1972	0.8816 **	0.8050 **	0.8686 **
ET (mm)	1973	0.6259 **	0.8562 **	0.6896 **
	1972+1973	0.7050 **	0.6481 **	0.7181 **
	1972		0.7706 **	0.9511 **
Air Temp.	1973		0.5164 *	0.8478 **
	1972+1973		0.6359 **	0.8955 **
	1972		—	0.6936 **
Solar radiation	1973		—	0.5084 *
	1972+1973		—	0.6038 **

Significant at 5% level. Significant at 1% level.

Solar radiation is the basic factor of temperature and relative humidity. In case of wet or moist soil relatively large net radiation enters the soil. This is probably the reason for high soil water interface temperature during periods of high solar radiation. The correlation coefficient values between these two factors (table 2) also show a very high positiue relationship among themselves. Since water is abundant a large amount of radiation is utilised for evaporation. Thompson (1965) also obtained a highly significant correlation (r = 0.95) between measured ET and net radiation from a sugarcane crop. This result confirms that the trends of ET are influenced to a considerable extent by solar radiation (fig. 2).

Relative humidity does not appear to exert any influence on ET. Similar results were also obtained at Malaysia where the effect of cloudiness and humidity were almost negligible on consumptive use (Anon, 1974).

It is further seen from Table 1 that the influence of wind on ET is more during *rabi* season. The wind affects the evapotranspiration rate by affecting both the turbulance of the air and thickness of the laminar layer (Chang, 1968).

Summary

It is concluded that if weather records are used to estimate evapotranspiration, solar radiation, air temperature, pan evaporation and wind velocity should be taken into consideratation. Out of these, solar radiation and air temperature are the most important factors which influence ET in this locality.

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സംഗ്രഹം

ബാഷ്പീകരണ–സ്വേദനതോത് കണക്കാക്കുന്നതിന് അന്തരീക്ഷാവസ്ഥ നിരീക്ഷണ രേഖകൾ ഉപയോഗിക്കുകയാണെങ്കിൽ, സൂര്യപ്രകാശ വികിരണം, വായുവ താപനില, താല സ്വേദനം, കാററിന്റെ വേഗത എന്നിവ കണക്കിലെടുക്കേണ്ടതാണ്. ഇവയിൽ സൂര്യപ്രകാശ വികിരണം, വായുവ താപനില എന്നിവയാണ് ബാഷ്പീകരണ സ്വേദന പ്രക്രിയയെ സ്വാധീനിക്കുന്ന ഘടകങ്ങളിൽ ഏററവും പ്രധാനപ്പെട്ടവ.

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