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Crop calendar with the use of meteorological data in Tripura

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ABSTRACT

The meteorological data recorded during the period from 1992 to 2006 were used for preparing crop calendar in Tripura. Maximum and minimum temperatures in the state varying from 22.4 to 35.6^{0}C and 9.3 to 26.1^{0}C, respectively. The crops, rice, maize, oil seeds, pulses, vegetables, mushrooms, tuber crops, fibre crops and fruits were considered in this calendar. Growing seasons for different kinds of mushrooms were determined for better productivity.

Key words: Crop calendar, cereals, pulses, mushrooms.

The state of Tripura, geographically located between 22^{0}56' to 24^{0}32' North latitude and 91^{0}09' to 92^{0}20' East longitude, covers an area of 10,491.69 square km. The general altitude of the state varies from 780m in the northeastern part to 15m in the western part above mean sea level. The terrain in Tripura consists of parallel hills and ridges alternated with narrow valleys. Sedimentary rocks, which range in age from Miocene to loosely consolidated sediments of recent age, represent the geology of the state. The climate is humid subtropical characterized by high rainfall. Based on climate and altitude, the vegetation in Tripura may be classified as the tropical forest type. Evergreen and moist deciduous forest generally predominates in Tripura. Swamp vegetation consisting of herbaceous species, some woody shrubs is present and a few scattered trees of subsidiary edaphic types consist of bamboo, cane and grass land vegetation. In Tripura two thirds of the total area is hilly. Six major hills run in the north-south directions and are interspersed by valley through which flow the major rivers of the state.

The net sown area constitutes barely 25 percent of the total land mass and 147.82 thousand hectares (15 percent of the total area) as revealed from remote sensing data available for settled cultivation. The average size of the land holding in this state varies from 0.97 to 1.02ha. The net irrigated area is only 18.9thousand hectares or about 7.7% of the net sown area of the state of which 3.6% belongs to wholly irrigated holdings and 4.1% by partly irrigated holdings. The total gross irrigated area in the state is 24.3 thousand hectares. The intensity of the irrigation is 1.290 (Statistical Abstract, 2001).

The climate is humid subtropical characterised by high rainfall. Based on climate and altitude, the vegetation in Tripura may be classed with the tropical forest type. Evergreen and moist deciduous forest generally predominates in Tripura.

Different crops need different weather conditions for better growth and yield. Sufficient work had been done to understand the influence of climate on yield and incidence of diseases and pests in crops. Farmers are also well aware about such relations based on their traditional knowledge. However, in many cases crop failure occurs due to misadjustment of time of sowing. Hence, in the present investigation the meteorological conditions for last fifteen years were considered to determine the growing periods for various crops suitable under agro-climatic conditions of Tripura.

MATERIALS AND METHODS

The meteorological data for the period of 1992 - 2006 were collected and their monthly averages were considered for matching with the standard agroclimatic conditions required of a given crop for its optimum growth. The rainfall and evaporation rate during the month were compared to avoid the moisture stress condition during the cropping period. Apart from this, for crop calendar of field crops the weekly rainfall were analysed at different levels of probability by using Weibull's method to determine the probability of rainfall during a given week of a year (Daschaudhuri *et al.*, 2008).

Based on this data sowing period of crops were determined considering 2.5mm day^{-1} as rainy day following the method of Ashokeraj (1979). The incidence of major diseases and pests were recorded during the growth period of crops. The monthly mean values of maximum and minimum temperatures, relative humidity during morning and evening, rain fall and rainy days number were also correlated with the yield of oyster, milky and paddy straw mushroom following the use of regression tools in order to prepare the crop calendar for mushroom.

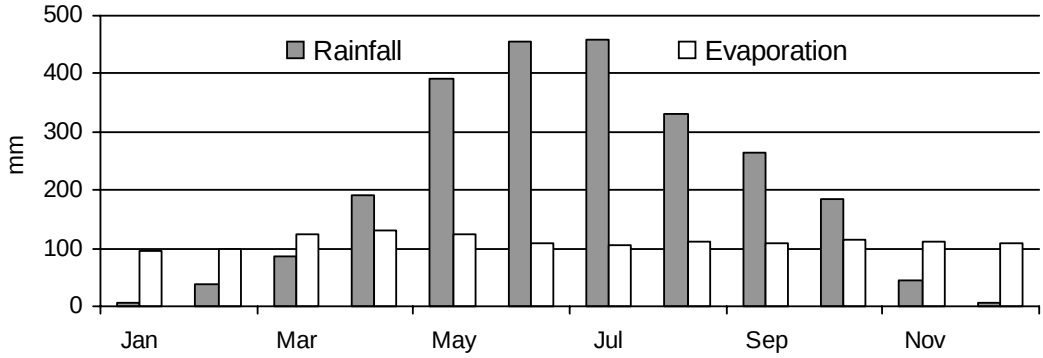

Fig 1: Monthly variation of rainfall and evaporation (1992 - 2006)

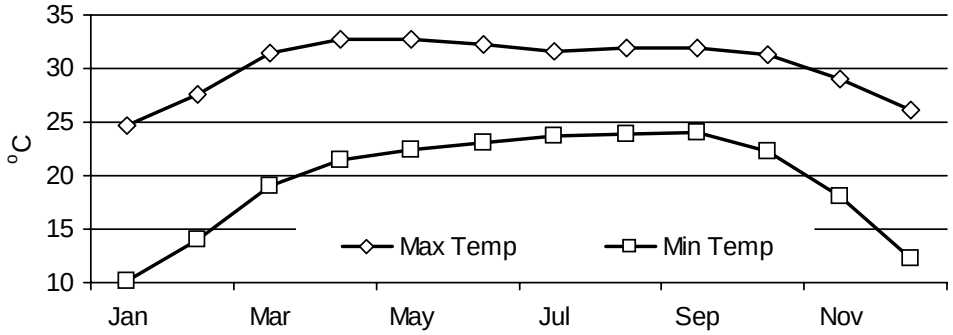

Fig 2: Monthly variation of maximum and minimum temperature (1992 - 2006)

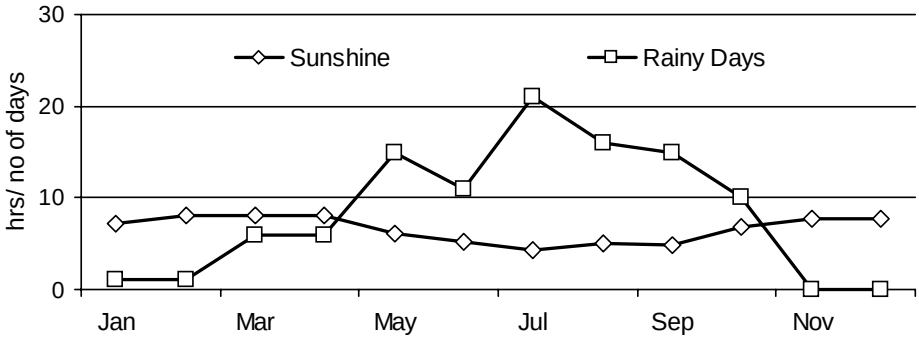

Fig 3: Monthly variation of sunshine hour and rainy days (1992 - 2006)

RESULTS AND DISCUSSION

The meteorological data in Tripura during the period w.e.f. 1992 to 2006 revealed that the maximum and minimum temperatures in the state were ranging between 22.4^{0}C to 35.6^{0}C and 9.3 to 26.1^{0}C, respectively, while, the average relative humidity was 51-89%, total rainfall 1871.1-3156.3mm, wind velocity 1.4-18.3km hr^{-1}, sunshine period 2.9-9.9hrs day^{-1}, total evaporation 777mm-1407.5mm with moderate soil temperature from 5-10cmm depth (Figs 1 to 3). The agro climatic conditions are considered moderate and very much suitable for cultivation of most of the cereals, pulses, oilseeds, vegetable, tuber crops, fibre crops and tropical mushrooms. The average minimum and maximum temperatures remained within 9.3 to 35.6^{0}C and thus favouring the growth of oyster mushroom during cooler season and paddy straw and milky mushrooms during warmer seasons of the year. As regards the field crop cultivation, the

Table 1: Latitude and Longitude of different cities under consideration.

Activity	Week No.	Normal rainfall (mm)	Probability percent	Mean rainfall (mm/ day)	Types of day*	Remarks
Sowing of aush	12	21.2	31.3	3.0	Rainy	Cultivation
	13	48.4	31.3	6.9	Rainy	under rain fed
	14	28.1	50	4.0	Rainy	condition
	15	29.6	50	4.2	Rainy	
Sowing of aman	23	105.3	43.8	15.0	Rainy	
	24	96.3	50	13.8	Rainy	
	25	126.9	31.3	18.1	Rainy	
	26	98.6	31.3	14.1	Rainy	
Transplantation of	27	69.1	50.0	10.0	Rainy	
aman	28	103.7	31.3	14.8	Rainy	
	29	136.4	31.3	19.5	Rainy	
	30	83.9	50.0	12.0	Rainy	
	31	97.3	31.3	13.9	Rainy	
Sowing of boro	45	19.8	31.3	2.8	Rainy	Cultivation
	46	5.2	18.8	0.7	Dry	under irrigated
	47	9.9	18.8	1.4	Dry	condition
	48	0	93.8	0.0	Dry	
Transplantation of	49	0.4	12.5	0.1	Dry	
boro	50	1.4	12.5	0.2	Dry	
	51	3.3	12.5	0.5	Dry	
	52	0.6	12.5	0.1	Dry	

* Categorized following the method of Ashokeraj (1979)

Table 2: Crop calendar of rice

Paddy	Sowing time	Transplantation time	Harvesting time	Major diseases
Aush	March/ April	-	August/ September	Bacterial leaf blight
Aman	June	July	October/ November	Sheath blight
Boro	November	December	April/ May	Blast

comparison of rainfall with evaporation rate revealed that the period April to October is suitable under rainfed conditions since during that period rainfall was found higher than the evaporation rate.

Paddy is cultivated as aush, aman and boro during three different seasons. The former two types are cultivated under rainfed condition. So, the rainfall was considered as primary factor for sowing of rice (Table 2). It was found that first heavy shower comes generally during second week March i.e. week No. 11 (with maximum rainfall 190.4mm, normal rainfall 27.2mm and probability 37.5%). So leaving that week for field preparation sowing is scheduled on 3rd week of March and accordingly the crop calendar was prepared for rice (Table 3). Similarly, the maize has been found possible to cultivate twice in a year under rainfed conditions of Tripura. The normal rainfall per day during sowing time found with probability ranging from 31.3 to 50% (Table 3). Accordingly the cropping schedule was prepared considering the growth and yield of maze cultivars, like, TRM – 5 (53-55q ha^{-1}), TRM – 11(46 q ha^{-1}) and TRM – 7 (50-52q ha^{-1}) in the research farm (Table 4). The crop calendar of pulses and oil seeds were prepared on the basis of prevailing rainfall, traditional practices and to compensate the gaps before and after the major crops (Table 5). As regards the tuber crops, the sprouting of *Colocasia* spp., *Xanthosoma* spp., and *Dioscoria* spp. started from March onwards and thus it's plantation period was found ideal in February. As regards, the edible mushroom cultivation the oyster mushrooms, *Pleurotus sajor-caju*, *P. flabellatus* and *P. florida* developed fruit bodies in every month through out the year, while, cultivated under in house condition at ICAR Research farm in Tripura during the period w.e.f. January, 2004 to December, 2006. However, of the years, the optimum production of fruit bodies (BE 85.8 to 95.7%) was observed during October to January. The monthly average of daily maximum temperature, was the best fit ($r^2 = 0.59$ and $r = -0.77$) to correlate the yield of *P. sajor-caju* (PS) (Fig. 4). However, in case of other

Table 3: Condition of rainfall favoring sowing of Maize twice under rainfed condition of Tripura

Activity	Week No.	Normal rainfall (mm)	Probability percent	Mean rainfall (mm) /day	Types of day	Remarks
Sowing of Maize 1st crop	12	21.2	31.3	3.0	Rainy	Cultivation under rainfed condition
	13	48.4	31.3	6.9	Rainy	
	14	28.1	50.0	4.0	Rainy	
	15	29.6	50.0	4.2	Rainy	
Sowing Maize 2nd crop	32	64.6	37.5	9.2	Rainy	
	33	65.3	31.3	9.3	Rainy	
	34	70.3	43.8	10.0	Rainy	
	35	60.9	37.5	8.7	Rainy	

Table 4: Crop calendar of Maize

Crop	Date of sowing	Date of harvest	Major diseases
Maize (1st crop)	3rd week of March/ 2nd of April	June/July	Sheath blight
Maize (2nd crop)	August	October	Sheath blight

Table 5: Crop calendar of Pulses and Oil Seeds

Pulses and oil seeds	Sowing time	Harvesting time	Preceding crop	Following crop	Diseases/pest
Mung (pre kharif)	Mid March	May		Rice (aman)	Leaf spot
Mung (post kharif)	September	November	Rice (aush)		Leaf spot; Yellow mosaic Powdery mildew
Black gram (pre kharif)	Mid March	May		Rice (aman)	Leaf spot
Black gram (post kharif)	August	October	Rice (aush)		Leaf spot; Yellow mosaic Powdery mildew
Arhar	April	March (next year)			Fruit borer
Linseed	4rth week October	March			Wilt
Rapeseed/ mustard	October	March			Alternaria leaf spot/ Aphids

Table 6: Crop calendar of mushroom

Mushroom	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oyster	PS	PS					PS	PS	PS	PS	PS	PS
	Pf	Pf					Pf	Pf	Pf	Pf	Pf	Pf
	Pflo	Pflo					Pflo	Pflo	Pflo	Pflo	Pflo	Pflo
Paddy straw						VV	VV	VV	VV	VV		
Milky				CI	CI	CI	CI	CI				

PS: *Pleurotus sajor–caju* Pf: *Pleurotus flabellatus* Pflo: *Pleurotus florida*
VV: *Volvariella volvacea* Cl: *Calocybe indica*

mushrooms (*P. flabellatus, P. florida, Volvariella volvacea and Calocybe indica*), the prevailing climatic factors although affected mushroom yield significantly as a whole there was no clear effect of a single factor. Thus based on the average yield of three years data crop calendar was prepared (Table 6)

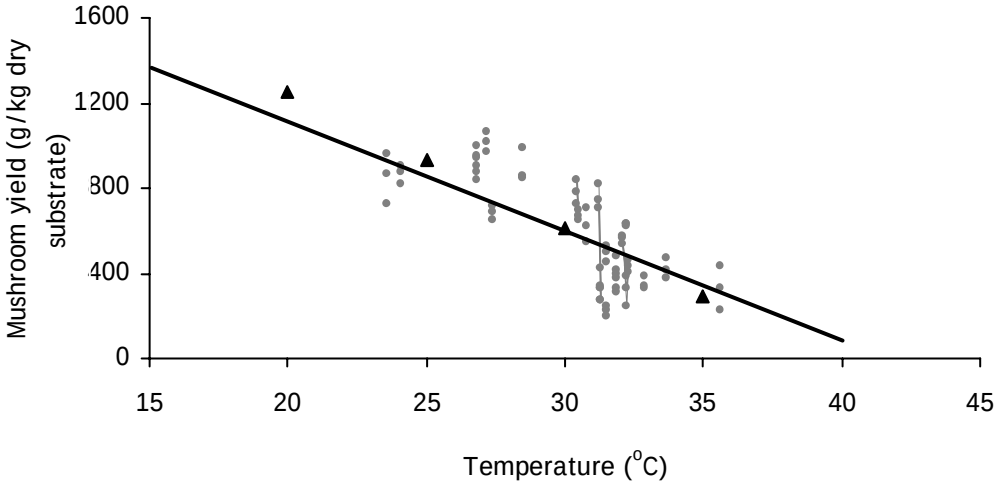

Fig 4: Relationship between maximum temperature and mushroom yield in regression analysis (y= 2524-64x)

CONCLUSION

Crop calendars as prepared for cultivation of cereals, vegetables, pulses and mushrooms are very much helpful to chalk out the plan for effective utilizing land of Tripura well in advance. This will also give some clear picture about the diversity of crops grown in Tripura during different seasons.

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