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THERMAL REQUIREMENT OF CROPS AND CROPPING SYSTEM SOWN ACCORDING TO RAINFALL PROBABILITIES

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ABSTRACT

Field experiments were conducted for five successive years on sole sunflower and sunflower + red gram intercropping system sown according to rainfall probabilities to understand behaviour of crops and cropping system in utilising thermal energy. The accumulated heat units and number of days for reaching various growth stages decreased with successive delay in sowing. The variation in accumulated heat units and number of days required for reaching various growth stages did not indicate any definite trend. The crop sown earlier received maximum thermal energy than later sown crop during all the year of experimentation. The heat units required to attain the harvesting stage marginally differ within the year under all sowing dates as evidenced from coefficient of variation.

KEY WORDS : Crops, Rainfall, Thermal Requirements

Intercropping has been recognised as a common practice throughout the tropical countries as it aims to increase the production potential per unit area and ensure against total crop failure under aberrant weather conditions. Aberration in the rainfall behaviour has been documented by Venkateshwarlu *et al.*, (1991). Rainfall in the scarcity zone is highly erratic, ill distributed with frequent dry spells. Due to fluctuations in the arrival of monsoon and further optimum condition to take up sowing of *kharif* crops and cropping systems as per the rainfall probabilities is the need of the day. The intercropping has established its advantages as compared to sole cropping as evidenced from higher yield from intercrop (Patil *et al.*, 1981). Any physiological and morphological development occurring in plants is markedly influenced by temperature and day length. Agronomic application of the temperature effects on plants is the concept of heat units or growing degree days. The concept assumes that each plant has its own threshold temperature below which growth does not occur.

The concept of heat units has been applied to correlate the phenological development of different crops to predict maturity days and yield (Swan *et al.*, 1987). However, in the case of intercropping system *viz.*, sunflower + red gram in comparison with sole sunflower, the relationship between heat units and growth stages need to be quantified particularly under drylands. Therefore, an attempt was made to understand phenophase development of crops and cropping system in relation to environment under various rainfall probabilities.

MATERIALS AND METHODS

Field experiment on sole sunflower and sunflower + red gram intercropping system was carried out at Dry Farming Research Station, Solapur ($17^{o}\ 41^{1}$ N, $75^{o}\ 44^{1}$ E and altitude 479 m) during *kharif* season for five successive years from 1988 to 1992 on medium black soils (30 cm depth). The pH of the soil was 7.9. The soil was poor in organic carbon (0.35 %), medium in available P_2O_5 (8.94 kg/ha) and high in K_2O (388 kg/ha) with electrical conductivity 0.11 mmhos/cm. The treatments consisted of sole sunflower (Morden) and sunflower + red gram (No.148) sown as per rainfall probabilities weeks (24, 25, 28 and 29 M.W.) and replicated three times.

The net plot size was 6.80 x 2.70 m^2. The crop was fertilised with 50 kg N and 25 kg P_2O_5/ha at sowing. The number of days required for different crop growth stages were recorded when 50 per cent plants from the treatments reached the specific growth stage. The crop growth stages studied for sunflower crop were : germination, seedling, button formation, 50 per cent flowering, grain filling and physiological maturity. For red gram crop the stages were : germination, branching, start of flowering, 50 per cent flowering, pod development and physiological maturity, (named serially as 1, 2, 3, 4, 5, and 6). The heat units (growing degree days) were calculated as per the following formula given by Iwata (1984).

able 1. Mean thermal requirement of sunflower and sunflower + red gram intercropping (1988 to 1992)

Met. Week	Crops/cropping system		Growth stages					
			1	2	3	4	5	6
24	Sole sunflower	SF	124	342	520	861	1230	1595
			(7)	(18)	(33)	(48)	(64)	(89)
	Sunflower	SF	118	332	579	842	1112	1579
			(6)	(17)	(32)	(47)	(64)	(87)
	Red gram (2:1)	Rh	143	1053	1770	1966	2670	4220
			(6)	(41)	(66)	(74)	(103)	(176)
25	Sole sunflower	SF	117	337	588	850	1103	1566
			(7)	(19)	(35)	(50)	(68)	(89)
	Sunflower	SF	114	313	562	821	1065	1535
			(6)	(18)	(34)	(49)	(68)	(89)
	Red gram (2:1)	Rh	143	992	1673	2025	2550	4124
			(7)	(38)	(54)	(71)	(98)	(166)
28	Sole sunflower	SF	114	313	549	815	1054	1514
			(7)	(17)	(31)	(46)	(62)	(83)
	Sunflower	SF	114	308	538	790	1038	1503
			(6)	(18)	(30)	(45)	(62)	(83)
	Red gram (2:1)	Rh	143	969	1619	1831	2490	3877
			(6)	(38)	(62)	(70)	(99)	(161)
29	Sole sunflower	SF	122	296	535	766	1009	1414
			(6)	(17)	(32)	(45)	(62)	(80)
	Sunflower	SF	113	275	499	749	960	1376
			(7)	(17)	(31)	(45)	(61)	(83)
	Red gram (2:1)	Rh	137	892	1432	1702	2309	3397
			(7)	(35)	(56)	(64)	(92)	(150)
	Mean	SF	119	322	548	823	1099	1522
		SF	115	307	545	801	1044	1498
		Rh	142	977	1624	1881	2505	3905
	SE	SF	1.98	9.29	12.6	18.5	41.3	34.5
		SF	0.96	10.3	15.0	17.5	27.6	37.8
		Rh	1.3	28.8	61.5	62.5	65.1	159.0
	CV	SF	3.32	5.77	4.61	4.50	7.52	4.54
		SF	1.67	6.69	5.52	4.37	5.28	5.04
		Rh	1.84	5.90	7.58	6.65	5.20	8.16

$$\text{:D D} = \frac{\text{Maximum + minimum base temperature}}{2}$$

The GDD were recorded by summing the daily DD from seeding to various growth stages. The ily meterological data were recorded from the eteorological observatory located on the farm. e GDD were quantified for different sowing es at various growth stages.

ESULTS AND DISCUSSION

The accumulated heat units for different owth stages were the highest when crops were wn on 24th M.W. while the maximum heat units re seen when crops were sown on 29th M.W. In general, the growing degree days for reaching different growth stages from sowing decreased with delay in sowing in alomost all the years (Table 1). However, in some years the days required to attain growth stages were increased as the sowing was delayed. The results are in the line of Diwansingh *et al.*, (1993). Late sown crop increased the period to reach successive growth stage in some year. This might be due to receipt of rainfall during crop growth period which delayed the crop growth. This might be because of less amount of thermal energy available in late sown crop due to low temperature. Similar findings were also reported by Warrington and Kanemasu (1983).

The crop sown earlier required more period for attaining the various growth stages. Due to sufficient moisture available during the crop growth stages and reverse was the case in delayed sown condition. Therefore the plants completed their life cycle in the shorter period under delayed sown conditions.

The data also reveal that the coeficient of variation was high during seedling and button formation stage of sunflower crop, while it was branching and start of flowering stage in red gram. There was no clear variation between other stages. The heat units required to attain harvest stage marginally differed within the years under all sowing dates, as evidenced from coefficient of variation values.

The regression equation between GDD and number of days required to attain various physiological growth stages was worked out for sole sunflower and sunflower intercropped with redgram and intercropped redgram depiced in Fig. 1 and 2a and 2b. The equations were as follows:-

Sole sunflower

$$Y = 20.54 + 16.68 \times R^2 = 0.97$$

Intercropped sunflower

$$Y = 2.25 + 17.11 \times R^2 = 0.92$$

Intercropped Redgram

$$Y = 134.83 + 23.68 \times R^2 = 0.94$$

Where Y = Accumulated growing degree days.
X = Number of days required to attain growth stage.

From this equation and by knowing th number of days required to attain the growth stag the GDD can be worked out for sole sunflow sunfower intercropped with redgram an intercropped red gram grown under drylan conditions.

Therefore, for accumulating more GDD and t obtain better production the sunflower an sunflower + redgram intercropping be sown in 2 and 25th M.W. under scarcity zone of Mahrashtra.

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SODIUM CHLORIDE NUTRITION IN COCONUT

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Field experiment was conducted at the Agricultural Research Station, Aliyarnagar during 1989-1994 to study the effect of sodium chloride (Nacl) application to coconut. The results revealed that application of Nacl @ 1 kg/tree/year along with recommended dose of NPK, significantly influenced the growth and nut characters and nut yield of coconut. There was no residual sodium available in the soil to cause sodium toxicity after application.

KEY WORDS : Coconut, Common Salt, Quality Features, Residual Toxicity

Application of common salt (sodium chloride) to the base of the coconut palms as wells as in the crowns is an age old practice among the coconu cultivators in India (Ramanathan, 1973). Sodiu