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Thermal requirement of *rabi* groundnut in Southern Telangana Zone of Andhra Pradesh

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ABSTRACT

Field experiment was conducted for two years during *rabi* season at College farm, ANGRAU, Rajendranagar to study thermal requirement of groundnut (variety TMV-2) sown under three dates of sowing. The duration taken for vegetative, reproductive and pod filling phases in different sowings of both the years varied between 32-45, 20-36 and 52-68, respectively but in terms of growing degree days they remained more or less constant at 488±37, 304±10 and 778±53°Cd, respectively. The crop matured on accumulating 1570±16°Cd regardless of sowing date and year. Studies on helio-thermal units and thermal interception rate revealed that with increase in their value, the total dry matter increased but the pod yield was unaffected.

Key words : Thermal requirement, groundnut

The occurrence of different phenological events during crop growth period in relation to temperature can be estimated by using accumulated heat units or Growing Degree Days (GDD). Knowledge of accumulated GDD can provide an estimate of harvest date as well as crop development stage (Ketring and Wheless, 1989). Heat units required for the groundnut crop to progress from one phase to other phase has been reported earlier by Leong and Ong (1983), Ghadekar (1988) and Bell and Wright (1998). However, information on heat unit requirement of *rabi* groundnut in South Telangana Agro-Climatic Zone of Andhra Pradesh is meagre. Hence, the present investigation was carried out with an objective to estimate the thermal requirement of *rabi* groundnut under field conditions at ANGRAU, Rajendranagar, Hyderabad.

MATERIALS AND METHODS

Field investigation was carried out during *rabi* season (October-March) in 1997-98 and 1998-99 at College farm, ANGRAU, Rajendranagar. The Farm is located at an altitude of 542.6 m above mean sea level at 17° 19' N latitude and

Table 1 : Heat unit accumalation during different groundnut phenophases under three sowing dates

Treatment	Year	Duration				GDD				PTI			
Dates of sowing		S_1	S_2	S_3	Total	S_1	S_2	S_3	Total	S_1	S_2	S_3	Mean
D_1	1997 – 98	32	19	56	107	493	296	773	1562	15.4	14.8	13.8	14.7
	1998 – 99	36	31	68	135	493.2	297.6	761.6	1552	13.7	9.6	11.5	11.6
D_2	1997 – 98	35	23	52	110	525	312.8	743.6	1581	15	13.6	14.3	14.3
	1998 – 99	40	36	56	132	476	313.2	778.4	1568	11.9	8.7	13.9	11.5
D_3	1997 – 98	36	24	48	108	504	300	773	1577	14	12.5	16.1	14.2
	1998 – 99	45	31	52	128	437	304	837.2	1578	9.7	9.8	16.1	11.9
Mean						488±37	304±10	778±53	1570±16				

GDD - Growing degree days
PTI - Pheno thermal index

78° 23' E longitude. Daily meteorological data during crop growth period was recorded in a class-B observatory situated at ARI, Rajendranagar. Soil of the experimental field is sandy loam in texture, shallow in depth, low in available nitrogen (210 kg ha^{-1}), medium in phosphorus (19 kg ha^{-1}) and potassium (275 kg ha^{-1}) with a bulk density of 1.66 g cm^{-3}.

The experiment was laid out in split plot design with three dates of sowing (17th October, 1st November and 23rd November during first year) and 23rd October, 6th and 22nd November during second year. Due to rainfall during third week of October, the time of first and second sowings of second year got delayed by 6 and 5 days respectively. Sowing dates were taken as main plots and six irrigation schedules were taken as sub plots, constituting 18 treatment combinations replicated thrice. The test groundnut variety TMV-2 with a duration of 130-140 days during *rabi* season was used and recommended package of practices were followed. Plant protection measures were taken up against pests and disease infestation. Crop-weather relations were worked out for the data of I_1 irrigation schedules where the crop did not suffer due to moisture stress at any stage, so as to keep the weather as the only variable in bringing the changes in crop growth and

development. The dates of occurrence of phenological events of groundnut crop were recorded in all treatments following Boote (1982) and they are further grouped into the following three phases for easy understanding (Rao, 1996). S_1 - Vegetative phase, S_2- Reproductive phase, S_3- Pod filling phase.

The growing degree days were computed by substracting the base temperature (10°C) from daily mean temperature as suggested by Ketring and Wheless (1989). The helio-thermal units are the product of growing degree days and the actual sunshine hours (Rajput, 1980). Pheno-thermal index is the ratio between GDD and number of actual days taken for each phenophase. Thermal interception rate was calculated by using the following formula (Ong and Squire, 1984).

$$TIR = Si / n * (T - T_b)$$

Where,

Si is PAR incedent on crop, T is mean temperature, n is number of plants m^{-2}, T_b is base temperature

RESULTS AND DISCUSSION

Growing degree days for each phenophase of the crop during 1997-98 and 1998-99 *rabi* seasons are presented in Table 1. The results revealed that, though crop duration varied widely between 107 and 135 days in different sowing dates during both the years, the accumulated GDD more or less remained the same at (1570 ± 16). The number of calendar days taken for vegetative (S_1), reproductive (S_2) and pod filling phases (S_3) varied between 32-45, 19-36 and 48-68 respectively during first and second year. However, the mean GDD for vegetative, reproductive and pod filling phase remained at 488 ± 37, 304 ± 10 and 778 ± 53 respectively. As the GDD are calculated based on the temperature, the duration of each phenophase and total crop duration is decided by the prevailing mean temperature during that period. Bell and Wright (1998) examined that the early bunch groundnut variety grown under wide range of environmental conditions in Australia, matured after accumulating 1808 ± (23) growing degree days from sowing.

The total helio-thermal units increased from 13,856 to 15,291 during 1998-99 where as the mean pheno-thermal index decreased from 14.7 to 14.2 with delay in sowing (Table 1&2). Among different sowing dates late sowing (D_3) recorded higher thermal interception rate (TIR) of 187 x 10^{-5} and 213 x 10^{-5} M J (°Cd^{-1}) $plant^{-1}$ during first and second year respectively. Studies on HTU and TIR (Table 2) indicated that

Table 2 : HTU and TIR, dry matter and pod yield of groundnut recorded in different sowing dates

Parameters	1997 – 98			1998-99		
	D_1	D_2	D_3	D_1	D_2	D_3
HTU	11940	12926	13717	13856	14602	15291
TIR(10^{-5})	180	167	187	199	207	213
Total Dry Matter (kg ha^{-1})	3990	4090	4320	4260	4390	4480
Pod yield (kg ha^{-1})	1646	1737	1575	1548	1639	1460

with increase in HTU from 11,940 to 15,291 and TIR from 180 x 10-5 to 213 x 10-5 M J ($^oCd^{-1}$) $plant^{-1}$, the total dry matter increased but the yield was mostly unaffected (Table 3). Similar results were observed by Brar *et al* .,(1999).

REFERENCES

Bell, M.J. and Wright, G.C. 1998. Groundnut growth and development in contrasting environments 2. Heat unit accumulation and photo thermal effects on harvest index. *Expt. Agric.*, 34(1) : 113-124.

Boote, K.J. 1982. Growth stages of peanut. *Peanut Sci.*, 9 : 35-40.

Brar, A.S., Dhingra, K.K. and Kaul, J.N. 1999. Phenological behaviour and heat unit requirement of five groundnut (*Arachis hypogaea* L.) genotypes under two dates of sowing during summer season. *Indian. J. Agric. Sci.*, 69(6) : 419-423.

Ghadekar, S.R. 1988. Effect of sowing date on heat unit requirement and yield of winter groundnut (*Arachis hypogaea* L.). *Indian. J. Agric. Sci.*,. 58 : 678-681.

Ketring, D.L. and Wheless, T.G. 1989. Thermal requirements for phenological development of peanut. *Agron. J.*, 8 (16) : 910 – 917.

Leong, S.K. and Ong, C.K. 1983. The influence of temperature and soil water deficit on the development and morphology of groundnut (*Arachis hypogaea* L.). *J. Expt. Botany.*, 34 : 1551 – 1561.

Ong C.K. and Squire G.R. 1984. Response of temperature in a stand of pearl millet (*Pennisetum*

typhodies S & H) VII Final number of spikelets and grains. *J. Expt. Botany.*, 35:1233 – 1240.

Rao, K.K. 1996. Impact of drought at different phenophases on yield and yield attributes in groundnut in scarce rainfall region. Ph.D thesis, Andhra Pradesh Agricultural University, Hyderabad.