

Effects of Weather Conditions on Pod Yield in Groundnut Varieties

ABSTRACT

Experiments were conducted at the Department of Agricultural Meteorology, Anand Agricultural University, Anand during the Summer of 2015 and 2016 with four varieties of groundnut (GG-2, GG-20, GJG-31 and TG-26) sown on three different dates to study the effect of weather parameters and agrometeorological indices on pod yield of groundnut. The results of the present investigation indicated that pod yield of groundnut was negatively correlated with maximum, minimum and mean temperature during most of the phenophases except P₉ (pod maturity to physiological maturity), where the mean temperature has varied between 32.7°C to 35.1°C during pod maturity to physiological maturity. In our experiment, we have found that more than 33.9°C is required for adequate seed development, resulting in higher test weight and higher pod yield. Agrometeorological indices have a significant and positive correlation with pod yield only during P₇ (pod initiation to pod development) phase.

Keywords: Phenological stages, Agrometeorological indices, correlation, groundnut

INTRODUCTION

Groundnut is a tropical crop and requires a long and warm growing season. It requires more than 16 °C soil temperature for germination. Low temperatures retard the germination and growth of plants and lengthen flowering. Temperature above 35 °C inhibits the growth of groundnut. The mean temperature for optimum growth is 30 °C and the growth ceases at a temperature less than 15 °C (Prasad *et al.*, 2000). The productivity of the crop mainly depends upon the climatic requirement of the particular crop like groundnut which can grow in a wide range of climatic conditions, but its productivity is depends on the prevailing weather conditions throughout the life cycle of the groundnut crop. Further, the different weather parameters affect growth and development of crops differently. Change in temperature, sunshine hours and day length influence the phenophasic development of crop. Sowing time, seed germination, physiological and metabolic processes of plant life are controlled by temperature (Aggarwal *et al.* 2016). Therefore, it was contemplated to have an insight on the effect of different weather parameters and agrometeorological indices for the production of groundnut crop and to identify the critical phases at which groundnut crop was most sensitive to the

effect of particular weather parameters. This experiment was conducted to study the correlation between pod yield with weather parameters and the agrometeorological indices.

MATERIALS AND METHODS

A field experiment was conducted in the Department of Agricultural Meteorology, Anand Agricultural University, Anand during summer 2015 and 2016 with treatments consisting of four varieties of groundnut viz., GG-2, GG-20, GJG-31 and TG-26 were sown on three different dates viz., D1 early date (3rd January), D2 normal date (15th February) and D3 late date (2nd March). The crop was sown as per recommended package of practices. The phenological events viz P1 (from sowing to emergence), P2 (from emergence to first flower opening), P3 (from first flower opening to 50 % flowering), P4 (from 50 % flowering to peg initiation), P5 (from peg initiation to 100 % flowering), P6 (from 100 % flowering to pod initiation), P7 (from pod initiation to pod development), P8 (from pod development to pod maturity), P9 (from pod maturity to physiological maturity) were recorded by visual observation on tagged five plants per replication from each plot. The daily meteorological data during both crop seasons was recorded at the Agrometeorological observatory of Anand Agricultural University, Anand. Correlation between the total pod yield was carried out using methodology described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Temperature

Correlation analysis showed that maximum temperature ($T_{max.}$) was significantly and negatively correlated with the P₂(emergence to first flower opening) phase. $T_{max.}$ during this phase was between 30.8 and 37.2 °C. Thus the higher $T_{max.}$ (>34°C) during early vegetative period was not suitable for groundnut. The significant positive correlation was observed between pod yield and $T_{max.}$ during maturity period P₉(pod maturity to physiological maturity) phase, during this period $T_{max.}$ varied between 38.7 and 42.8°C, pod maturity requires $T_{max.}$ more than 40.7 °C for proper seed development which resulted in higher test weight resulting in higher pod yield of groundnut.

The pod yield was negatively correlated with minimum temperature ($T_{min.}$) during most phenophases except during **the** maturity. Higher night temperature $T_{min.}$ during P_2 and P_6 phase adversely affected the flowering., which ultimately contributed to lower pod yield. Similarly the pod yield was negatively correlated with mean temperature ($T_{mean.}$) during most of the phenophases except during maturity period. However, **a** significant negative correlation was obtained with T_{mean} during P_2 (emergence to first flower initiation) phase. T_{mean} during this was between 22.9 and 28.6 °C. Similarly, significant and negative correlation was obtained with T_{mean} during P_6 (100% flowering to pod initiation) phase. T_{mean} during P_6 between 23.7 and 30.3 °C. Thus, the higher $T_{mean.}$ were ($>25.7^{\circ}C$) and ($>27^{\circ}C$) during P_2 and P_6 phase was not suitable for groundnut.

Bright sunshine hours (BSS)

The pod yield was negatively correlated with bright sunshine hours (BSS) during most of the phenophases except during P_3 , P_4 , P_7 and P_9 phases. However, **a** significant negative correlation was obtained with BSS during P_6 (100% flowering to pod initiation) phase. BSS during this phase were between 8.6 and 10.7 hrs. Similarly significant and negative correlation was obtained with BSS during P_8 (pod development to pod maturity) phase. BSS during P_8 between 9.8 and 11.0 hr. Thus, the higher BSS varied between >9.6 hrs. and >10.4 **hrs.** during P_6 and P_8 phase was not suitable for groundnut. Higher BSS during P_6 and P_8 phase adversely affected the pod yield.

Relative humidity

The significant and positive correlation between pod yield and afternoon relative humidity RH_2 during P_1 (sowing to emergence) phase suggest that during this period RH_2 varied between 28.0 and 48.8 per cent. Afternoon relative humidity requires more than 38.4 per cent for

ahigher pod yield of groundnut.(Prathima, *et al.* 2022) also reported that maximum temperature and after noon relative humidity during flowering had a strong positive correlation with pod yield.However, a significant negative correlation was obtained with RH₂ during P₃ (first flower initiation to 50 % flowering) phase. RH₂ during this was between 17.0 and 41.67 %. Similarly, significant and negative correlation was obtained with T_{mean} during P₅(peg initiation to 100 % flowering) and P₉ (pod maturity to physiological maturity) phases. RH₂ during P₅ between 12 and 68 % and P₉ between 27 and 53%. Thus, the higher RH₂ was (>27.8%), (>40%) and (>40%) during P₃, P₅and P₉phases was not suitable for groundnut.

VapourPressure

The results showed that the pod yield was negatively correlated with morning vapour pressure VP₁ during all the phenophases. Incase afternoon vapour pressure VP₂ during P₁(sowing to emergence) phase had a positive correlation with pod yield,Pod yield was also negatively correlated with mean vapour pressure VP_{mean} during all the phenophases.

Agrometeorological Indices

The significant and positive correlation between pod yield and growing degree days GDD °C day only during P₇(pod initiation to pod development) phase suggest that during this period GDD varied between 285 and 411°C day. GDD requires more than 348°C day for higher pod yield of groundnut during pod initiation to pod developmentphase. Similarly, the significant and positive correlation between pod yield and heliothermal units HTU during P₃ (first flower initiation to 50% flowering) and P₇(pod initiation to pod development) phase suggest that during this period HTU varied between (382 and 922°C day hrs) and (2577 and 4175 °C day hrs). HTU requires more than 652°C day hrs. and 3376°C day hrs. for higher pod yield of groundnut during P₃and P₇ phase.Also,the significant and positive correlation between pod yield and photothermal

units PTU during P₇(pod initiation to pod development) phase suggest that during this period PTU varied between 3655 and 5196 °C day hrs. PTU requires more than 4425°C day hrs. for higher pod yield of groundnut during pod initiation to pod development phase.(Guled *et al.* 2013)also, reported that the pod yield was positively correlated with heliothermal units HTU and photothermal units PTU from flower initiation to maturity.

CONCLUSION

There was a good correlation with Agrometeorological indices like GDD, HTU and PTU was positively correlated with pod yield during pod initiation to pod development and negatively correlated with maximum, minimum temperature, mean temperature, BSS during most of the phenophases except during maturity period.

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Parameters	P1	P2	P3	P4	P5	P6	P7	P8	P9
Tmax.	-0.20	-0.50*	-0.21	0.15	-0.32	-0.36	-0.40	-0.2	0.54**
Tmin.	-0.29	-0.48*	0.04	-0.38	-0.38	-0.50*	-0.29	-0.35	0.23
Tmean	-0.26	-0.49*	-0.08	-0.11	-0.28	-0.52**	-0.37	-0.32	0.53**
BSS	-0.27	-0.11	0.19	0.25	-0.32	-0.44*	0.08	-0.41*	0.51**
RH1	-0.05	0.16	-0.08	-0.09	-0.26	0.11	-0.31	-0.07	-0.16

Table1: Correlation coefficients between phase wise weather parameters, agrometeorological indices and pod yield of groundnut

RH2	0.53**	0.28	-0.42*	-0.26	-0.48*	-0.00	-0.17	-0.29	-0.49*
Rhmean	0.27	0.22	-0.17	-0.20	-0.39	0.03	-0.27	-0.24	-0.40*
VP1	-0.35	-0.59**	-0.31	-0.35	-0.46*	-0.30	-0.52**	-0.32	-0.12
VP2	0.41*	-0.12	-0.47*	-0.28	-0.42*	-0.18	-0.43*	-0.27	-0.42*
Vpmean	-0.19	-0.42*	-0.40*	-0.32	-0.44*	-0.24	-0.50*	-0.30	-0.31
Rainfall	.a	0.20	.a	0.14	-0.28	-0.17	-0.14	0.32	-0.41*
GDD	0.33	-0.04	0.33	0.30	-0.11	0.27	0.54**	0.07	-0.14
HTU	0.28	-0.22	0.42*	0.11	-0.17	-0.16	0.52**	0.06	-0.10
PTU	0.33	-0.07	0.29	0.23	-0.15	0.22	0.52**	0.05	-0.15

Where P₁ (from sowing to emergence), P₂ (from emergence to first flower opening), P₃ (from first flower opening to 50 % flowering), P₄ (from 50 % flowering to peg initiation), P₅ (from peg initiation to 100 % flowering), P₆ (from 100 % flowering to pod initiation), P₇ (from pod initiation to pod development), P₈ (from pod development to pod maturity), P₉ (from pod maturity to physiological maturity) phase