Asian Journal of Biology

Volume 29, Issue 11, Page 109-113, 2024; Article no.AJOB.125668
ISSN: 2456-7124

Effects of Weather Conditions on Pod Yield in Groundnut Varieties

B. M. Mote [a*], Vyas Pandey [b] and Neeraj Kumar [a]

[a] Navsari Agricultural University, Navsari-396 450, Gujarat, India.
[b] Department of Agricultural Meteorology, Anand Agricultural University, Anand, 388110, Gujarat, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajob/2024/v20i11454

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/125668

Original Research Article

Received: 17/08/2024
Accepted: 20/10/2024
Published: 29/10/2024

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 P_9 (pod maturity to physiological maturity), where the mean temperature has varied between 32.7^0C to 35.1^0C during pod maturity to physiological maturity. In our experiment, we have found that more than 33.9^0C 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.

**Corresponding author: E-mail: amarmote4141@nau.in;*

Cite as: *Mote, B. M., Vyas Pandey, and Neeraj Kumar. 2024. "Effects of Weather Conditions on Pod Yield in Groundnut Varieties". Asian Journal of Biology 20 (11):109-13. https://doi.org/10.9734/ajob/2024/v20i11454.*

Keywords: Phenological stages; agrometeorological indices; correlation; groundnut.

1. INTRODUCTION

Groundnut is a tropical crop and requires a long and warm growing season. It requires more than 16 ^{0}C soil temperature for germination. Low temperatures retard the germination and growth of plants and lengthen flowering. Temperature above 35 ^{0}C inhibits the growth of groundnut. The mean temperature for optimum growth is 30 ^{0}C and the growth ceases at a temperature less than 15 ^{0}C [1]. 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 [2]. 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.

2. 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 D 3 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 Agrometeorlogical observatory of Anand Agricultural University, Anand. Correlation between the total pod yield was carried out using methodology described by Gomez and Gomez [3].

Table 1. Correlation coefficients between phase wise weather parameters, agrometeorological indices and pod yield of groundnut

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
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 P_1 (from sowing to emergence), P_2 (from emergence to first flower opening), P_3 (from first flower opening to 50 % flowering), P_4 (from 50 % flowering to peg initiation), P_5 (from peg initiation to 100 % flowering), P_6 (from 100 % flowering to pod initiation), P_7 (from pod initiation to pod development), P_8 (from pod development to pod maturity), P_9 (from pod maturity to physiological maturity) phase

3. RESULTS AND DISCUSSION

3.1 Temperature

Correlation analysis showed that maximum temperature (Tmax.) was significantly and negatively correlated with the P_2 (emergence to first flower opeining) phase. Tmax. during this phase was between 30.8 and 37.2 ^{0}C. Thus the higher Tmax. (>34^{0}C) during early vegetative period was not suitable for groundnut. The significant positive correlation was observed between pod yield and Tmax. during maturity period P_9 (pod maturity to physiological maturity) phase, during this period Tmax. varied between 38.7 and 42.8^{0}C, pod maturity requires Tmax. more than 40.7 ^{0}C for proper seed development which resulted in higher test weight resulting in higher pod yield of groundnut. The above presented results are in confirmation with the findings of Cox [4] Nigam et al. [5] Bapuji Rao et al. [6], Patel et al. [7] and Caliskan et al. [8] as they reported that cooler temperatures during flowering (P2) due to higher afternoon vapour pressure (VP2) had favored production of more number of flowers during both the years as they partitioned more dry matter to pods and hence had higher dry matter indicating better utilization of photosynthate carbon in growth, especially leaf area development.

The pod yield was negatively correlated with minimum temperature (Tmin.) during most phenophases except during the maturity. Higher night temperature Tmin. 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 (Tmean.) during most of the phenophases except during maturity period. However, a significant negative correlation was obtained with Tmean during P_2 (emergence to first flower initiation) phase. Tmean during this was between 22.9 and 28.6 ^{0}C. Similarly, significant and negative correlation was obtained with Tmean during P_6 (100% flowering to pod initiation) phase. Tmean during P_6 between 23.7 and 30.3^{0}C. Thus, the higher Tmean. were (>25.7^{0}C) and (>27^{0}C) during P_2 and P_6 phase was not suitable for groundnut.

3.2 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.

3.3 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 a higher pod yield of groundnut. Prathima, et al. [9] 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 RH_2 during P_3 (first flower initiation to 50 % flowering) phase. RH_2 during this was between 17.0 and 41.67 %. Similarly, significant and negative correlation was obtained with Tmean. during P_5 (peg initiation to 100 % flowering) and P_9 (pod maturity to physiological maturity) phases. RH_2 during P_5 between 12 and 68 % and P_9 between 27 and 53%. Thus, the higher RH_2 was (>27.8%), (>40%) and (>40%) during P_3, P_5 and P_9 phases was not suitable for groundnut.

3.4 Vapour Pressure

The results showed that the pod yield was negatively correlated with morning vapour pressure VP_1 during all the phenophases. In case afternoon vapour pressure VP_2 during P_1 (sowing to emergence) phase had a positive correlation with pod yield, Pod yield was also negatively correlated with mean vapour pressure VPmean during all the phenophases.

3.5 Agrometeorological Indices

The significant and positive correlation between pod yield and growing degree days GDD ^{0}C day only during P_7 (pod initiation to pod development) phase suggest that during this period GDD varied between 285 and 411^{0}C day. GDD

requires more than 348^{0}C day for higher pod yield of groundnut during pod initiation to pod development phase. Similarly, the significant and positive correlation between pod yield and heliothermal units HTU during P_3 (first flower initiation to 50% flowering) and P_7 (pod initiation to pod development) phase suggest that during this period HTU varied between (382 and 922^{0}C day hrs) and (2577 and 4175 ^{0}C day hrs). HTU requires more than 652^{0}C day hrs. and 3376^{0}C day hrs. for higher pod yield of groundnut during P_3 and P_7 phase. Also, the significant and positive correlation between pod yield and photothermal units PTU during P_7 (pod initiation to pod development) phase suggest that during this period PTU varied between 3655 and 5196 ^{0}C day hrs. PTU requires more than 4425^{0}C day hrs. for higher pod yield of groundnut during pod initiation to pod development phase. Guled et al. [10] Bhaskaran et al. 2020, Mote et al. [11] given the effect of growing degree days on yield and sowing date of groundnut and weather relations.

4. 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.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Prasad PVV, Craufurd PQ, Summerfield RJ. Effect of high air and soil temperature on dry matter production, pod yield, and yield components of groundnut. Plant and Soil. 2000’222: 231-239.
2. Aggarwal N, Singh A, Singh SP. Heat utilization and radiation interception in transplanted rice (*Oryza sativa* L.) in relation to seedling age. Journal of Agrometeorology. 2016;18(1):93-96.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research (2nd ed.). An International Rice Research Institute. John Wiley & Sons, New York; 1984.
4. Cox FR. Effect of temperature treatment on peanut vegetative and fruit growth. Peanut Sci. 1979;6(1):14-17.
5. Nigam SN, Rao RCN, Wynne JC, Williams JH. Effect and interaction of temperature and photoperiod on growth and partitioning in three groundnut genotypes. Ann. Appl. Biol. 1994;125(3):541-552.
6. Bapuji Rao B, Ramana Rao BV, Subba Rao AVM, Manikandan N, Narasimha Rao SBS, Rao VUM, Venkateswarlu B. Assessment of the impact of increasing temperature and rainfall variability on crop productivity in drylands-An illustrative approach. Research Bulletin 1/2011, Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, Andhra Pradesh, India. 2011; 1- 32.
7. Patel GG, Patel HR, Pandey V, Shekh AM, Patel JS, Vadodaria RP, Bhatt BK, Shroff JC. Influence of weather parameters on pod yield of groundnut in middle Gujarat agroclimatic region. J. Agrometeorol. 2010; 12(1):77-80.
8. Caliskan S, Caliskan ME, Arslan M. Genotypic differences for reproductive growth, yield, and yield components in groundnut (*Arachis hypogaea* L.). Turk. J. Agric. 2008;32(5):415-424.
9. Prathima T, Sudheer KVS, Madhuri CV, Subramanyam G. Crop-weather relations in groundnut and yield forecasting with growing degree days in the southern region of Andhra Pradesh. Environment and Ecology. 2022;40(2):246-250.
10. Guled PM, Shekh AM, Pandey Vyas Patel HR. Effect of weather conditions on kharif groundnut (*Arachis hypogaea* L.) at Anand in middle Gujarat agro-climatic zone. Asian Journal of Environmental Science. 2013; 8(2):72-76.

11. Mote BM. Effect of temperature variation on phenology and heat units of summer groundnut cultivars. Journal of Agrometeorology 19 (Special Issue - AGMET). 2016;98-102.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/125668