***Original Research Article***

**Correlation of Weather Parameters with different phenophases of Groundnut (*Arachis hypogaea* L.) during different sowing windows**

**ABSTRACT:**

 A field experiment was conducted to assess the performance of groundnut genotypes under different sowing windows during *rabi* season under ICAR-AICRP on groundnut at Zonal Agricultural and Horticultural Research Station, Hiriyur during 2023-24. The experiment was laid out in strip plot design with three replications consisting of three sowing windows as vertical factor and four varieties as horizontal factor. The influences of weather parameters on various critical stages of groundnut were distinct Pod and dry matter yields of groundnut sown on 48th MW and 52nd was higher compared to early sowings. Correlation analysis between weather parameters and seed yield at different phenophases of groundnut indicated that maximum temperature (r=0.468\*\*), minimum temperature (r = 0.384\*), cumulative bright sunshine hours (r = 0.405\*) and cumulative pan evaporation(r=0.502\*\*) from pod development to physiological maturity stage had significantly positive relationship with seed yield. On the other hand, minimum temperature (r = -0.519\*\*), minimum relative humidity (r = -0.431\*\*), maximum relative humidity (r = -0.378\*) and wind speed(r = -0.473\*\*) from pegging to pod development stage had a significantly negative relationship with seed yield. The correlation of seed yield with growth and yield parameters has shown significantly higher positive relationship *i.e.,* number of pods per plant (r = 0.879), weight of pods per plant (r = 0.811), 100 seed test weight (r = 0.926), significantly positive relationship with plant height (r = 0.652), total dry matter per plant (r = 0.708) and leaf area per plant (r = 0.812).

Key words: Correlation, phenophases, minimum temperature, minimum relative humidity,                         maximum relative humidity, wind speed.

1. **INTRODUCTION:**

The groundnut is cultivated on large scale in almost all the tropical and sub-tropical countries. Role of climate in crop production has vital and significant impact on growth and yield of the crop. However, individual weather parameter does not decide crop performance, while it is a combined effect of all the other parameters. Because of this unsteady behaviour there have been several changes in crop production and also in management aspects.Weather fluctuations accurately reflect projected yield. Weather conditions that persisted during crop growth, as well as inputs provided and other factors have an impact on crop production and yield.One of the main causes of the interannual variation in crop growth and yield is thought to be weather variability. The combination of the crop plants’ genetic makeup and the meteorological conditions that prevail during the growing season determines yield. Evaporation at distinct phenophases, strong daylight hours, and temperature(maximum, minimum and their diurnal variation) all have an impact on dry matter accumulation, crop development, and yield. Shift in sowing dates directly influence both thermo and photo-period, consequently have a great bearing on the phasic development and partitioning of dry matter. to pods (Nigam *et al.,* 1994). As a result, choosing the right genotypes and sowing at the right time is one of the most critical non-monetary inputs for increasing crop yield and productivity. This study focuses on the influence of weather on growth, phenology and yield of groundnut

1. **MATERIAL AND METHODS:**

 The experiment was conducted during *rabi* season 2023-24 on black loam soil at AICRP on Groundnut, Zonal Agricultural and Horticultural Research Station (ZAHRS), Babbur Farm, Hiriyur which is situated in the Central Dry Zone (Zone-4) of Chitradurga, Karnataka at 13057**'** 32**"** North latitude and 700 37**'** 38**"** East longitude with an altitude of 606.1 m above the mean sea level (MSL). The experiment was laid out in strip- plot design with three replications consisting of three sowing windows as vertical factor D1: 42nd MW (15 October- 21 October), D2 : 48th MW (26 November- 02 December), D3 : 52nd MW (24 December- 31 December) and four varieties as horizontal factor V1 : Dh-256, V2 : K-6, V3 : KL-1812 and V4 : TMV-2.

 Treated seeds were sown manually at a spacing of 30×10 cm. Gap filling was done at ten days after sowing of groundnut. Farm yard manure @ 7.5 t ha-1 was applied 15 days before sowing. The nitrogen, phosphorus and potassium were applied in the form of urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. 50 per cent of N, is urea, a full dose of P, is SSP and for K in the form of MOP vice that were mixed and applied at the time of sowing and the remaining 50 per cent of N, is urea was applied at 30 DAS.

 In order to develop crop weather relationships as well as to study the influence of prevailed weather conditions during different growth stages on the seed yield of groundnut, correlation and regression analysis was made. Growth stages were selected according to BBCH codes of Phenology (Munger *et al*., 1998). The stages included are P1 - Sowing to emergence (BBCH Code 00-09), P2 - Emergence to flowering stage (BBCH Code 09-59), P3 - flowering stage to pegging stage (BBCH Code 61-69), P4 - pegging stage to pod development stage (BBCH Code 71-79) and P5 - pod development stage to physiological maturity stage (BBCH Code 81-99). First, Seed yield was correlated with the weather parameters, *viz.,* Rainfall, maximum and minimum temperature, maximum and minimum relative humidity, wind speed, pan evaporation and bright sunshine hours. If the relationship was found significant, then stepwise regression was employed to study the individual and combined effect.

1. **RESULTS AND DISCUSSION**

 **3.1. Correlation between seed yield with growth and yield parameters**

 The correlation of seed yield with growth and yield parameters has shown significantly higher positive relationship *i.e.,* number of pods per plant (r = 0.879), weight of pods per plant (r = 0.811), 100 seed test weight (r = 0.926), significantly positive relationship with plant height (r = 0.652), total dry matter per plant (r = 0.708) and leaf area per plant (r = 0.812). (Table.1)

**Table.1: Correlation matrix of seed yield with growth and yield components**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Seed yield (kg ha-1) | Number of pods (plant-1) | Weight of pods (plant-1) | 100 kernel weight (g) | Plant height (cm) | Total dry matter (g plant-1) | Leaf area (dm2 plant-1) |
| Seed yield (kg ha-1) | 1.000\*\* |  |  |  |  |  |  |
| Number of pods (plant-1) | 0.879\*\* | 1.000\*\* |  |  |  |  |  |
| Weight of pods (plant-1) | 0.811\*\* | 0.987\*\* | 1.000\*\* |  |  |  |  |
| 100 kernel weight (g) | 0.926\*\* | 0.761\*\* | 0.699\* | 1.000\*\* |  |  |  |
| Plant height (cm) | 0.652\* | 0.862\*\* | 0.883\*\* | 0.572NS | 1.000\*\* |  |  |
| Total dry matter (g plant-1) | 0.708\*\* | 0.874\*\* | 0.876\*\* | 0.613\* | 0.905\*\* | 1.000\*\* |  |
| Leaf area (cm-2 plant-1) | 0.811\*\* | 0.982\*\* | 0.997\*\* | 0.702\* | 0.854\*\* | 0.844\*\* | 1.000\*\* |

\*- Significant @ 5%, \*\*- Significant @ 1%, NS-Non significant

**3.2. Crop-weather relationships in groundnut**

 An attempt was made to relate stage-wise prevailed weather parameters with the seed yield to develop crop weather relationships in groundnut. Role of climate in crop production has vital and significant impact on growth and yield of the crop. However, individual weather parameter does not decide crop performance, while it is a combined effect of all the other parameters. Because of this unsteady behaviour there have been several changes in crop production and also in management aspects.Weather fluctuations accurately reflect projected yield. Weather conditions that persisted during crop growth, as well as inputs provided and other factors have an impact on crop production and yield.The correlation between yield and meteorological parameters is provided in Table.2.

 *3.2.1 Maximum temperature*

 A significantly positive correlation was obtained between seed yield and average maximum temperature during the pod development to physiological maturity stage (r = 0.468). On the other hand, average maximum temperature from sowing to emergence stage (r = -0.380) exhibited a negative relationship with seed yield. A non-significant relationship was obtained between seed yield and maximum temperature at other growth stages. Maximumtemperature is one of the most important environmental elements influencing on plant reproductive activities such as pollen germination, pollen tube growth, and fruit set. A significant positive relationship was observed between average maximum temperature and seed yield from pod development to physiological maturity stage. Pod development stage is the most critical stage to weather parameters as also observed by (Pathak *et al*., 1988, Ramachandrappa *et aI*., 1992).

*3.2..2 Minimum temperature*

 A significantly positive relationship was obtained between seed yield and average minimum temperature during and pod development to physiological maturity (r = 0.384). On the other hand, the average minimum temperature from emergence to flowering (r = -0.443), flowering to pegging stage (r = -0.480) and pegging to pod development stage (r = -0.519) exhibited a significantly negative relationship with seed yield. A low minimum temperature of 10C below the climate normal increases yields variability of groundnut. Lower minimum temperature from pegging to pod development stage affects the yield. Nigam *et al*.(1994) and Meena *et al*. (2005) also reported similar effect of temperature and photoperiod on groundnut crop.

*3.2..3 Maximum and Minimum relative humidity*

 The significantly negative relationship between seed yield and average maximum relative humidity was observed in the phenophase flowering to pegging stage (r = -0.367) and pegging stage to pod development stage (r = -0.378).Average minimum relative humidity during flowering to pegging stage (r = 0.437), had significant positive relationship with seed yield. On the other hand, average minimum relative humidity during pegging to pod development stage (r = -0.431) and pod development to physiological maturity stage (r = -0.475) has significant negative relationship yield compared to other growth stages. Groundnut prefers long warm conditions for successful vegetative and reproductive growth. Lower maximum relative humidity during these stages makes crops more susceptible to insect pests, particularly sucking pests and leaf cutters, which affect the vegetative and reproductive growth and finally yield of the crop. Saritha *et al*. (2020) recorded a positive correlation between maximum relative humidity and infestation of Thrips in groundnut.

*3.2.4 Cumulative bright sunshine hours*

 A significant positive relationship was observed between cumulative bright sunshine hours and seed yield from pegging to pod development stage (r = 0.595) and pod development to physiological maturity stage(r = 0.405). The duration of sunshine has a direct impact on growth and development, while a shortage of light has a direct impact on the structure of groundnut stems and leaves as well as the flowering time. Cloudy weather during pod development stage restricts vegetative development, flowering, and production, ultimately lowering pod and seed build up and seed yield.

*3.2.6 Diurnal temperature range*

 Diurnal temperature range during emergence to flowering (r = 0.397), flowering to pegging stage (r = 0.433) and pegging to pod development stage (r = 0.450) had significant positive relationship with seed yield compared to other growth stages. The diurnal temperature range is a measure of temperature variations during the day. Higher diurnal temperature ranges describe crop exposure to varying temperature conditions throughout the day, which influences on crop development during these establishment phases.

*3.2.7 Wind speed*

 When compared to other growth stages, average wind speed from emergence stage to flowering stage (r = -0.424) and pegging to pod development stage (r = -0.473) exhibited significantly negative relationship with seed yield. Wind can change the microclimate through increasing evapotranspiration losses.

*3.2..8 Pan Evaporation*

 Cumulative pan evaporation from flowering to pegging stage (r = 0.337), pegging to pod development stage (r = 0.562) and pod development stage to physiological maturity stage(r = 0.502) exhibited a significantly positive relationship with seed yield. Evaporation is a direct indicator of crop water requirements.

**Table:2.Correlation between seed yield and weather parameters at different                       phenophases**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Weather parameters | P1 | P2 | P3 | P4 | P5 |
| Cumulative rainfall | - | 0.268NS | 0.249NS | - | - |
| Average maximum temperature | -0.380\* | -0.097NS | 0.007NS | 0.329NS | 0.468\*\* |
| Average minimum temperature | -0.272NS | -0.443\*\* | -0.480\*\* | -0.519\*\* | 0.384\* |
| Cumulative bright sunshine hours | 0.010NS | 0.104NS | 0.186NS | 0.595\*\* | 0.405\* |
| Maximum relative humidity | 0.123NS | -0.095NS | -0.367\* | -0.378\* | -0.233NS |
| Minimum relative humidity | 0.156NS | -0.269NS |  0.437\*\* | -0.431\*\* | -0.475\*\* |
| Wind speed | 0.232NS | -0.424\*\* |  0.128NS | -0.473\*\* | 0.029NS |
| Pan evaporation | 0.182NS | 0.171NS |  0.337\* | 0.562\*\* | 0.502\*\* |
| Diurnal temperature range | 0.050NS | 0.397\* | 0.433\*\* | 0.450\*\* | 0.301NS |

\*- Significant @ 5%, \*\*- Significant @ 1%, NS- Non significant

Where,

P1 – Sowing to emergence(BBCH Code 00-09) ,

 P2 – Emergence to flowering(BBCH Code 51-59),

P3 – Flowering to pegging stage(BBCH Code 61-69),

P4 – pegging to pod development stage (BBCH Code 71-  79)

P5 – pod development to physiological maturity stage (BBCH Code 81-99)

1. **CONCLUSION**

 Correlation analysis between weather parameters and seed yield at different phenophases of groundnut revealed a significant relationship between weather parameters and yield of the crop. Among the various weather elements, average maximum and minimum temperature, cumulative bright sunshine hours, average maximum and minimum relative humidity and bright sunshine hours posed a significant impact on final seed yield.

**ACKNOWLEDGEMENT**

 Gratitude is expressed to Zonal Agricultural and Horticultural Research Station, Hiriyur and Department of Agronomy, College of Agriculture, Shivamogga for being generous in providing the essential facilities for the conduct of research. Support rendered at times of need is invaluable.

**COMPETING INTEREST**

 Authors have declared that no competing interest exists.

**REFERENCES :**

MEENA, R.P., SINGH, S.P. AND BENIWAL, R.K., 2005, Correlation of weather parameters with growth, yield attributes and pod yield of groundnut (*Arachis hypogaea* L.) during different phenophases under irrigated condition of western Rajasthan. *Ann. Arid Zone*, **44**(1): 23-28.

MUNGER, L., BLEIHOLDER, H., HACH, H., HESS, M. AND WEBER, E., 1998, Phenological growth stages of the peanut plant (*Arachis hypogea* L*.*) codification and description according to BBCH Scale with figures. *J. Agron. Crop Sci*.,**180**: 101-107.

NIGAM, S.N., RAO, R.C.N., WYNNE, J.E., WILLIAMS, J.H., FITZNER, M AND NAGABHUSHANAM, G.V.S., 1994, Effect and interaction of temperature and photoperiod on growth and partitioning in three groundnut (*Arachis hypogaea* L.) genotypes. *Ann. Appl. Biol*., **125**: 541-552.

PATHAK, S.R., PATEL, M.S., QURESHI, A.V. AND GHODASAR, G.V., 1988, Effect of water stress on yield and diurnal changes of bio-physical parameters of groundnut. *Leg. Res.,*  **II**: 193-11) 5.

 RAMACHANDRAPPA, F. K., KULKURNI, K.R. AND NANIAPPA, H. Y.,1992, Stress degree day index for scheduling in summer groundnut (*Arachis hypogaea* L.). *Indian. J.Agron.,* **37**: 276-279.

SARITHA , R, SIRISHA A.B.M., HASEENA,S,K AND SUJATHA,V., 2020, Impact of weather on incidence of sucking pest in groundnut. *J. Entomol. Zool. Stud.,* 2020, **8**(3): 1157-1163.