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Short communication

Influence of weather parameters on summer greengram (*Vigna radiata* (L.) Wilczek) at Sardarkrushinagar

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Greengram *(Vigna radiata* (L.) Wilczek) is one of the important pulse crops, cultivated in India since ancient times. Greengram is a native of India and central Asia and grown in these regions since prehistoric times. In Gujarat it is cultivated in 2.30 Lakh ha producing about 1.21 lakh metric tonnes with a productivity of 526 kg ha^{-1} (Anonymous 2011). In North Gujarat region main greengram growing districts are Banaskantha and Sabarkantha. The duration of specific stages of growth shows direct relationship with temperature and for particular species this duration may be predicted through summation of mean daily air temperature (Wang, 1960), because the duration of each growth phase determines the accumulation and partitioning of dry matter in different organs (Dalton, 1967) as well as crop responses to external environmental factors. Solar radiation, temperature, soil moisture, relative humidity and bright sunshine hours are the important weather elements that influence the crop life cycle during summer season.

The experiment was conducted at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, SDAU, Sardarkrushinagar (latitude of 24° 19' N and longitude 72° 19' E) during summer season of 2012. The soil of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, medium in available phosphorus and potassium status. Twelve treatment combinations with four dates of sowing (5^{th} , 15^{th} & 25^{th} February and 5^{th} March) and three varieties (GM 2, GM 3 and GM 4) were tried in split plot design with four replications with the date of sowing as main plot and varieties as sub plot treatments. The crop was sown in line with spacing of 30 x 15 cm, using seed rate of 17.5 kg ha^{-1} with fertilizer dose of 20 kg N and 40 kg P_2O_5 ha^{-1}. Full dose of fertilizer in the form of urea and DAP was applied in furrows before sowing. Two interculturing and two hand weedings were carried out in greengram crop to maintain weed free condition during crop season. The crop was kept free from major insect pests by taking suitable plant protection measures. Phenological observations were recorded from selected five plants from net plot. The crop growth stages from each date of sowing were recorded as date of emergence, branching, 50 per cent flowering, pod development and pod maturity.

Weather parameters *viz.,* maximum temperature (T_{max}), minimum temperature (T_{min}), Relative humidity (RH I & RH II), Vapour pressure (VP_1, VP_2), Bright sunshine hours (BSS), Evaporation (EP) and wind speed (WS) were recorded at the agrometeorological observatory located near the experimental field. The agrometeoroligical indices *viz.,* growing degree days (GDD), photothermal unit (PTU), heliothermal units (HgTU I & II) were calculated following Chopada (2004) using base temperature of 10° C (Lavand, 2012).

HgTU-I& II = GDD X Relative humidity at morning (I) and at afternoon (II)

The effective day temperature (T_{photo}) and night temperature (T_{nycto}) were calculated following Went (1957) while Interdiurnal range of temperature (T_{IDR}) was calculated following Wang (1963).

$$T_{photo} = T_{max} - 1/4 \text{ X } (T_{max} - T_{min})$$

$$T_{nycto} = T_{max} + 1/4 \text{ X } (T_{max} - T_{min})$$

$$T_{IDR} = (T_{max})_i - (T_{min})_{i+1}$$

Where, $(T_{max})_i$ = maximum temperature of the i^{th} day, $(T_{min})_{i+1}$ = minimum temperature of the $(i+1)^{th}$ day

The result on phenological observations indicated that the duration of greengram decreased with delay in sowing. Early sown (Feb., 5) crop took longer duration for maturity (94 days) than the later sown crop in all cultivars due to fulfillment of thermal unit requirements in more days. The results on seed yield revealed that sowing on 25^{th} February resulted into significantly higher seed yield (833.3

Table 1 : Effect of date of sowing on duration of crop phenology for greengram

Date of sowing	Phenophases					Total
	P_1	P_2	P_3	P_4	P_5	
D_1	9	20	21	26	18	94
D_2	7	19	20	25	17	88
D_3	6	18	19	25	17	85
D_4	5	17	18	24	16	80

Table 2 : Effect of date of sowing on seed yield of summer greengram varieties

Treatments	Seed yield (kg ha^{-1})
Date of sowing (D)	
D_1 - 5th February	500.0
D_2 - 15th February	616.7
D_3 - 25th February	833.3
D_4 - 5th March	793.3
S.Em.±	33.17
C.D. at 5 %	106.13
C.V. %	16.76
Varieties (V)	
V_1 - GM 2	631.3
V_2 - GM 3	686.3
V_3 - GM 4	740.0
S.Em.±	21.44
C.D. at 5 %	62.59
C.V. %	12.51

kg ha^{-1}) being at par with 5th March. The variety GM4 gave significantly higher seed yield (740.0 kg ha^{-1}), but it was statistically at par with, GM 3 variety. Sowing on 25th February produced 40 per cent higher seed yield over 5th March sowing. The per cent increase in seed yield by GM 4 was 14.6 per cent over GM 3 variety. This may be due to favourable climatic condition.

Correlation analysis

The relationship between yield and the phenophase wise average weather parameters were studied using correlation study. However, correlation values are presented only for whole crop duration (Table 3). Results revealed that most of the weather parameters had positive and highly significant correlation with the seed yield of greengram except temperature range (T_{range}) and BSS which had negative correlations.

Table 3 : Correlation coefficient of summer greengram yield with average weather parameters and agrometeorological indices

Weather Parameters and Agrometeorological indices	Mean Value correlation coefficient
Tmax	0.826**
Tmin	0.938**
Tmean	0.921**
Trange	-0.928**
RH I	0.899**
RH II	0.902**
MRH	0.912**
VP I	0.900**
VP II	0.915**
MVP	0.910**
BSS	-0.449
EP	0.859**
WS	0.930**
GDD	0.287
PTU	0.588*
HTU	0.206
PTI	0.687*
HgTU I	0.942**
HgTU II	0.910**
T_{photo}	-0.526
T_{nycto}	-0.027
T_{IDR}	-0.877**

Where, * Significant at 5% level of significance
** Significant at 1% level of significance

It may be seen that the correlations workout with various agrometeorological indices did not improve except in case of hygrothermal unit (HgTU-I) which had highest correlation (0.942**) among all correlations.

Based on significant correlation, step wise regression was used to develop regression model as given below,

$\mathbf{Y}$= -18367.387 + 132.824 (X_4Tmax) - 665.00 (X_4BSS) + 695.136 (X_5Trange) + 770.845 (X_5 WS) + 0.208 (X_5HgTU-II)

$\mathbf{R^2}$ = 0.926**

(Where, Y= Seed yield, X_1= Germination phase, X_2= Branching phase, X_3= Flowering phase, X_4= Pod development phase, X_5= Pod maturity phase, ** Significant at 1% level of significance)

It may be seen that the maximum temperature (T_{max}), Sunshine hour (BSS) during pod development & Temperature range (T_{range}), wind speed (WS) and hygrothermal unit (HgTU-II) during pod maturity were found to contribute significantly to predict the yield variation in greengram with $R^2 = 0.926$**. So, this model could be used for predicting the greengram yield, however this model need to be validated with the independent dataset.

REFERENCES

Anonymous (2011). Districtwise area, production and yield per hectare of important food crops in Gujarat State. Directorate of Agriculture, Gujarat state, Gandhinagar.

Chopada, M.C. (2004). Phenological behavior and yield of chickpea (*Cicer arietinum* L.) cultivars under different environments with references to heat unit concept. M.Sc. (Agri) Thesis (Unpublished) submitted to Junagadh Agricultural University, Junagadh.

Daltan, L. G. (1967). A positive response of yield on maturity of sorghum. *Crop Sci*., 7: 721-726.

Lavand, P. S. (2012). Crop - Weather relationship in summer greengram (*Vigna radiata* (L.) Wilczek). M.Sc. (Agri) Thesis (Unpublished) submitted to Junagadh Agricultural University, Junagadh.

Wang, J. Y. (1960). A critique of the heat unit approach to the plant response studies. *Ecology,* 41: 785-90.

Wang, J. Y. (1963). Agricultural Meteorology, University of Wisconsin, Medison, Pacemaker Press. pp: 101-135.

Went, F. W. (1957). The experimental control of plant growth. Chronica Botanica Co. Waltham, mass.

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