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RESEARCH PAPER

Effect of sowing environments on tikka (*Cercospora* spp.) in groundnut (*Arachis hypogea* L.)

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Abstract : The experiment was laid out in Randomized Block Design with five sowing dates *viz.*, S_1 -22nd June, S_2 -29th June, S_3 -6th July, S_4 -13th July and S_5 -20th July and four replications. The observations on initiation of tikka diseases and per cent disease intensity were recorded periodically at an interval of one week after the occurrence of these diseases. The first incidence of tikka disease was observed at 30 DAS in S_1, S_2, S_3, S_4 treatments and at 56 DAS in S_5. The maximum incidence in all the five dates of sowing in *Kharif* season was observed between 65 to 79 DAS. Favourable climatic conditions for disease incidence and development were temperature ranged between 26^{0}C to 32^{0}C and relative humidity ranged between 61-79 per cent. The data revealed that in case of tikka disease there was positive significant correlation between disease intensity and maximum temperature (0.66), morning relative humidity (0.34), evaporation (0.39) and bright sunshine hours (0.65), whereas minimum temperature (-0.55), evening relative humidity (-0.69), wind speed (-0.73) and rainy days (-0.26) showed negatively significant correlation with disease intensity in *Kharif* season and wind speed, rain and rainy days were responsible for development tikka disease intensity. From the multiple regression analysis here it is concluded that the tikka disease severity was significantly related with wind speed (-5.53), rain (0.12) and rainy days (-4.46) and these factors were found to be significantly superior among the all weather parameters.

Key Words : Sowing, Environment, Groundnut, *Arachis hypogea* L.

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INTRODUCTION

The *Kharif* groundnut is grown during the south west monsoon (*Kharif* season) period across the country. The crop grown during this period is affected by high incidence of foliar fungal diseases, and attack by insect pests due to humid and rainy weather. The temperature, rainfall, relative humidity, prolonged cloudy weather are the major weather parameters for occurrence and growth of tikka and rust disease incidence in groundnut crop.

It is necessary to work out the relation between all these weather parameters and occurrence and growth of tikka and rust diseases of groundnut; which are the major diseases of groundnut that cause heavy yield losses. However, very meagre research work is carried out to quantify the correlation between these weather parameters

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and occurrences and development of tikka diseases. Therefore, the present investigation is undertaken to study the influence of weather parameters on tikka of groundnut.

MATERIAL AND METHODS

A replicated field experiment was conducted on a plot using groundnut variety JL-24 during the *Kharif* at the Department of Agricultural Meteorology Farm, Pune. The 5 sowing environments *viz.*, 25thMW(S_1), 26thMW(S_2), 27th MW(S_3), 28th MW,(S_4) and 29th MW (S_5) of groundnut was done with spacing 30 cm × 10 cm as per different sowing dates. The soil of the experimental field was medium deep with adequate fertility was suitable for a growth of the groundnut crop.

The incidence pattern of the tikka diseases, number of infected plants at seven days interval from 30 days after sowing were recorded and percentage of infected plants was worked out. Per cent disease incidence was calculated using following formula :

$$\text{PDI} = \frac{\text{Number of diseased plants}}{\text{Total number of plants observed}}$$

Disease intensity was calculated by following formula :

$$\text{Disease intensity (\%)} = \frac{0(X_0) + 1(X_1) + 2(X_2) + \ldots\ldots}{X_0 + X_1 + X_2 + \ldots\ldots \text{max. grade used}} \times 100$$

where, X represents the number of diseased entities within a sampling unit in the respective class or grade such as 0, 1, 2, …. 9

The correlation and regression equations were also worked out by the following formulae between different sowing dates and per cent disease intensity.

$$Y = a + b_1x_1+b_2x_2+b_3x_3+\ldots\ldots+b_nx_n$$

where, Y= PDI, 'a' as constant and 'b' as regression co-efficients of independent variable 'x'.

The influence of factors on tikka and rust disease incidence was estimated by using prediction equation as,

$$Y = a + b_1x_1+b_2x_2+b_3x_3+\ldots\ldots+b_nx_n$$

where, Y= PDI, 'a' as constant and 'b' as regression co-efficients of independent variable 'x'.

The influence of factors on tikka disease intensity was estimated by using prediction equation as,

$$Y = a + b_1x_1+b_2x_2+b_3x_3+\ldots\ldots+b_nx_n$$

where, Y= PDI, 'a' as constant and 'b' as regression co-efficients of independent variable 'x'.

The scale explained by Mayee and Datar (1986) was used to record field observations on tikka diseases of groundnut.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Disease observations :

The symptomatology of tikka diseases of groundnut was studied under field conditions during *Kharif* season. Symptomatology was studied by recording observations on growing plants sown on five different dates in *Kharif* season. The first symptom of tikka disease normally appeared on groundnut in *Kharif* and it was observed 25-30 days after sowing in all sowing dates. The sequence of development of symptoms in all sowing dates was similar, however, differed in conspicuousness and the severity.

Tikka (*Cercospora arachidicola* and *Cercospora personata*) :

The first symptom of tikka disease was lesions normally developed on the older leaves near ground level. The conidia produced on them are disseminated by wind, rain splash and insects leading to secondary infections, within 10-15 days. The small chlorotic spots appeared on leaflets which developed in about five days into mature, sporulating lesions. Lesions caused by *Cercospora arachidicola* were sub circular and 1 to over 10 mm in diameter. They were dark brown on the adaxial (upper) surface of the leaflet, where most sporulation occured, and of a lighter shade of brown on the abaxial (lower) surface. Lesions formed by *Cercospora personata* were smaller, nearly circular and darker than those formed by *Cercospora arachidicola* on the abaxial surface, the lesions were black and slightly rough in appearance. In *Cercospora arachidicola* a chlorotic halo was present around the lesions.

In addition to causing leaf spots, they produced lesions on petiols, stems and pegs. The lesions were oval to elongate and had more distinct margins than the leaflet lesions. When the disease attack was severe, the affected leaflet became chlorotic, then necrotic, the lesions coalesced and finally resulted in shedding of leaflets. While working with leaf spot disease of groundnut similar results were reported by Kucharek (1975). The conidia is a source of inoculums was observed by Karunakaran and Raj (1973). The overall similar disease symptoms

were observed by Woodroof (1933); Porter *et al*. (1982) and Subramanyam and Mc Donald (1970).

Per cent disease intensity of tikka of groundnut in sowing dates :

The data on tikka disease intensity of five sowing dates are depicted in Table 1. The data indicated that the occurrence of the tikka of groundnut was observed throughout the *Kharif* season, normally 30 days after sowing and then upto the harvesting. The disease intensity was higher mostly in the month of September. Among all sowing dates studied, the average tikka intensity level was higher (80.15%) in second date of sowing. The first incidence of tikka disease was observed 30 DAS in S_1, S_2, S_3, S_4 treatments and 56 DAS in S_5. The outbreak was not uniform for the diseases, the maximum intensity in all the five dates of sowing in *Kharif* season was observed between 65 to 79 days after sowing.

Tikka (*Cercospora* spp.) :

The data on disease intensity depicted in Table 2 indicated that in *Kharif* season the tikka disease incidence exponentially increased during 30 MW to 41 MW from 1.89 per cent to 67.04 per cent, during 33 MW to 42 MW from 22.96 per cent to 80.15 per cent, during 33 MW to 42 MW from 6.86 per cent to 56.99 per cent, during 35 MW to 44 MW from 6.96 per cent to 62.22 per cent, 38 MW to 44 MW from 6.72 per cent to 56.49 per cent in S_1, S_2, S_3, S_4, S_5 treatments, respectively. From the observed disease intensity it is concluded that the tikka disease incidence was initiated after 30 of sowing and thereby increased upto the harvest. Relative humidity, rain and rainy days and other climatic conditions during crop growing period were found to be significantly correlated with disease development. The similar disease

Table 1 : Development of tikka disease in different sowing dates during *Kharif* season

Sr. No.	Sowing dates	Tikka disease intensity (%) days after sowing												
		30	37	42	49	56	63	70	77	82	89	96	105	HAR
1.	S_1 (22nd June)	0.19	1.89	9.5	12.14	20.46	28.95	46.19	48.67	56.75	59.05	60.37	61.79	67.04
2.	S_2 (29th June)	1.63	4.19	6.3	22.96	43.33	47.78	54.22	57.48	66.89	70.74	73.55	77.75	80.15
3.	S_3 (6th July)	0.26	0.52	6.86	11.48	16.38	18.22	21.53	29.14	33.48	40.3	41.56	56.17	53.99
4.	S_4 (13th July)	0.33	1.2	3.56	6.96	7.2	12.04	13.89	34.96	42.52	48.74	49.22	58.44	62.22
5.	S_5 (20th July)	0	0	0	0	1.52	6.72	10.23	25.74	30.48	41.63	47.23	51.48	56.49

Table 2 : Development of tikka diseases in different sowing dates and different meteorological weeks during *Kharif* season

Sr. No.	Particulars		Tikka per cent disease intensity (PDI)				
	Obs. dates	MW	S_1 (22nd June)	S_2 (29th June)	S_3 (6th July)	S_4 (13th July)	S_5 (20th July)
			Tikka	Tikka	Tikka	Tikka	Tikka
1.	22-Jul	29	0.19	0	0	0	0
2.	29-Jul	30	1.89	1.63	0.11	0	0
3.	05-Aug	31	9.5	4.19	0.26	0.15	0
4.	12-Aug	32	12.14	6.3	0.52	0.33	0
5.	19-Aug	33	20.46	22.96	6.86	1.2	0
6.	26-Aug	34	28.95	43.33	11.48	3.56	0
7.	02-Sep	35	46.19	47.78	16.38	6.96	0
8.	09-Sep	36	48.67	54.22	18.22	7.2	0
9.	16-Sep	37	56.75	57.48	21.53	12.04	1.52
10.	23-Sep	38	59.05	66.89	29.14	13.89	6.72
11.	30-Sep	39	60.37	70.74	33.48	34.96	10.23
12.	07-Oct	40	61.79	73.55	40.3	42.52	25.74
13.	10-Oct	41	67.04	77.75	41.56	48.74	30.48
14.	18-Oct	42	–	80.15	56.17	49.22	41.63
15.	28-Oct	43	–	–	56.99	58.44	47.23
16.	04 Nov	44	–	–	–	62.22	51.48
17.	11-Nov	45	–	–	–	–	56.49

severity progress was observed by Gupta and Saharan (1974) and they concluded that the *Cercospora* leaf spot on *urdbean* was severe in early sown crop.

Also Rewal and Bedi (1976) studied that the late sown mungbean crop developed much less disease compared to the early sown mundbean crop. The minimum disease intensity caused by *Cercospora canescens*, was achieved when plants were sown in

Table 3 : Correlation co-efficient between biometeorological factors and tikka disease intensity in groundnut in five different sowing dates

Sr. No.	Weather parameters / Particulars	'r' values for groundnut disease (Tikka)				
	Climatic factors	S_1 (22nd June)	S_2 (29th June)	S_3 (6th July)	S_4 (13th July)	S_5 (20th July)
1.	Temperature (Max.) ^{0}C	0.639*	0.703**	0.785**	0.877**	0.891**
2.	Temperature (Min.) ^{0}C	-0.761**	-0.653**	-0.784**	-0.841**	-0.879**
3.	Relative humidity am (%)	-0.464	0.419	0.283	0.295	0.243
4.	Relative humidity pm (%)	-0.704**	-0.728**	-0.838**	-0.914**	-0.947**
5.	Wind speed (km/hr)	-0.775**	-0.819**	-0.909**	-0.940**	-0.923**
6.	Rainfall (mm)	0.128	0.030	-0.069	-0.110	-0.205
7.	Rainy days	-0.098	-0.217	-0.299	-0.319	-0.370
8.	Evaporation (mm/day)	0.278	0.406	0.450	0.571*	0.541*
9.	Bright sunshine hours/day	0.674**	0.736**	0.798**	0.851**	0.835**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 3(a) : Correlation co-efficient between biometeorological factors and tikka disease intensity (prior to one week) in groundnut in five different sowing dates

Sr. No.	Biometeorological parameters / Particulars	'r' values for groundnut disease (Tikka)				
	One week prior	S_1 (22nd June)	S_2 (29th June)	S_3 (6th July)	S_4 (13th July)	S_5 (20th July)
1.	Temperature (Max.) ^{0}C	0.621*	0.651**	0.796**	0.859**.	0.904**
2.	Temperature (Min.) ^{0}C	-0.532	-0.593*	-0.695**	-0.788**	-0.827**
3.	Relative humidity am (%)	0.385	0.450	0.478	0.316	0.294
4.	Relative humidity pm (%)	-0.697**	-0.719**	-0.836**	-0.912**	-0.938**
5.	Wind speed (km/hr)	-0.779**	-0.795**	-0.872**	-0.922**	-0.912**
6.	Rainfall (mm)	0.135	0.099	0.038	0.67	-0.39
7.	Rainy days	-0.242	-0.304	-0.347	-0.377	-0.313
8.	Evaporation (mm/day)	0.432	0.360	0.432	0.539*	0.529*
9.	Bright sunshine hours/day	0.653*	0.695**	0.796**	0.861**	0.852**
10.	Disease intensity (%)	0.988**	0.985**	0.983**	0.986**	0.985**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 3b : Correlation co-efficient between biometeorological factors and tikka disease (prior to two week) intensity in groundnut in five different sowing dates

Sr. No.	Biometeorological parameters / Particulars	'r' values for groundnut diseases Tikka				
	Two weeks prior	S_1 (22nd June)	S_2 (29th June)	S_3 (6th July)	S_4 (13th July)	S_5 (20th July)
1.	Temperature (Max.) ^{0}C	0.292	0.454	0.625**	0.765**	0.819**
2.	Temperature (Min.) ^{0}C	-0.411	-0.492	-0.656**	-0.715**	-0.779**
3.	Relative humidity am (%)	0.592*	0.584*	0.566*	0.490*	0.427*
4.	Relative humidity pm (%)	-0.437	-0.528*	-0.715**	-0.826**	-0.876**
5.	Wind speed (km/hr)	-0.693**	-0.663**	-0.822**	-0.879**	-0.900**
6.	Rainfall (mm)	0.041	0.141	0.167	0.074	0.131
7.	Rainy day	-0.345	-0.296	-0.244	-0.331	-0.221
8.	Evaporation (mm/day)	0.257	0.294	0.245	0.416*	0.383
9.	Bright sunshine hours/day	0.507	0.576*	0.672**	0.803**	0.804**
10.	Disease intensity %	0.973**	0.961**	0.975**	0.971**	0.957**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

the 1st week of September, followed by plants sown in the last week of August, the most favourable period for disease development was the 2nd week of July.

Awurum (2000) reported that planting date had significant effect on the incidence and severity of these diseases. Disease severity for leaf spot diseases was significantly higher in the crops sown on 1 June, 21 June and 12 July than those sown on 2 August and 23 August. This was significantly higher than those obtained from groundnut sown in June. The results of this study indicated that appropriate sowing date could help to reduce severe infection caused by most fungi in the field and that medium-maturing groundnut crops should be sown in August for better yield.

Effect of biometeorological factors on disease intensity and pathogenesis of tikka of groundnut :

The effect of bio-meteorological factors *viz.*, PDI, maximum and minimum temperatures, morning and evening humidity, rainfall, rainy days, evaporation, wind speed and bright sunshine hours on PDI of tikka of groundnut was studied in same week (0-week), one week prior (W^{-1}) and two weeks prior (W^{-2}). The data on PDI on each plant considered from the earlier observations for calculating the correlation co-efficients. The correlation co-efficients worked out for PDI and different climatic factors are in Table 3, Table 3(a) and Table 3(b).

Among studied factors in *Kharif* season on tikka disease the multiple regression analysis by step down method was worked out wherein PDI of W^0 taken as a dependent variables and W^{-1} (one week prior) PDI, W^{-2} (two weeks prior) PDI as well as weather parameters of (W^0), (W^{-1}), (W^{-2}) weeks as a independent variables. Multiple regression analysis was carried out and regression equation worked out and depicted in Table 4.

In case of tikka disease for first date of sowing (W^{-1}) PDI for one week prior, (W^{-2}) PDI of two weeks prior (0.97), maximum temperature (0.63) and bright sunshine hours (0.67) of same week were found to be significant and positively correlated with PDI. Minimum temperature (-0.76), evening relative humidity (-0.70) and wind speed (-0.77) were found to be significant and negatively correlated as well as for one week prior weather parameters, maximum temperature (0.62) and bright sunshine hours (0.65) found to be significant and positively correlated with PDI. Evening relative humidity (-0.69) and wind speed (-0.77) were found to be significant and negatively correlated. In two weeks prior weather parameters morning relative humidity (0.59) was found to be significant and positively correlated with PDI. Further wind speed (-0.69) was significant but negatively correlated.

In second date of sowing (W^{-1}: one week prior PDI (0.98), (W^{-2}: two week prior PDI (0.96), maximum temperature (0.70) and bright sunshine hours (0.73) of same week were found to be highly significant and positively correlated. minimum temperature (-0.65), evening relative humidity (-0.72) and wind speed (-0.81) were found to be significant and negatively correlated. As well as maximum temperature (0.65) and bright sun shine hours (0.69) of (W^{-1}) one week prior and morning relative humidity (0.59) and bright sunshine hours (0.57) of W^{-2} weeks were found to be significant and positively correlated and minimum temperature (-0.59), evening relative humidity (-0.71) and wind speed (-0.79) of W^{-1} week and evening relative humidity (-0.43) and wind speed (-0.69) of W^{-2} weeks were found to be significant negatively correlated.

In third date of sowing (W^{-1}: one week prior PDI (0.98), (W^{-2}: two week prior PDI (0.97), maximum temperature (0.78) and bright sunshine hours (0.79) of W^0 week, maximum temperature (0.79) of one week prior W^{-1} and minimum temperature (-0.65), morning relative humidity (0.56) and bright sunshine hours (0.67) of W^{-2} weeks were found to be significant and positively correlated. As well as and minimum temperature (-0.78), evening relative humidity (-0.83) and wind speed (-0.90) of (W^0) same week, minimum temperature (-0.69), evening relative humidity (-0.83) and wind speed (-0.87) of (W^{-1}) preceding week and minimum temperature

Table 4 : Regression equations for groundnut tikka disease development over sowing dates

Sr. No.	Sowing dates	Equations	R^2
1.	S_1 (22nd June)	$PDI=-3.854+0.982PDI^{(W-1)}-0.058RAIN^{(W0)}+1.750RD^{(W0)}$	0.981
2.	S_2 (29th June)	$PDI=-247.977+0.967PDI^{(W-1)}-1.794T(MAX)^{(W0)}+5.284RH\text{-}I^{(W0)}+1.091RH\text{-}II^{(W0)}-3.896RD^{(W0)}+2.250EVA^{(W0)}+5.806T(MAX)^{(W-1)}$	0.998
3.	S_3 (6th July)	$PDI=44.919+0.901PDI^{(W-1)}-1.755T(MAX)^{(W0)}+1.435T(MIN)^{(W0)}-2.641WS^{(W0)}-1.628RAIN^{(W0)}$	0.990
4.	S_4 (13th July)	$PDI=-5.829+0.823\ PDI^{(W-1)}+2.207\ BSS^{(W0)}+1.178RD^{(W0)}$	0.987
5.	S_5 (20th July)	$PDI=13.947+0.849\ PDI^{(W-1)}-1.653WS^{(W0)}$	0.980

(-0.65), evening relative humidity (-0.71) and wind speed (-0.82) and rainy day (-0.24) of (W^{-2}) two weeks prior were found to be highly significant and negatively correlated.

In last two dates of sowing (W^{-1}:one week prior PDI (0.98), (W^{-2}:two week prior PDI (0.97), maximum temperature (0.87), evaporation (0.57) and bright sun shine hours (0.85) of (W^{0}) same week, (W^{-1}) a previous week, maximum temperature (0.76), morning relative humidity (0.49) and bright sunshine hours (0.80) of (W^{-2}) two weeks prior, were found to be highly significant and positively correlated. As well as minimum temperature, evening relative humidity and wind speed of (W^{0}), (W^{-1}), (W^{-2}) week were found to be highly significant and negatively correlated.

From all the observations and results it is concluded that, for development of tikka disease in 22nd June sowing the bio-meteorological parameters that is PDI of one week prior and rain and rainy days were found to be significantly superior and highly correlated among the all other parameters.

For 29th June sowing the bio-meteorological parameters that is PDI of one week prior and maximum temperature, morning relative humidity, evening relative humidity, rainy days and evaporation rate of same week as well as maximum temperature of one week prior were found to be significantly superior and highly correlated among the all other parameters. For 6th August sowing the bio-meteorological parameters that is PDI of one week prior and maximum temperature, minimum temperatures, wind speed and rainy days of same week were found to be significantly superior and highly correlated among the all other parameters. For 13th August sowing the bio-meteorological parameters that is PDI of one week prior bright sun shine hours and rainy days of same week ware found to be significantly superior and highly correlated among the all other parameters.

For delayed sowing 20th July the bio-meteorological parameters that are PDI of one week prior and wind speed of same week were found to be significantly superior and highly correlated among the all other parameters.

Singh *et al*. (1990) studied that the tikka leaf spot intensity was positively correlated with maximum temperature (0.48), minimum temperature (0.42), evaporation (0.61) and age (0.51) of the crop.

Similar results were found by Sud and Singh (1984). The rapid development of leaf spot, caused by *Cercospora canescens* in urdbean [*Vigna mungo* (L.) Hepper], was favoured by a mean temperature of 22.5-23.5^{0}C, relative humidity of 77-85 per cent, more sunshine hours (>5/day) and more number of rainy days. Intermittent rains were found to be favourable for disease development. Heavy rainfall or continuous dry spells were not conducive to disease development. Infection periods characterized by more number of rainy days combined with more sunshine hours were conducive for disease development.

Effect of climatic factors on tikka disease intensity:

The data on correlation co-efficient between disease intensity and various climatic factors are detailed in Table 5.

The data revealed that in case of tikka disease there was positive significant correlation between disease intensity and maximum temperature (0.66), morning relative humidity (0.34), evaporation rate (0.39) and bright sun shine hours (0.65), whereas minimum temperature (-0.55), evening relative humidity (-0.69) and wind speed

Table 5 : Correlation co-efficients between disease intensity of five different sowing dates with climatic factors

Sr. No.	Particulars	'r' values for groundnut Tikka diseases
		Climatic factors
1.	Temperature (Max.)	0.664**
2.	Temperature (Min.)	-0.550**
3.	Relative humidity am (%)	0.349**
4.	Relative humidity pm (%)	-0.691**
5.	Wind speed (km/hr)	-0.737**
6.	Rainfall (mm)	0.047
7.	Rainy days	-0.261*
8.	Evaporation (mm/day)	0.396**
9.	Bright sunshine hours/day	0.656**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

(-0.73), and rainy days (-0.26) showed negatively significant correlation with disease development in *Kharif* season.

The overall step down multiple regression analysis was worked out between PDI of (W^0) same week with weather parameters of one week prior (W^{-1}) for all sowing dates. The results obtained are given as follows.

The multiple regression equation is given below :

$Y = 66.750 - 5.536WS^{(W-1)} + 0.124RAIN^{(W-1)} - 4.463RAINY\ DAYS^{(W-1)}$

From the overall step-down regression analysis here it is concluded that the tikka disease severity was significantly related with wind speed (-5.53), rain (0.12) and rainy days (-4.43). These variables showed favourable condition for disease progress in *Kharif* season.

Verma and Patel (1969) reviewed that *Cercospora cruenta* on cowpea although appeared very late in the season, progressed rapidly under conditions of moderate mean temperature (26^0C) relative humidity (61-79 %) and scanty rainfall (2.4 mm).

Similar results were reported by Pandu and Apparao (1979). They concluded that *Cercospora arachidicola* appeared earlier on groundnut crop than *Cercospora personata* and the gap between the appearances of the two species decreased when sowing was delayed. Age of the groundnut crop had no influence on the relative appearance of the two species and the crop was equally susceptible to both the species at all ages of the crop. The early appearance of *Cercospora arachidicola* is believed to be due to early liberation of inoculum. Environmental conditions, especially rainfall, were observed to have profound influence on the incidence of the two species. Despite the early initiation of *Cercospora arachidicola*, *Cercospora personata* dominated the former as the season advanced. Number of days taken by *Cercospora personata* to dominate over *Cercospora arachidicola* was significantly influenced by rainfall and minimum temperature prevailing during the fortnight after the appearance of the former.

Conclusion :

Based on the response of groundnut to different dates of sowing in respect of growth, yield and influence of weather parameters on tikka disease development, following conclusions were drawn.

The climatic factors *viz.*, maximum and minimum temperature, morning and evening relative humidity, rainfall and rainy days, wind speed, evaporation rate and bright sunshine hours played vital role in occurrence and development of tikka diseases on groundnut crop. These climatic factors are highly correlated either positively or negatively with the occurrence, development of tikka.

From the observed values of the above weather parameters for tikka diseases of groundnut the following step down regression equations were developed.

Tikka: $Y = 66.750 - 5.536WS^{(W-1)} + 0.124RAIN^{(W-1)} - 4.463\ RAINY\ DAYS^{(W-1)}$

From the above regression equation it is possible to predict the tikka disease severity of the groundnut crop one week prior.

From the above equations the tikka diseases severity can be predicted one/two weeks prior by considering mean earlier one week weekly observations of weather parameters *viz.*, maximum and minimum temperatures (T max. and T min. °C), relative humidity in per cent (RH-I and RH-II), bright sunshine hours (BSS), rainfall (mm) and rainy days, wind speed (WS km/hr) and evaporation rate (mm/day).

It can be concluded from the existing study that, in the scenario of existing state of global warming and climate change, the appropriate sowing time of groundnut crop will be first week of July in Western Maharashtra and particularly in Pune region instead of earlier recommended sowing time of 15 June to 7 July which will help in obtaining comparatively higher pod yield and less occurrence of diseases like tikka of groundnut in *Kharif* season.

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