The Andhra Agric. J 61(3):719-722, 2014

Effect of Various Weather Parameters on Initiation and Spread of Tikka Leaf Spot Disease in Groundnut

Key words : Groundnut, effect of various weather parameters and tikka leaf spot disease.

Effect of various weather parameters on tikka disease pathogens, C*ercospora arachidicola* Hori. *Phaeoisariopsis personata* (Berk. and Curt.) V. Arx. indicated that minimum temperature was significant negatively (r = -0.8461) correlated with per cent disease intensity during *kharif,* 2005 while it showed significant positive correlations (r = 0.974) during summer, 2006. On the basis of the regression analysis the prediction equation indicated that increase in 1^0C of minimum temperature decreased the per cent disease Index (PDI) of early and late leaf spot by 38.71 in *kharif,* 2005, while on increase in 1^0C of minimum temperature increased the PDI of early and late leaf spot by 11.16 in summer, 2006. The multiple regression equations $Y=978.38 -2.38 X_1 -38.71 X_2 -0.88 X_3+1.86 X_4 -0.29 X_5 -0.029 X_6 =0.800$ and $Y= -8.661 -3.79 X_1+11.16^{**} X_2 -1.68 X_3 + 0.54 X_4 =0.978$ were fitted for *kharif,* 2005 and summer, 2006, respectively for prediction of disease intensity of early and late leaf spot of groundnut.

Groundnut (*Arachis hypogaea L.*) is one of the principal oilseed crops of the world. It is the world's fourth most important source of edible oil and third most important source of vegetable protein. It is grown in tropical, subtropical and warm temperate zones of the world between 40^0 N and 40^0 S latitudes. It is native to South America. Among the developing countries, production is mainly concentrated in Asia and Africa. Asia accounts for 51 % of global area and 60 % of production. India occupies 25.4 % of global area and contributs 19.7% to the world groundnut production. The area, production and productivity of world 234.6 lakh ha; 370.3 lakh tonnes and 1579 kg/ha, respectively. India holds the world's largest area under groundnut (59.7 lakh ha), second in production (72.9 lakh tonnes) and yield 1220 kg/ha (Misra *et al.*, 2011). Ninety per cent of the total groundnut area is confined to six states viz., Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra and Rajasthan, which account for 92 % of the total production. Besides *kharif* it is grown in summer season also and gives good yield too.

Groundnut crop often suffers from many fungal, bacterial, viral, phytoplasma, nematode diseases and pests. The major biotic factors affecting groundnut yield and quality in India are foliar fungal diseases, stem rot, collar rot, root rot and seedling rots etc. Early (*C. arachidicola* Hori.) and late leaf spots (*P. personata* (Berk. and Curt.) Von Arx.) are the most widely distributed and economically important foliar diseases of groundnut causing severe damage to the crop (McDonald *et al*., 1985 and Kokalis-Burelle *et al*., 1997). Each disease alone is capable of causing substantial yield loss but when they occur together losses are further increased. Early and late leaf spots are commonly called as "Tikka disease". Loss of production from the combined effects of the both leaf spots can range from 10to50 per cent depending on the time of appearance and the weather (McDonald *et al*., 1985).

In Saurashtra region of Gujarat State, leaf spots are major problem for quality production in groundnut. Hence, an attempt was made to know the effect of weather factors on initiation and spread of early and late leaf spots in groundnut.

The study was conducted during *kharif,* 2005 at Department of Plant Pathology, research Farm, Main Oilseed Research Station, Junagadh Agricultural University (JAU), Junagadh Campus, Junagadh and during summer, 2006 at farmer field of Govindpara village using highly susceptible GG-2 variety (Veraval taluka, Junagadh district).

In order to create artificial epiphytotic condition in the field trial early and late leaf spot infected leaves were used collected from natural infected fields near coastal region of Junagadh. These leaves were kept under muslin cloth for

preventing drying and preserved in refrigerator until use.

The infected leaves were rufed in water to separate the spores . The entire scrapping of leaves were thoroughly mixed in the bowl and then drained through double layered muslin cloth. A few drop of Tween-20 was added in the mixture. The spore suspension was calibrated to 10^8 spores/ml and sprayed in the field with the help of hand sprayer in the evening.

The experiment was laid out in randomized block design keeping plot size of 4.0 x 2.70 s.m^2. The disease intensity was (Subramanyam *et al.,* 1995) recorded at weekly interval on ten randomly selected plants, using modified 9 point scale between 31st to 41st standard week in *kharif* 2005 and 9th to 20th standard week in summer-2006. Per cent disease index was calculated using formula below.

$$\text{Per cent Disease Index} = \frac{\text{Sum of individual ratings}}{\text{Total leaflets observed on plants X Maximum disease rating}} \times 100$$

The PDI values were transformed by arc sine transformation and analyzed statistically.

Weather data were collected from Meteorological Observatory at University research farm for *Kharif,* 2005 and for Summer, 2006 from Indian Meterological Department (IMD),Veraval and mean of weekly intervals were calculated. Multiple regression analysis were done of weather factors, such as means of maximum (X_1) and minimum (X_2) temperatures, morning (X_3) and evening (X_4) relative humidity, total rainy days (X_5) and rainfall (X_6) to determine R^2 (Coefficient of determination) and partial regression coefficient (b) value at 5 % level of probability (Snedecor and Cochran, 1967). The predicted mean disease severity (Y) equation

$Y = a + b_1X_1 + b_2X_2 + \ldots\ldots\ldots + b_6X_6$ was derived where, Y denotes the predicted early and late leaf spot disease severity; "a" denotes intercept and b_1 to b_6 denote partial regression coefficients of X_1 to X_6 weather factors.

The groundnut early leaf spot was observed in the College of Agriculture, Department of Plant Pathology fields, JAU, Junagadh during *kharif* season in the second week of August-2005 and also observed in summer season at Govindpara village experiment field in the 2nd week of March-2006.

The spore suspension was sprayed twice during evening hours two times at four days interval. The leaf spot was well established in all field trial through artificial inoculation of spore suspension.

Effect of weather parameters on early and late leaf spot disease in groundnut

Correlation studies between weather parameters and per cent disease incidence (PDI) of early and late leaf spots in groundnut

During *kharif* – 2005 highly significant negative correlation was observed between PDI and temperature minimum (r = -0.8461). Non significant positively correlation was observed between PDI and maximum temperature (r = 0.47), morning relative humidity (r = 402) and evening relative humidity (r = 0.230). However, rainy days (r = -0.163) and rainfall (r = -0.141) were non significant, but negatively correlated with PDI (Table1).

During summer–2006 highly significant positive correlation was observed between PDI and temperature minimum (r = 0.974). Temperature maximum, relative humidity morning and relative humidity evening were non significant, but positively correlated with PDI (Table1).

ii) Multiple regression studies between weather parameters and PDI of early and late leaf spot of groundnut

In order to know the abilities of weather parameters on the per cent disease intensity (PDI) of early and late leaf spot of groundnut, the regression analysis was carried out by taking PDI (Y) as a dependent variable and weather parameters (X) as independent variable and prediction equation were developed (Table 2).

The prediction equation indicated that increase in 1^{0}C of minimum temperature decreased the PDI of early and late leaf spot by 38.71 in *Kharif*– 2005 while on increase in 1^{0}C of minimum temperature increased the PDI of early and late leaf spot by 11.16 in summer– 2006. The value of coefficient determination (R^2) (table 2) was worked out to the tune of 0.800 and 0.978 indicating 80.0

Table 1. Correlation between weather parameters and per cent disease incidence (PDI) of early and late leaf spot disease in groundnut.

Year	Temperature (° c)		Relative humidity (%)		Rainy days (X_5)	Total Rain fall (mm) (X_6)
Kharif-2005	Maximum temp. (X_1)	Minimum temp. (X_2)	Morning RH(X_3)	Evening RH(X_4)		
	0.47	-0.8461**	0.402	0.230	-0.163	-0.141
**Significant at 1% (r = 0.735), *Significant at 5% (r = 0.602), n=11.						
Summer-2006	0.227	0.974**	0.338	0.358	-	-

**Significant at 1% (r = 0.708), *Significant at 5% (r = 0.576), n=12.

Table 2. Regression between weather parameters and per cent disease incidence (PDI) of early and late leaf spot disease in groundnut

Year	Regression equation	R^2
Kharif-2005	$Y=978.38-2.38\ X_1-38.71\ X_2-0.88\ X_3+1.86\ X_4-0.29\ X_5-0.029\ X_6$	0.800*
**Significant at 1% (R = 0.861), *Significant at 5% (R = 0.786), n=11. **Significant at 1% (t = 4.023), *Significant at 5% (t = 2.571), n=11.		
Summer-2006	$Y= -8.661-3.79\ X_1+11.16^{**}\ X_2-1.68\ X_3+0.54\ X_4$	0.978**
**Significant at 1% (R = 0.840), *Significant at 5% (R = 0.763), n=12. **Significant at 1% (t = 3.355), *Significant at 5% (t = 2.306), n=12.		

X_1 =Maximum temperature (°C), X_2 =Minimum temperature (°C),
X_3 =Morning relative humidity (%), X_4 =Evening relative humidity (%),
X_5 = Rainy days, X_6 = Rain fall

and 97.8 per cent variation in per cent disease index (PDI) was explained due to these weather factors during the year *kharif*-2005 and summer-2006, respectively in groundnut crop.

Climatic conditions greatly influence development of early and late leaf spot diseases which was also reported by many workers.

Jensen and Boyle (1965) observed severity of leaf spots positive correlated with relative humidity (> 80%) and maximum temperature. The late leaf spot disease severity was negatively correlated with minimum temperature, relative humidity and rainfall but it was positively correlated with maximum temperature (Benagi *et al.,* 1998).

Hazarika *et al.* (2000) noted a significant and positive correlation existed between disease incidence and weather factors (rainfall, relative humidity and temperature) for both the diseases of groundnut.

Krishnamurthy *et al.* (2004) and Patil *et al.* (2010) showed negative correlation with minimum temperature and evening relative humidity to per cent diseases severity of late leaf spot and rust diseases in groundnut. Minimum temperature

was negatively correlated with disease prediction (Dubey., 2005).

LITERATURE CITED

Benagi VI, Advani MR and Srikant Kulkarni 1998 Epidemilogical factors in relation to development and prediction of late leaf spot of groundnut. *Karnataka Journal of Agricultural Science*, 11(3): 679-683.

Dubey SC 2005 Role of weather on development of cercospora leaf spot (*Cercospora arachidicola*) on groundnut (*Arachis hypogaea* L.). *Indian Journal of Agricultural Science,* 75(4): 232-234 .

Hazarika D K, Dubey L N and Das K K 2000 Effect of sowing dates and weather factors on development of leaf spots and rust of groundnut. *Journal of Mycology and Plant Pathology,* 30(1): 27-30.

Jensen R E and Boyle L W 1965 The effect of temperature, relative humidity and precipitation on peanut leaf spot. *Plant Disease Repoter*, 49:975-978.

Kokalis-Burelle N, Porter DM, Rodringnez-kabana R, Smith DH and Subrahmanyam P 1997 Eds. Compendium of peanut disease, Second edition. pp. 94 *American Phytopathology Society*, USA.

Krishnamurthy SK, Sarada G, Sreeramulu E, Subramanyam K and Yellamandareddy T, 2004 Influence of weather parameters on initiation and spread of groundnut leaf diseases (late leaf spot and rust). National Symposium enhancing productivity of groundnut for sustaining food and nutritional security, NRCG, Junagadh, 160-161 p.

McDonald D and Subrhamanayam P 1985 Early and late leaf spots of groundnut. Information bulletin No.21, ICRISAT, Patan Cheru, Andhra Pradesh.

Misra and Rathnakumar 2011 Genetic and other management options for bacterial wilt and *Sclerotium* stem rot in groundnut in India,*Vision-2030*.Directorate of Groundnut Research, Junagadh ,Gujarat , Indian Council of Agricultural Research.

Patil M B and Pillai S G 2010 Epidemiology of Tikka disease of groundnut.*International Journal of Plant Sciences,* (Muzaffarnagar);. 5: 2, 436-438. 3 ref.

Snedecor GW and Cochran WG 1967 Statistical methods. Oxford and IBH Publishing Co., New Delhi. 593 p.

Subrahmanyam P, McDonald D, Waliyah F and Reddy L J 1995 Screening methods and sources of resistance to rust and late leaf spot of groundnut, ICRISAT,Information Bulletin ,No.47:2-4, 20 p.

Dept of Plant pathology,
R A R S,
Warangal.

A Vijaya Bhaskar
A M Parakhia

(Received on 08.02.2013 and revised on 18.03.2013)