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Effect of Weather Parameters on Development and Progress of Late Leaf Spot (*Phaeoisariopsis personata*) Disease in Groundnut

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A field experiment was conducted to evaluate the effect of weather parameters on initiation and progress of late leaf spot (*Phaeoisariopsis personata*) disease in Groundnut under three different dates of sowing (July first week, July third week and August first week). Correlation and regression analysis showed that weather parameters like minimum temperature and morning relative humidity highly influenced the Initiation and progress of late leaf spot. Minimum temperature showed significant negative correlation while morning relative humidity showed significant positive correlation with the late leaf spot development which indicated that progress of late leaf spot epidemic was favoured by high morning relative humidity (more than 80%) and low temperature. Maximum temperature showed significant negative correlation with disease progress in the two late sown conditions (July third week and August first week) while evening relative humidity showed significant positive correlation only in second date of sowing (July third week sowing). Area Under Disease Progress Curve (AUDPC) increased and both pod yield and haulm yield (kg ha^{-1}) decreased with delay in sowing time.

Key words: *Phaeoisariopsis personata*, late leaf spot, weather parameters, disease progression.

Groundnut (*Arachis hypogaea* L.) is cultivated in India mainly as an oil seed crop. Late leaf spot is commonly seen wherever groundnut crop is grown. Under favourable conditions late leaf spot caused by *Phaeoisariopsis personata* accounts for 25.3 per cent reduction in pod yield and 53.0 per cent reduction in haulm yield in groundnut (Eswara Reddy and Venkateswara Rao, 1999). Premature leaf fall due to the disease is a factor that reduces yield. It is a well-known fact that weather parameters like temperature and humidity play an important role in the development of diseases. Late leaf spot development and progress is highly influenced by weather parameters. Moreover, the information on weather parameters can be used to forecast the disease by developing prediction models which will reduce the usage of fungicides to a greater extent.

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MATERIALS AND METHODS

An experiment was conducted at College farm of S.V. Agricultural College Tirupati, situated at an altitude of 182.90 m above mean sea level on 79°E longitude and 13°N latitude during *Kharif* 2012 to find out the effect of weather parameters on the progression of the late leaf spot. Groundnut variety Kadiri-6 obtained from Agricultural Research Station, Kadiri was sown in 300 m^2 area with 3 different dates of sowing. Experiment was laid in three separate 100 m^2 plots with two week time interval between each sowing *i.e.*, first week of July, third week of July and first week of August. Data on weather parameters viz., maximum temperature, minimum temperature, morning and evening relative humidity, rainfall and sunshine hours was collected from meteorological observatory, Regional Agricultural Research Station, Tirupati. One month after sowing 20 plants were randomly selected and tagged. Late leaf spot disease severity was recorded on the tagged

plants at weekly intervals according to modified 1-9 point field scale (Subramanyam *et al.,* 1995).
Per cent Disease Index (PDI) was calculated using the following formula:

$$PDI = \frac{\text{Sum of individual ratings}}{\text{Number of samples graded}} \times \frac{100}{\text{Maximum disease grade}}$$

PDI was calculated at weekly intervals till the maturity of the crop from disease scores recorded on the tagged plants. Harvesting was done when crop attained maturity in each plot. The pod and haulm of each plot was dried separately and weighed. Weekly average of weather data on maximum temperature, minimum temperature, morning and evening relative humidity, rainfall and sunshine hours and weekly PDI were subjected to correlation analysis using IBM SPSS Statistics 20 software.

RESULTS AND DISCUSSION

The data on PDI at weekly intervals and weekly average of weather parameters is presented in the Table 1. Among the three dates of sowing studied, the infection and development of late leaf spot disease was maximum under delayed sowing (August first week) in which the favourable conditions like high relative humidity and low temperatures coincided. In July first week sowing

Table 1. Late leaf spot severity in relation to weekly average of major weather parameters

week	PDI (%)			Temperature (°C)		Relative humidity (%)		Rain-fall (mm)	Sunshine hours (h/day)
	July first week sowing	July third week sowing	August first week sowing	Minimum	Maximum	Morning	Evening		
05 to 11 Aug	11.11	-	-	26.29	34.93	69.14	45.00	2.29	3.40
12 to 18 Aug	11.11	-	-	24.61	35.47	74.86	42.86	3.64	6.81
19 to 25 Aug	11.11	11.11	-	24.79	35.50	73.71	46.43	8.07	6.66
26 Aug to 01 Sep	12.77	11.11	-	24.00	32.74	80.43	55.57	9.50	2.06
02 to o8 Sep	15.55	11.11	11.11	24.70	33.70	81.40	53.00	4.40	3.40
09 to 15 Sep	22.22	12.77	11.11	25.17	34.69	78.71	47.00	0.93	5.57
16 to 22 Sep	25.55	13.88	11.11	24.71	34.86	78.57	48.86	1.50	6.06
23 to 29 Sep	30.55	20.00	16.11	24.04	34.24	76.00	47.00	3.14	3.77
30 Sep to 06 Oct	38.89	33.88	27.22	23.79	33.83	80.29	54.43	13.43	5.27
07 to 13 Oct	42.22	35.55	30.00	23.79	34.57	80.86	43.57	0.43	6.80
14 to 20 Oct	52.22	48.88	40.55	23.14	31.93	82.43	54.86	4.50	3.91
21 to 27 Oct	-	58.88	51.66	22.04	30.86	87.43	59.86	4.14	6.21
28 Oct to 03 Nov	-	71.11	56.66	23.36	29.07	82.43	69.57	14.57	1.80
04 to 10 Nov	-	-	65.00	21.84	32.30	84.14	55.14	3.14	7.20
11 to 17 Nov	-	-	73.33	17.07	30.17	81.29	49.14	0.00	8.66

initial disease symptoms were recorded after 55 DAS but disease progressed slowly. It increased from traces (12.77%) to 52.22 per cent at the end of the season. In July third week sowing disease although initiated on 55 DAS, it remained in traces for some period later it increased to 33.88 per cent in the first week of October. An average rainfall of 13.43 mm/day and morning relative humidity of 80.29 per cent occurred in the October first week. Late leaf spot increased from traces (12.77) to 71.11 per cent at the end of season.

In August first week sowing disease initiated early (52 DAS) with much more severity (16.66%) when compared to the other two sowings may be due to the availability of inoculum from the previous sowings coupled with congenial environmental conditions. Per cent disease index at the end of season was relatively high (73.33%) due to the availability of favourable environmental factors like low temperature and high humidity, compared to July first week sowing.

Disease after initiation, in general, progressed steadily except in weeks of low relative humidity. Low temperature coupled with high relative humidity resulted in a rapid progress of disease severity at the end of the season. Frequent

rainfall received in month of October and November, made the environment more congenial for disease development.

Correlation analysis showed that (Table 2) minimum temperature gave significant negative correlation coefficients and morning relative humidity showed significant positive correlation coefficients for all the three dates of sowing. This indicated that progress of late leaf spot epidemic increased with increase in morning relative humidity and decrease in temperature. Shew *et al.* (1988) found that infection by late leaf spot pathogen was optimum when exposed to 20°C and at least 12 hr/day, duration of >93 per cent RH for six days. Similar results were reported with temperature optima close to 20°C and minimum and maximum of about eight and 34°C, respectively by Butler *et al.* (1994). Kadam *et al.* (2008) also reported that high relative humidity, moderate mean temperature and shower of rains are congenial factors for the dispersal of conidia of *Cercospora* species. Shew *et al*. (1988) expected leaf spot severity to be the highest when temperatures were near 24°C and during long leaf wetness periods as the infection is probably occur at night or in early morning when leaves are wet and temperatures are cool. Post infection development probably proceeds rapidly at warm temperatures, slows during the hottest part of the day, and resumes in the evening as temperatures decrease.

Maximum temperature showed significant negative correlation with disease progress in the two late sown conditions (July third week and August first week) while evening relative humidity showed significant positive correlation only in second date of sowing (July third week sowing). Maximum temperature was higher in beginning of the season which decreased slowly towards the end of disease season. Minimum temperature also followed the same trend while disease increased steadily towards the end of the season. This was in accordance with Shew *et al*., 1988. Maximum incidences occurred at 20°C and with increase in temperature to 28°C and above a very slow progress took place (Shew *et al*., 1988). Sarada Jayalakshmi (1996) also reported that maximum and minimum relative humidity were positively correlated to the development and progress of late leaf spot of groundnut in Southern zone of Andhra Pradesh.

Area Under Disease Progress Curve (AUDPC) increased and both pod yield and haulm yield (kg ha^{-1}) decreased with delay in sowing time (Fig. 1 and Table3). Relative humidity increased towards the end of the season as temperature decreased. Low temperature coupled with high

Table 2. Correlation coefficients of groundnut late leaf spot with weekly average of major meteorological parameters for three dates of sowing (*Kharif* 2012)

Weather parameters	Date of sowing		
	July first week	July third week	August first week
Minimum temperature (°C)	-0.735*	-0.834**	-0.838**
Maximum temperature (°C)	-0.531	-0.851**	-0.851**
Morning relative humidity (%)	0.607*	0.692*	0.650*
Evening relative humidity (%)	0.286	0.730*	0.475
Rainfall (mm)	-0.021	0.362	0.118
Sunshine (h/day)	0.094	-0.172	0.353

* Correlation is significant at 0.05 % ** Correlation is significant at 0.01 %

Table 3. Effect of dates of sowing on final disease intensity and yield of groundnut (*Kharif* 2012)

Observations	July first week sowing	July third week sowing	August first week sowing
Final PDI (%)	52.22	71.11	73.33
Pod yield (kg ha^{-1})	1618	1455	1412
Haulm yield (kg ha^{-1})	2712	2250	2197

humidity created congenial atmosphere for the progress of late leaf spot in the late sown crop. Low incidence of late leaf spot (52.22 %) was recorded in the early sown plot (July first week) in which low average relative humidity and high temperatures were recorded which are not much favourable for the development of late leaf spot. Maximum yield was recorded in this treatment due to the reduced intensity of late leaf spot which resulted in very good pod filling.

In conclusion, weather parameters like minimum temperature and morning relative humidity highly influenced the initiation and progress of late leaf spot. Minimum temperature showed significant negative correlation while morning relative humidity showed significant positive correlation with the late leaf spot development which indicated that progress of late leaf spot epidemic was favoured by high morning relative humidity (more than 80%) and low temperature.

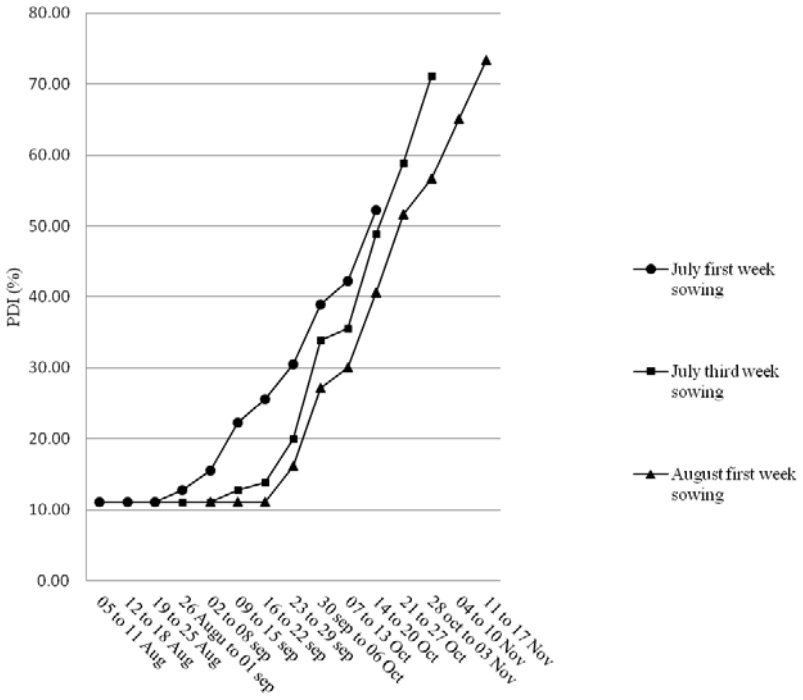

Fig. 1. Effect of dates of sowing on the development and progress of late leaf spot in groundnut (*Kharif* 2012)

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