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Disease dynamics and relationship of disease development with weather parameters

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Abstract
A field experiments was conducted during *Rabi* seasons of 2014-2015 and 2015-2016 at the Agromet. Farm, N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) with a view to study the disease dynamics and relationship of disease development with weather parameters. The findings of present investigation indicated that the grain and straw yields as well as most of the growth and yield attributes of wheat were significantly influence due to different temperature (T. max. and T. min.), seed rate and variety of wheat. Disease occurrence was started with slow rate from January onwards during both the years of investigation. PDI during both the years of investigation increased during warm and humid climate and its maximum intensity was found during reproductive stage of growth. Losses in yield were estimated due to leaf blight was 15.1% and 14.6% as the result of multiplication of pathogen rapidly during warm and humid climate.

Keywords: Wheat, maximum temperature, minimum temperature, P.D.I

Introduction
Wheat (*Triticum aestivum* L.) belongs to the poaceae family. It is the single most important cereal crop that has been considered as integral component of the food security system of several nations. It rank first in the world among the cereals both in respect of acreage 221.76mha and production 696.64mt. In India total area under wheat is 29.40mha with the total production of 93.62mt and productivity of 2.95 tonnes/ha (Anonymous, 2012-13) [1]. Uttar Pradesh rank first in respect of area and production which is about 9.25mha with the total production 25.60mt and productivity of 27.90q ha^{-1}, But the average productivity in our state is comparatively much lower than that of Punjab and Haryana. India is the second wheat growing country after China in the world. Weather not only affects the plants but also affects the pathogens, insects (including vector of plant pathogens) and weeds that reduced the crop yield. Karnal bunt (KB) of wheat is causes by soil and seed-borne inoculums. All the grains in an ear may not be uniformly infected. The incidence of Karnal bunt varies considerably from year to year due to its dependence on favorable weather during heading (Gill *et al*., 1993) [2]. The demand of wheat by 2020 has been projected to be between 105-109 million tones. Most of this increase in production will have to manage by increasing productivity as the land area under wheat is not expected to expand. Efficient input management along with varietal improvement are the two basic aspects that can help in achieving the target. Irrigation water is a major constraint for assumed crop production. To grow successfully wheat crop must achieve water economy such that the demand of climate is balanced by the supply available to it. The problem is that the atmospheric evaporation demand is practically continuous as against sporadic supply of water by natural precipitation even short term water deficit can reduce crop yield substantially.

Material and Methods

Experimental site

The experiment was conducted at Agromet Research Farm, of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj) Faizabad (U.P.), during *Rabi* season of 2014-2015 and 2015-2016. This farm is located at a distance of 42.0 Km. on Faizabad-Raibareilly road from Faizabad district headquarter.

Design and layout

The experiment was conducted with 9 treatment combinations comprised of three varieties in main plot and three seed rates in sub plot was laid out in split plot design with three replications.

Initial plant population

The germinated plants in one meter row length were counted randomly after 15 days of sowing. The average was taken and finally plant population was expressed in per running meter.

Plant height (cm)

Five plants were selected randomly in each plot and tagged for measuring height at different intervals. Height was measured at 30, 60, 90 days after sowing and at harvest stage with the help of meter scale from ground surface to the tip of the top most leaf before heading and up to the base of ear head after heading.

Number of shoots m^{-2}

The number of shoots were counted per meter row length from three places selected randomly in each plot at 30, 60, 90 days after sowing and at harvested stage.

Disease infestation (PDI)

It is the percentage of diseased plants or parts in the sample or population of plants. It can be the proportion or percentage of diseased leaves in a plant, diseased stalks or a tiller or diseased seedlings in a field.

$$PDI = \frac{\text{No. of infected plants}}{\text{Total no. of plant assessed}} \times 100$$

Maximum and minimum temperature above and below canopy

Maximum & minimum temperature is recorded during the crop duration. The maximum thermometer &minimum thermometer in use mercury-in-glass & sprit-in-glass. The temperature range for max. & min. thermometer is from -35 to + 55 and -40 to + 50 ^{o}C.

Relative humidity above and below crop canopy

Relative humidity above & below crop canopy measured with the help of Assmann Psychrometer.

Result and Discussion

Number of total tillers (m^{-2})

An examination of data presented in table 1 manifests that number of total tillers $m^{-2}$was significantly influenced due to varieties at all the stage except 30 DAS. V_3 recorded significantly higher number of total tillers at all the stages as compared toV_2 and V_1 which did not differed significantly at all the stages during both the years of investigations. An examination of data presented in table 1 manifests that number of total tillers m^{-2} was significantly influenced due to seed rates at all the stage except 30 DAS. Significantly higher number of total tillers m^{-2} were noticed under 100% seed rates (S_2) as compared to S_1andS_3 at all the stages during both the years of investigations.

Table 1: Effect of Varieties and seed rates on number of total tillers m^{-2} of wheat

Treatment	Number total tillers m-2							
	30 DAS		60 DAS		90 DAS		At harvest	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Varieties								
V_1	305.4	304.3	380.8	379.7	366.2	365.3	354.8	353.2
V_2	304.1	303.0	379.9	378.6	365.3	364.4	354.0	353.1
V_3	307.4	305.2	415.0	414.1	399.0	398.1	386.7	385.2
SEm±	8.1	8.0	10.8	10.5	9.6	9.2	8.8	8.2
CD at 5%	NS	NS	38.0	37.8	33.6	33.1	30.9	30.0
Seed rates								
S_1	304.1	303.1	379.9	378.1	365.3	364.2	352.7	350.3
S_2	307.4	305.6	415.0	414.2	399.0	398.1	379.8	378.0
S_3	305.4	303.1	380.8	378.3	366.2	364.3	370.7	368.5
SEm±	2.0	2.9	9.4	9.0	8.3	8.0	7.6	7.2
CD at 5%	NS	NS	27.2	26.0	24.0	24.1	22.2	22.0

Leaf area index

An examination of data presented in table 2 manifests that LAI was significantly influenced due to Varieties at all the stage except 30 DAS and 60 DAS. V_3 recorded significantly higher LAI at all the stages as compared to V_2 and V_1 which did not differed significantly at all the stages during both the years of investigations.

Table 2: Effect of Varieties and seed rates on leaf area index of wheat

Treatment	Leaf area index					
	30 DAS		60 DAS		90 DAS	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Varieties						
V_1	1.17	1.15	3.58	3.51	3.88	3.82
V_2	1.17	1.16	3.50	3.49	3.80	3.77
V_3	1.22	1.20	3.75	3.70	4.18	4.16
SEm±	0.02	0.01	0.08	0.07	0.10	0.09
CD at 5%	NS	NS	NS	NS	0.35	0.33
Seed rates						
S_1	1.16	1.15	3.50	3.49	3.80	3.79
S_2	1.21	1.20	3.75	3.73	4.18	4.17
S_3	1.18	1.16	3.58	3.56	3.88	3.85
SEm±	0.02	0.01	0.06	0.07	0.09	0.08
CD at 5%	NS	NS	0.23	0.21	0.25	0.24

Disease incidence (%)

Data pertaining to PDI of leaf blight as affected by weather parameters are presented in table no. 3 and 4 during both ears 2014-15 and 2015-16 respectively. Disease occurrence was started with slow rate from January onwards during both the years of investigation. PDI during both the years of investigation increased during warm and humid climate and its maximum intensity was found during reproductive stage of growth. Relationship between weather parameters and PDI of leaf blight has been depicted in figure no. 1& 2. Losses in yield were estimated due to leaf blight was 15.1% and 14.6% during first year and second year of investigation respectively.

Table 3: PDI of Leaf blight as affected by weather parameters of Wheat crop during 2014-15

Week no.	Min. Temp. (ºC)	Max. Temp. (ºC)	Average RH (%)	BSS (hrs.)	PDI
47	8.2	27.2	66.8	6.0	0
48	8.6	27.5	66.5	5.4	0
49	7.9	23.2	73.6	1.9	0
50	8.0	19.2	77.8	1.7	0
51	5.9	17.0	83.0	3.1	0
52	5.1	16.6	83.7	3.1	1.1
1	11.3	18.6	83.1	1.2	2.2
2	6.4	14.8	83.3	0.3	3.2
3	6.8	14.3	86.6	0.9	5.6
4	10.3	20.0	77.4	3.0	5.8
5	8.9	20.8	73.1	5.6	8.9
6	8.0	21.5	73.5	4.1	12.4
7	10.5	25.0	66.9	3.3	18.3
8	14.0	28.1	64.3	4.7	23.9
9	14.6	24.9	72.5	2.5	28.5
10	11.6	27.0	65.5	7.0	37.0
11	13.1	29.1	67.0	4.4	42.3
12	15.0	30.5	63.0	8.2	46.2

Table 4: PDI of Leaf blight as affected by weather parameters of Wheat crop during 2015-16

Week no.	Min. Temp. (ºC)	Max. Temp. (ºC)	Average RH (%)	BSS (hrs.)	PDI
47	11.0	30.6	60.2	5.6	0
48	12.5	29.5	66.6	4.6	0
49	9.4	26.1	78.8	3.5	0
50	7.7	23.8	75.8	3.2	0
51	5.2	23.0	65.8	3.9	0
52	6.2	27.2	74.5	6.1	0
1	6.5	24.9	68.5	4.9	0
2	7.5	25.1	67.4	5.1	3.3
3	6.8	20.1	77.6	2.7	5.3
4	5.2	22.7	70.5	3.1	5.1
5	8.5	25.6	63.7	4.6	8.0
6	7.5	25.4	66.7	5.3	12.1
7	6.3	28.3	60.7	4.8	17.5
8	11.6	28.9	60.2	6.1	21.3
9	13.4	29.7	66.0	8.1	26.9
10	15.1	32.4	61.9	7.9	28.8
11	14.5	30.9	53.9	6.1	35.6
12	15.4	33.4	42.7	7.9	36.3

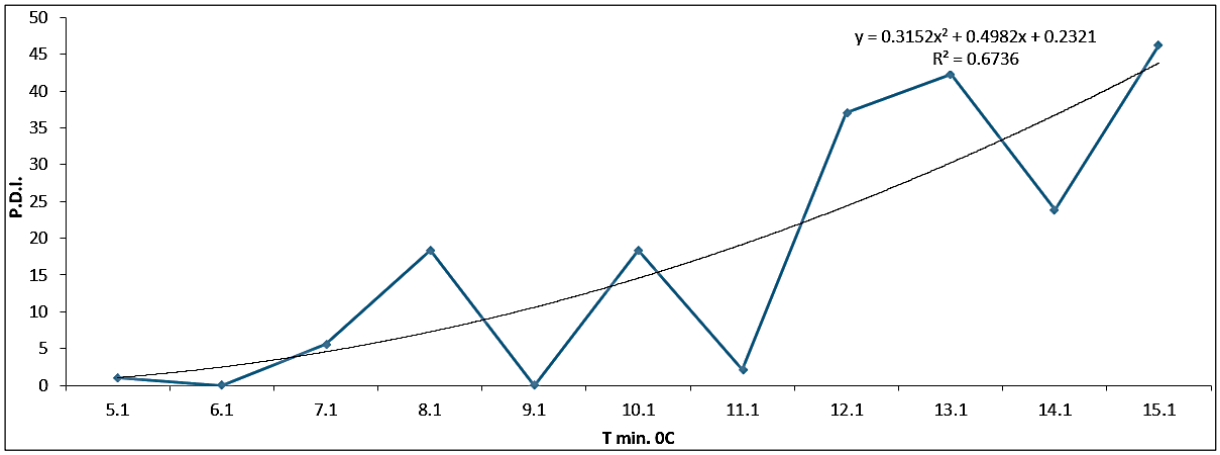

Fig 1: Relationship between T. min. (ºC) and leaf blight of wheat. (2014-15)

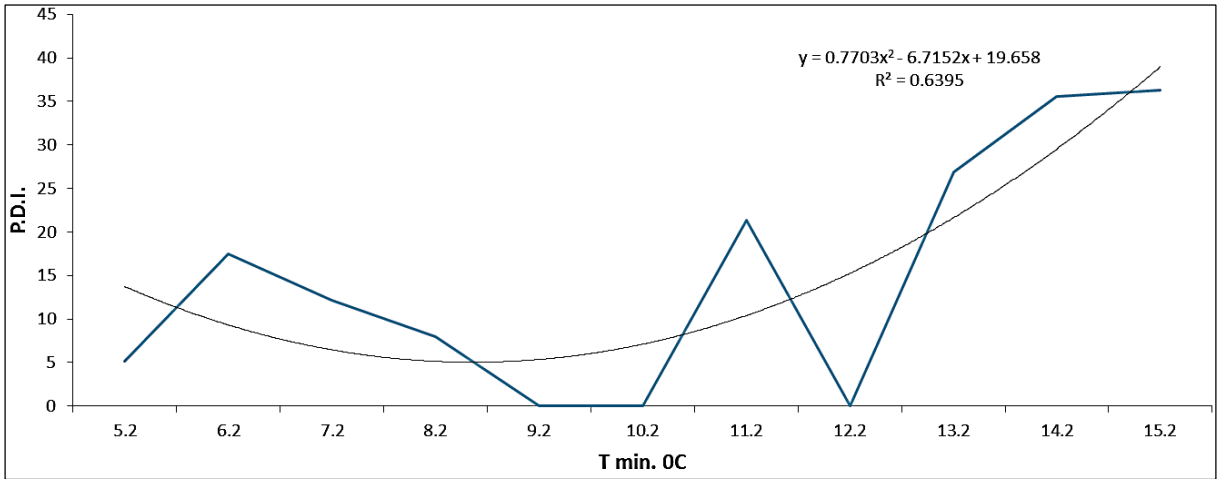

Fig 2: Relationship between T. min. (ºC) and leaf blight of wheat. (2015-16)

Conclusion

Number of effective tillers m^{-2} and Leaf area index was significantly influenced due to varieties at all the stage except 30 DAS. V_3 recorded significantly higher LAI and effective tillers at all the stages as compared to V_2 and V_1 which did not differed significantly. LAI was significantly influenced due to seed rates except 30 DAS. Significantly higher LAI were noticed under 100% seed rates (S2) as compared to S_1 and S_3. Disease occurrence was started with slow rate from January onwards. PDI during both the years of investigation increased during warm and humid climate and its maximum intensity was found during reproductive stage of growth.

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