

Original Research Article

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## Implication of Meteorological Parameters on the Incidence of Purple Blotch of Onion under Odisha Condition

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### ABSTRACT

The incidence of Alternaria blight caused by *Alternaria porri* largely depends on meteorological parameters, location, cultivars susceptibility and cultural practices. Change of climate affects the disease incidence. Correlation of meteorological parameters on the natural occurrence of Alternaria blight was studied from 21/11/2012 to 19/03/2013 in sixteen meteorological weeks under field condition at experimental plot, Dept. of plant pathology, OUAT, Bhubaneswar. The weather factors such as maximum and minimum temperature ( $^{\circ}\text{C}$ ), maximum and minimum relative humidity (%), rainfall (mm), number of rainy days (days), wind velocity(km/hr) contributed about 70.2% towards the disease incidence. However, the parameters like maximum temperature, maximum RH, number of rainy days and wind velocity were found statistically significant with respect to disease development.

#### Keywords

*Alternaria porri*,  
Onion, Weather  
parameters.

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### Introduction

Onion (*Allium cepa*) is a popular vegetable crop grown in India. It is an important source of vitamins, minerals and proteins. Onion is found to be effective against heart diseases and other ailments like treatment of anaemia, urinary disorder, bleeding piles and teeth disorders (Lokhande *et al.*, 2011). Onions are among the most widely adapted vegetable crops. They can be grown from the tropics to sub-arctic regions. But it succeeds best in mild season without extremes of heat and cold. Indian onions have two crop cycles, first harvesting starts in November to January and

the second harvesting from January to May. India is the 2<sup>nd</sup> largest producer of onion in the world after China. There is a lot of demand of Indian Onion in the world, the country has exported 1.48 million Tonnes of fresh onion to the world for the worth of Rs. 3,169.63 crores during the year 2013-14.

Major Export Destinations (2013-14) are Bangladesh, Malaysia, Sri Lanka, United Arab Emirates, Indonesia, Pakistan and Singapore. The Major Onion producing states area Maharashtra, Karnataka, Madhya

Pradesh, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana and Tamil Nadu. Maharashtra ranks first in Onion production with a share of 27.72%. Being the eleventh highest producer of onion, Odisha produces 4.1 lakhs tonnes in 2012-13 (National Horticulture Board).

Various factors are responsible for low yield of the crop, especially disease. Onion is susceptible to numerous foliar, bulb and root pathogens that ultimately reduce yield and quality.

Onion is subjected to the attack by several fungal, bacterial and viral diseases. Onion diseases can cause severe losses by reducing yield and quality of marketable onions.

These onion diseases can occur in seedbeds, production fields and storage. Among all, purple blotch incited by *Alternaria porri* causes huge economic loss. The incidence of *Alternaria* blight caused by *Alternaria porri* largely depends on meteorological parameters, location, cultivars susceptibility and cultural practices.

Change of climate affects the disease incidence. For that present investigation was taken to study on the disease incidence in relation with the weather parameters.

## Materials and Methods

In order to study the relationship of meteorological parameters on the natural occurrence of *Alternaria* leaf blight disease onion cultivar Agrifound dark red was selected. Five randomly selected samples each comprising of 10 plants were taken for observation at weekly intervals from 21/11/2012 to 19/03/2013 consisting of 17 meteorological weeks, 2012-13 (Rabi) under field condition at experimental field, Department of Plant Pathology, OUAT, Bhubaneswar.

Intensity of disease appearance on onion leaves was followed through visual estimation. Per cent disease incidence (PDI) was calculated by using the formulae as mentioned below

$$PDI = \frac{\text{Sum of all numerical ratings} \times 100}{\text{Total no. of observations} \times \text{Maximum disease rating}}$$

For recording the disease incidence of the test samples, the standard scale (0-6) was followed (Conn *et al.*, 1990) as indicated below.

Standard meteorological parameters like maximum and minimum temperature (°C), morning and afternoon RH (%), rain fall (mm) and wind velocity (km/hr) were obtained from the meteorological observatory, Department of Agronomy, OUAT, Bhubaneswar. Simple correlation, regression and per cent contribution of weekly average meteorological parameters with disease incidence was studied for perpetuation of the disease under natural condition.

## Results and Discussion

The data on meteorological parameters and disease intensity are presented in table 2. It may be seen from the table 2 that, the disease appeared more or less throughout the season on onion leaves. There was least infection during Nov to Dec when the temperature and RH were in the range of 16.7°C to 33.1°C and 46-96% respectively. Disease incidence progresses towards the end of the season (Tables 1-3). The prediction equation obtained by regression analysis was

$$Y = -113.265 + 8.589X_1 - 5.964 X_2 + 0.396X_3 - 0.489X_4 - 0.395X_5 + 2.562X_6 + 5.702X_7$$

Coefficient of Determination  $R^2 = 0.832$ , Adjusted  $R^2 = 0.702$ , Multiple Regressions: 0.912

Where,

$X_1$  : Maximum temperature,  $X_2$  : Minimum

temperature,  $X_3$  : Morning RH,  $X_4$  : of Rainy days,  $X_7$  : Wind velocity,  
 Afternoon RH,  $X_5$  : Rainfall,  $X_6$  : Numbers Y: Percent Disease Incidence

**Table.1** Scale showing disease severity and disease incidence of *Alternaria porri*

Sl. No.	Scale(0-6)	Disease severity	Disease incidence
1	0	Immune	No incidence
2	1	Highly resistant	1-5% incidence
3	2	Resistant	6-10% incidence
4	3	Moderately resistant	11-25% incidence
5	4	Moderately susceptible	26-50% incidence
6	5	Susceptible	51-75% incidence
7	6	Highly susceptible	>75% incidence

**Table.2** Weather parameters on incidence of purple blotch of onion

Meteorological Week	Max. Temp. (°C)	Min. temp. (°C)	Max. RH (%)	Min. RH (%)	Rainfall (mm)	No. of rainy days	Wind velocity (km/hr)	PDI
21.11.2012-27.11.2012	33.1	20.9	59	92	110.5	3.0	2.5	1.5(7.03)
28.11.2012-04.12.2012	30.7	20.5	72	90	45.4	2.0	3.5	2.8(9.63)
05.12.2012-11.12.2012	29.6	21.0	72	96	0.0	0.0	2.5	4.7(12.52)
12.12.2012-18.12.2012	28.9	16.7	46	96	0.0	0.0	3.8	10.8(19.19)
19.12.2012-25.12.2012	30.4	20.4	62	91	0.0	0.0	4.0	18.6(25.56)
26.12.2012-01.01.2013	29.8	15.4	45	94	0.0	0.0	2.0	21.4(27.56)
02.01.2013-08.01.2013	30.9	15.1	41	95	0.0	0.0	1.8	30.3(33.4)
09.01.2013-15.01.2013	32.1	20.2	54	96	0.0	0.0	2.4	38.6(38.41)
16.01.2013-23.01.2013	29.7	14.7	38	90	0.0	0.0	2.5	46.5(42.99)
23.01.2013-29.01.2013	27.4	12.0	44	92	0.0	0.0	2.8	48.3(44.03)
30.01.2013-05.02.2013	29.6	18.2	63	96	0.0	0.0	3.8	48.6(44.2)
06.02.2013-12.02.2013	28.2	12.6	34	86	0.0	0.0	3.7	52.0(46.15)
13.02.2013-19.02.2013	31.9	16.5	43	95	0.0	0.0	3.6	56.3(48.62)
20.02.2013-26.02.2013	29.3	13.9	36	88	0.0	0.0	3.6	58.6(49.95)
27.02.2013-05.03.2013	29.9	14.4	41	94	0.0	0.0	3.5	58.6(49.95)
06.03.2013-12.03.2013	32.5	16.8	36	88	0.0	0.0	2.5	60.0(50.77)
13.03.2013-19.03.2013	31.6	17.4	40	90	2.8	2.0	2.9	60.0(50.77)

Figure in paranthesis indicates the transform value

**Table.3** Co-relation Matrix of climatic parameters on disease incidence (Rabi, 2012-2013)

	X1	X2	X3	X4	X5	X6	X7	Y
X1	1.000							
X2	0.596	1.000						
X3	0.136	0.826	1.000					
X4	0.076	0.329	0.408	1.000				
X5	0.467	0.459	0.385	-0.097	1.000			
X6	0.499	0.461	0.323	-0.206	0.853	1.000		
X7	-0.312	-0.012	0.111	-0.173	-0.116	-0.082	1.000	
Y	-0.125	-0.657	-0.743	-0.286	-0.608	-0.454	0.128	1.000

**Table.4** Per cent contribution of individual parameters to disease incidence

	Parameters	per cent contribution to disease incidence
X <sub>1</sub>	Maximum temperature	49.52
X <sub>2</sub>	Minimum temperature	23.88
X <sub>3</sub>	Morning RH	0.11
X <sub>4</sub>	Afternoon RH	0.16
X <sub>5</sub>	Rainfall	0.11
X <sub>6</sub>	Numbers of Rainy days	4.41
X <sub>7</sub>	Wind velocity	21.82

The weather parameters like maximum and minimum temperature, maximum and minimum RH, rainfall, number of rainy days and wind velocity in total contributed about 70.2% towards the disease development. However, maximum temperature, maximum RH, number of rainy days and wind velocity were found to be statistically significant with respect to disease development which supports the findings of Cova and Rodriguez (2001), Delahaut and Walt (2004) and Shrestha *et al.*, (2005) (Table 4). The maximum temperature alone contributed 49.28% towards the disease development followed by minimum temperature (23.88%) and then wind velocity (21.82%). Razdan *et al.*, (2012) found maximum temperature, maximum RH and rainfall influence the disease incidence which is corroboration with present findings. Weather parameters play a vital role in causing disease incidence.

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