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Correlation studies including physico-chemical properties of ginger-soils from different locations of Cooch Behar and rhizome - rot and wilt disease severity of ginger

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Among the spice crop cultivated in India ginger is one of the important spices crop. Giger is cultivated in all the states in India. Ginger suffers from a wide variety of diseases. Rhizome rot and wilt disease complex is a serious disease of ginger, causing considerable economic loss. In India, this disease complex is prevalent in most of the ginger growing areas and may cause losses to the extent of 50% or more. In Terai region of West bengal ginger is a very important spice crop and Rhizome rot and wilt disease complex is the prime yield limiting biotic stress, often causes total loss of the production. Rhizome rot and wilt disease complex is found highly co related with different of physico-chemical properties of soil like pH electrical conductivity, organic carbon content, available nitrogen, phosphorus and potassium of the soil. The disease severity may be dependent primarily on organic carbon content of the soil with negative correlation. Secondary dependence may be on pH and potassium content of the soil with negative and positive correlation respectively.

Key words: Ginger, organic carbon, pH, Rhizome rot

INTRODUCTION

India is the largest producers, consumers and exporter of spices in the world. Among the spice crop cultivated in all the states in India. Ginger is cultivated in 110.6 thousand hectares with a production of 391000 tonnes and productivity of 3537 kg/ha (2005-06) [Pandey and Kumar, 2007]. Ginger suffers from a wide variety of diseases. Rhizome rot and wilt disease complex is a serious disease of ginger, causing considerable economic loss to growers in different countries. In India, this disease complex is prevalent in most of the ginger growing areas and may cause losses to the extent of 50% or more (Joshi and Sharma, 1982). In Terai region of West Bengal ginger is a very important spice crop and Rhizome rot and wilt disease complex is the prime yield limiting biotic stress, often causes total loss of the production.

MATERIALS AND METHODS

Determination of physico-chemical properties of ginger soil

Determination of soil pH : The pH of the soil sample was determined in water using soil suspension ratio of 1:2.5 with a glass electrode pH meter (Systronics model 335).

Determination of electrical conductivity (EC) : EC of the soil sample was determined in the soil water suspension ratio of 1:2.5 at room temperature by conductivity meter (Systronics model 30 3).

Determination of organic carbon : Organic Carbon was determined by The method of Walkley and Black (1934).

Determination of available nitrogen : Available nitrogen was estimated by modified Kjeldahal method (Jackson, 1967).

Determination of available phosphorus : Available phosphorus was determined by Bray and Kutz No.1 method (Bray and Kurtz, 1945).Extraction was done by Bray and Kurtz No.1 extractant consisting of 0.03 *N* NH_4F and 0.025 *N* HCl with soil solution ratio of 1:10 and shaking time 5 minutes.

Determination of available potassium (K) : Available K was determined by flame photometer after extracting the soil with neutral normal ammonium acetate (Baruah and Barthakur, 1997)

RESULTS AND DISCUSSION

The physico-chemical parameters of ginger soil from different locations of Cooch Behar estimated in relation to the disease severity of rhizome rot and wilt disease complex in ginger were put to regression as independent variables and disease index as dependent variable Table 1 and the results of the stepwise regression are presented in Table 2.

Table 1 : Physico-chemical properties (independent variables; X_1-X_6) of ginger soils put to step wise regression with PDI (dependent variable)

Locations	PD1	pH (X_1)	EC (X_2)	O.C.% (X_3)	N content (kg/ha) (X_4)	P content (ppm/2.5g) (X_5)	K content (g/Kg soil) (X_6)
Pundibari	47	4.50	0.36	1.26	115.4	96.45	0.87
Picherdanga	58	5.01	0.44	1.06	120.3	133.91	0.93
Sakunibala	25	6.06	0.15	1.72	122.3	25.41	0.48
Khagribari	48	4.98	0.19	1.36	119.8	40.85	0.69
Madhupur	38	5.82	0.17	1.49	121.2	35.75	0.57
Dauguri	53	5.12	0.39	0.98	119.6	102.81	0.89

PDI - Percent disease Index, EC - electrical Conductivity, OC - Organic Carbon

Table 2 : Correlation matrix of the multiple regression model including all the 6 independent variables with the dependent variable (PDI)

	pH (X_1)	EC (X_2)	O.C.% (X_3)	N content (kg/ha) (X_4)	P content (ppm/2.5g) (X_5)	K content (g/Kg soil) (X_6)	PDI (Y)
X_1	1.000	-0.692	0.704	0.879	-0.722	-0.841	-0.780
X_2		1.000	-0.903	-0.514	0.998	0.961	0.823*
X_3			1.000	0.444	-0.909	-0.948	-0.943**
X_4				1.000	-0.562	-0.633	-0.464
X_5					1.000	0.970	0.829*
X_6						1.000	0.921**
Y							1.000

At 5% level of significance r = 0.811, at 1% level of significance r = 0.917

Table 3 : Coefficients of the regression models to estimate the PDI based on different ginger soils physico-chemical properties as independent variables at different steps

Steps	pH (X_1)	EC (X_2)	O.C.% (X_3)	N content (kg/ha) (X_4)	P content (ppm/ 2.5g) (X_5)	K content (gm/Kg soil) (X_6)	Inter-cept	R^2
I	-9.59	-	-15.46	-	-	1.49		0.960
II	-2.77	-	-19.90	-	-	-	82.56	0.917
III	-	-	-24.03	-	-	-	73.44	0.89

Correlation coefficients between all the physico-chemical parameters of ginger soils of Cooch Behar with disease index and within themselves presented in Table 3 indicated that pH and organic carbon content of ginger soils from different locations of Cooch Behar showed negative correlation with PDI. Even some of the parameters showed high correlations within themselves, i.e., the independent variables considered here to have certain amount of interdependence. So stepwise regression was performed to eliminate the parameters having interdependence to find the most important determinant contributing to the disease. Regression models with biochemical parameters which contribute to disease severity, are presented in Table 3. Initially 3 parameters were dropped and then by step wise regression with backward elimination, X_1 and X_6 were removed from predictors. Even on removal of two of the parameters from the equation, it shows very high correlation coefficient (R^2 = 0.89). so, the disease severity may be dependent primarily on organic carbon content of the soils with negative correlation. This may be due to low activity and low population of beneficial microorganism in low organic carbon soil. This finding is found to be similar with the findings of AICRP on spices, Pundibari centre (2002-2003) where it was found that rhizome rot disease is more severe in soils with low pH and low organic carbon content in some places of Kalimpong. Secondary dependence may be on pH and potassium content of the soil with negative and positive correlation respectively.

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