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Reaction of potassium doses on severity of Tursicum leaf blight on maize hybrids (*Zea mays* L.)

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Abstract
Maize, third leading cereal crop, is one of the important foods, green forage and industrial crops of the world. Maize occupies a prominent position and each part of the maize plant is put to one or the other use and nothing goes as waste. Tursicum or northern corn leaf blight (TLB) caused by *Exserohilum tursicum*, is a serious foliar disease of maize, distributed widely throughout the world, causing significant yield losses. Yield loss is caused predominantly through loss of photosynthetic leaf area due to blighting. Disease symptoms first appear on the leaves at any stage of plant growth, but usually at or after anthesis. Potassium (K), a major soil nutrient, affects the reaction of a plant to pest or disease. It affects the plant's ability to recover from pest or disease attack through the repair of damage or, more simply and most frequently, by a general improvement of growth. Considering the role of K in disease management, an experiment was conducted to study the disease reaction of TLB in twelve maize hybrids, developed by crossing four high productive female with three drought tolerant tester. Potassium was applied as basal dose of two different concentration of 60kg/ha and 100kg/ha along with same dose of Nitrogen & Phosphorus @ 150:60kg/ha. Analysis of variance of arc sin transformed data for *tursicum* leaf blight revealed significant variability among the hybrids at both K levels. At high dose of potassium, hybrids was observed with less severity of disease. The hybrids was observed with a disease reaction of Moderately resistant but for three hybrids, at high dose of potassium less severity was observed and the disease reaction changes to resistant thus signifying that high dose of K enhances the plants ability to resist against disease incidence.

Keywords: Maize, *tursicum* leaf Blight, Severity, Yield loss, Potassium

Introduction
Maize (*Zea mays* L.) is one of the most robust plants of the *Gramineae* genus. It is 3rd important cereal crops in India after rice and wheat. Productivity of maize in India remains low due to number of biotic and abiotic constraints. Among the biotic stresses, *turcicum* leaf blight disease caused by *Exserohilum turcicum* (Pass.) Leonard and Suggsis the most important and destructive foliar disease (Gupta *et al*., 2015). The diseases affects photosynthesis causing severe reduction in grain yield to an extent of 28 to 91% (Reddy *et al*. 2013). Disease symptoms first appears on the leaves at any stage of plant growth, but usually at or after anthesis. *Turcicum* leaf blight is characterized by long, elliptical, greyish green or tan leaf lesions that first appear on the lower leaves and increase in size and number until very little living tissue is left. Potassium (K), a major soil nutrient, affects the reaction of a plant to pest or disease. It affects the plant's ability to recover from pest or disease attack through the repair of damage or, more simply and most frequently, by a general improvement of growth. Keeping in view the importance of disease and the response of K towards disease incidence present study was done with an objective to find the response of maize hybrids towards TLB infestation under two doses of potassium under natural field condition.

Materials & Methods
A field study was done using twelve hybrids developed by crossing four high productive lines with three drought tolerant tester at the experimental farm of Birsa Agricultural University, Ranchi during kharif 2016. The hybrids were evaluated at two different concentration of K, 60kg/ha K_2O and 100kg/ha K_2O along with same dose of Nitrogen & Phosphorus @ 150:60kg/ha. The experiment was laid out in randomized block design with three replications. All the leaves on infected plants were scored following the 1 - 9 rating scale of Balint-Kurti *et al.* (2006), Chung *et al.* (2010) and Mitiku *et al.* (2014) as 1= nil to very slight infection (≤ 10%); 2= slight infection, a few lesions scattered on two lower leaves

(10.1- 20%); 3 = Light infection, moderate number of lesions scattered on four lower leaves (20.1-30%); 4 = light infection, moderate number of lesions scattered on lower leaves, few lesions scattered on middle leaves below the cob (30.1 – 40%); 5 = Moderate infection, abundant number of lesions scattered on lower leaves, moderate number of lesions scattered on middle leaves below the cob (40.1 – 50%); 6 = Heavy infection, abundant number of lesions scattered on lower leaves, moderate infection on middle leaves and a few lesions on two leaves above the cob (50.1 – 60%); 7 = Heavy infection, abundant number of lesions scattered on lower and middle leaves and moderate number of lesions on two to four leaves above the cob (60.1 – 70%); 8 = Very heavy infection, lesions abundant scattered on lower and middle leaves and spreading up to flag leaf (70.1 – 80%); 9 = Very heavy infection, lesions abundant scattered on almost all the leaves, plant prematurely dried and killed (> 80%).

Severity scores were converted to percent disease index (PDI) as described by Wheeler (1969) using the formula below;

$$PDI = \frac{\text{Sum of all numerical grading} \times 100}{\text{No. of Leaves examined}}$$

The PDI values was then arc sine transformed and subjected for Analysis of Variance.

Results

Disease incidence was assessed as the proportion of plants showing symptoms in the field. PDI of hybrids are presented in table 1.

Table 1: Percent Disease Index of hybrids at different Concentration of K

Hybrids	K_2 O @60 kg/ha	K_2O @100 kg/ha
BAUIM-2 x HKI 1532	36.8	30.5
BAUIM-2 x HKI 577	39.375	38.15
BAUIM-2 x HKI 335	42.1	39.8
BAUIM-3x HKI 1532	41.655	34
BAUIM-3x HKI 577	40.65	34.7
BAUIM-3x HKI 335	37.985	35.8
BAUIM -4 x HKI 1532	43.35	32.95
BAUIM-4 x HKI 577	46.85	31.9
BAUIM-4 x HKI 335	54.5	50.65
BAUIM -5 x HKI 1532	47.7	43.45
BAUIM-5 x HKI 577	55.35	41.65
BAUIM-5 x HKI 335	53.25	44.8

Transformation of data by arc sine method (Steel and Torrie, 1980) was done and analysis of variance in transformed data of both K doses are presented in table 2 & table 3, respectively. Significant differences of hybrids was observed suggesting variable performance of hybrids under the different doses of K.

Table 2: ANOVA for arc-sine transformed generation means for reaction to *tursicum* leaf blight @ 60kg/ha K_2O

Sources	DF	SS	MSS	F cal.
Repli	2	3.06	1.53	1.09
Treatm	11	447.75	40.70**	29.12
Error	22	30.75	1.40	
Total	35	481.56		
CD @5% = 2				
SE(mean) = 0.68				

Table 3: ANOVA for arc-sine transformed generation means for reaction to *tursicum* leaf blight @ 100kg/ha K_2O

Sources	DF	SS	MSS	F cal.
Repli	2	3.58	1.79	0.79
Treatm	11	387.26	35.21**	15.48
Error	22	50.02	2.27	
Total	35	440.87		
CD @5% = 2.55				
SE(mean) = 0.87				

Table 4: Disease Reaction of Hybrids for *tursicum* leaf Blight

Hybrids	K_2 O @60 kg/ha	K_2O @100 kg/ha
BAUIM-2 x HKI 1532	MR	R
BAUIM-2 x HKI 577	MR	MR
BAUIM-2 x HKI 335	MR	MR
BAUIM-3x HKI 1532	MR	MR
BAUIM-3x HKI 577	MR	MR
BAUIM-3x HKI 335	MR	MR
BAUIM -4 x HKI 1532	MR	R
BAUIM-4 x HKI 577	MR	R
BAUIM-4 x HKI 335	MR	MR
BAUIM -5 x HKI 1532	MR	MR
BAUIM-5 x HKI 577	MR	MR
BAUIM-5 x HKI 335	MS	MR

The hybrids were grouped into categories of resistant, moderately resistant and moderately susceptible (table 4) based on percent disease index value. Most of the hybrids lies under the categories of moderately resistant at low dose of K and only one hybrids shows moderately susceptible but at higher K dose disease reaction gets improved for four hybrids *viz.,* BAUIM-2 x HKI 1532, BAUIM-4 x HKI 1532, BAUIM-4 x HKI 577 from moderately resistant to resistant and for BAUIM-5 x HKI 335 the reaction changes from moderately susceptible to moderately resistant. These hybrids was identified as most responsive one at high dose of K signifying that high dose of K enhances the plants ability to resist against disease incidence.

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