

POSTER SUMMARY

EVALUATION OF SMUT INOCULATION TECHNIQUES IN SUGARCANE SEEDLINGS

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Abstract

Smut disease of sugarcane, caused by the fungus *Ustilago scitaminea* Sydow, can cause considerable yield losses and reductions in cane quality. To investigate the reactions of the seedlings to smut, three different inoculation methods were employed. Data on number of smut whips per stool, disease incidents per population and number of tillers per plot were recorded and analysed. Results showed that screening for smut resistance at the first stage of selection to assess seedling reaction to smut is possible. The paste method of inoculation gave better results than the other techniques evaluated.

Keywords: *Ustilago scitaminea*, sugarcane, smut, screening, Mtwapa, Kenya, inoculation methods

Introduction

Owing to its vegetative mode of propagation, sugarcane (*Saccharum spp.*) is prone to infection by systemic pathogens. The most effective method of controlling sugarcane diseases is the use of resistant cultivars (Schenck, 1998). The most widely used technique to evaluate for resistance to smut involves immersing sugarcane setts (seed pieces with 1-3 nodal buds) in a teliospore suspension before planting, and counting the number of sori (whips) that develop (Ferreria *et al.*, 1989). Resistance is rated on a scale of 1 (highly resistant) to 9 (highly susceptible) (Hutchinson, 1969) based on the percentage sori produced. If sori are not produced in the first growing season, the plants are grown for a second season and scored again (Lloyd and Pillay, 1980).

To assess smut reaction, researchers typically use a dip inoculation assay in which nodal buds are immersed briefly in a suspension of teliospores, and then planted in a greenhouse. Evaluation can take place in a greenhouse or in the field (Alexander *et al.*, 1991). Injection inoculation may induce greater smut infection than dip inoculation, and cultivars can respond differently to the two methods of inoculation (Waller, 1970). The protocol presently used to screen for resistance to covered kernel smut in sorghum is inconsistent and escapes are common (Claflin and Ramundo, 1996). In sugarcane, little work has been done on screening seedlings with smut and evaluating the inoculation methods.

Objective

To assess the feasibility of inoculating sugarcane seedlings with smut, and to evaluate the effectiveness of different inoculation techniques.

Materials and Methods

Seedlings arising from two families, Co 421 X Co 945 and Co 331 X Co 945, were used. To investigate the reaction of the seedlings to smut, three different inoculation methods were employed. The first method involved soaking the seedlings in a smut spore suspension (4 g spores/litre sterile water at 4×10^6 spores/ml) for 30 minutes. The second method involved wounding the seedlings at the bud with a scalpel, then applying a paste of smut made at a concentration of 2 g spores/2 ml sterile water. The third method involved applying a paste of smut to the seedling buds without wounding.

Each treatment had 30 entries (seedlings) planted in plastic bags in the glasshouse. Two controls of un-inoculated progenies were included. The experiment was replicated three times. Data collection on seedling reaction to infection took place at two, four and six months after inoculation. Data on number of smut whips per stool, seedling survival and mortality, disease incidents per population and number of tillers per plot were recorded. Individual analyses of variance were performed using the procedure general linear model (GLM) (SAS/STAT, 1994).

Results and Discussion

The tillering rate (the rate at which young shoots appear) has been reported to progressively decrease in the field infected sugarcane cultivars (Waller, 1969). In this study there was no significant difference in whip production between the two families.

Based on the scores, family Co 421 X Co 945 registered poor results in terms of whips counted and soral production per inoculation method. Population Co 331 X Co 945 had good results, with the wound + paste method leading on whip production, followed closely by the paste method. Inoculation had a significant effect on seedling survival across four months under observation.

There was a difference in whip production between the two families at five months (Table 1).

Recommendations

Screen for smut resistance at the first stage of selection, to assess seedling reaction to smut and to avoid carrying large numbers of clones that will eventually be discarded at the advanced stage of selection.

More families should be included in the evaluation process to measure the family effect on smut disease expression in sugarcane seedlings.

The paste method led to significantly higher disease levels than the other two treatments. It should be adopted as the inoculation method due to its ease of application and non-injury to sugarcane seedlings.

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Table 1. Analysis of variance on tillers, survival and smut incidence.

Dependent variables	Independent variables and model	D.F	F-value	P-Value	R-Sq	Mean
Tiller count at 2 months	Model	9	3.69	0.0140	0.70	28.42
	Family	1	0.16	0.6987		
	Inoculation method	3	7.58	<0.0001		
	Interaction	3	2.22	0.1306		
Tiller count at 3 months	Model	9	4.06	0.0097	0.72	28.62
	Family	1	3.40	0.0865		
	Inoculation method	3	7.10	0.0039		
	Interaction	3	2.50	0.1042		
Tiller count at 4 months	Model	9	2.15	0.0960	0.58	19.41
	Family	1	2.36	0.1468		
	Inoculation method	3	3.08	0.0618		
	Interaction	3	0.73	0.5500		
Survival at 1 month	Model	9	9.79	0.0001	0.86	20.17
	Family	1	4.96	0.0428		
	Inoculation method	3	23.70	<0.0001		
	Interaction	3	3.92	0.0467		
Survival at 2 months	Model	9	6.09	0.0015	0.80	19.20
	Family	1	0.72	0.4100		
	Inoculation method	3	14.55	0.0001		
	Interaction	3	3.43	0.0467		
Survival at 3 months	Model	9	6.09	0.0015	0.80	19.20
	Family	1	0.72	0.4100		
	Inoculation method	3	14.55	0.0001		
	Interaction	3	3.43	0.0467		
Survival at 4 months	Model	9	2.44	0.0654	0.61	15.88
	Family	1	0.67	0.4270		
	Inoculation method	3	4.94	0.0152		
	Interaction	3	0.98	0.4305		
Smut whip count at 3 months	Model	9	7.78	0.0014	0.83	0.25
	Family	1	19.38	0.0060		
	Inoculation method	3	7.90	0.0025		
	Interaction	3	7.90	0.0020		
Smut whip count at 5 months	Model	9	1.78	0.0620	0.74	1.92
	Family	1	2.82	0.1151		
	Inoculation method	3	1.59	0.2352		
	Interaction	3	7.78	0.0010		

D.F –Degree of freedom

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