SHORT COMMUNICATION

FUNGICIDE TRIALS TO DETERMINE THE EFFECT OF BROWN RUST ON THE YIELD OF SUGARCANE VARIETY N29

MCFARLANE K, MCFARLANE S A, MOODLEY D and RUTHERFORD R S

South African Sugarcane Research Institute, Private Bag X02,
Mount Edgecombe, 4300, South Africa
Keith.mcfarlane@sugar.org.za

Abstract

Since the release of sugarcane variety N29 (genotype 84E1334) for commercial planting in the spring of 1997, severe infections of brown rust (*Puccinia melanocephala*) have been reported in this cultivar. Many growers have persevered with N29, risking substantial yield losses should the crop become infected. Two fungicide trials were established to assess the effect of brown rust on the yield of N29 in the KwaZulu-Natal Midlands where the disease is prevalent. The results of these trials are discussed.

Keywords: Puccinia melanocephala, yield, brown rust, sugarcane diseases, fungicides

Introduction

Brown rust, caused by *Puccinia melanocephala*, was first recorded in the South African sugar industry in the 1940s on variety Co301, after which it re-appeared in the mid-1970s, with variety N55/805 exhibiting severe symptoms (Bailey, 1995). Since then, varietal resistance has been used effectively to control the disease.

Although variety N29 was released with an intermediate rating for brown rust, five years after its commercial release it became evident that N29 was more susceptible to rust than was originally thought. This may have been due in part to an increase in the area planted to the variety resulting in a build-up of inoculum levels. In addition, the variety's susceptibility to rust may not have been fully expressed prior to its release if climatic conditions were not favourable for rust development. However, the variety was exposed to a range of climatic conditions in the Plant Breeding and Pathology trials and during the bulking process, so this would seem unlikely. It is also possible that *P. melanocephala* has changed genetically. In a recent study, different populations of brown rust were identified in samples collected from a number of locations in KwaZulu-Natal (Pillay *et al*, 2005). Whether these differences affect the pathogenicity of the fungus is unknown.

Severe brown rust infections can cause significant yield loss; up to 23% has been recorded in N55/805 (Anon, 1980). Yield losses of between 10 and 40% have been recorded in susceptible varieties internationally (Comstock *et al*, 1992). This is reportedly due to a combination of a reduction in the number of millable stalks and stalk biomass. The optimal plant age for rust development is between four to six months as the leaf area increases (Comstock and Ferreira, 1986). Severe infections at this early stage are likely to cause significant yield losses and may result in tiller death. This paper describes two trials aimed at assessing yield loss in N29 due to brown rust.

Materials and Methods

Two trial sites were selected at Eston in the KwaZulu-Natal Midlands. The first was a plant field of N29 on virgin soil (ex-pasture) and the second site was a ratoon field.

The trial at each site was prepared and treated in the same way. Plots consisted of five 10 m rows, replicated four times. Each trial had five treatments. The two fungicides used in the trials were Dithane WP (ai mancozeb, 2.25 kg per ha) and Tilt EC (ai propiconazole [triazole], 300 ml per ha). The treatments are outlined below:

Treatment 1	Spray weekly with propiconazole/mancozeb.
Treatment 2	Spray weekly with Tilt until after untreated control becomes infected with rust and/or the canopy closes.
Treatment 3	Spray every two weeks with propiconazole/mancozeb.
Treatment 4	Spray every four weeks with propiconazole/mancozeb.
Treatment 5	No fungicide (untreated control).

The field at site 1 was planted during the last week of September 2002. Fungicide treatments (applied with a knapsack sprayer) commenced on 9 December 2002 and continued for 12 weeks. The final treatments were applied on 25 February 2003, when the cane was shoulder height. The trial was due for harvest at 18 months of age in March 2004. However, a widespread frost in August 2003 caused severe damage to the trial. Stalk counts, heights and diameters in the three net rows of each plot were recorded so that the yields of the plots could be estimated and the trial was abandoned. Data were analysed using ANOVA. Fungicide treatments at site 2 began on 4 August 2003 and were completed on 15 December 2003. The trial was harvested in May 2005 and cane and sucrose yields were recorded.

Results and Discussion

Trial site 1

Severe rust was first observed in the trial at site 1 during the week of 27 January 2003, eight weeks after the commencement of spraying. Propiconazole/mancozeb sprayed at two weekly intervals (T3) offered some protection against rust. When sprayed every four weeks (T4), the level of rust appeared to be similar to that in the untreated control plots, but the yield in T4 was higher. Propiconazole sprayed weekly on its own (T2) was not effective in controlling rust and appeared to have a slight phytotoxic effect on the sugarcane. Yield estimates indicated a 26% reduction in yield in the untreated control plots (T5) compared with plots sprayed weekly with a combination of propiconazole and mancozeb (T1) (Figure 1). This reduction was not statistically significant due to the high degree of variability in T1.

Trial site 2

Moderate levels of rust developed in the untreated control plots. A 12% reduction in yield was recorded between the untreated control plots (T5) and those sprayed weekly with a combination of propiconazole and mancozeb (T1). Propiconazole/mancozeb sprayed at two weekly intervals (T3) again offered some protection against rust and, when sprayed every four weeks (T4), yields were improved slightly, although there was little difference in rust levels between this treatment and the untreated control plots. Again propiconazole sprayed weekly on its own (T2) was ineffective in controlling rust and appeared to reduce cane yield.

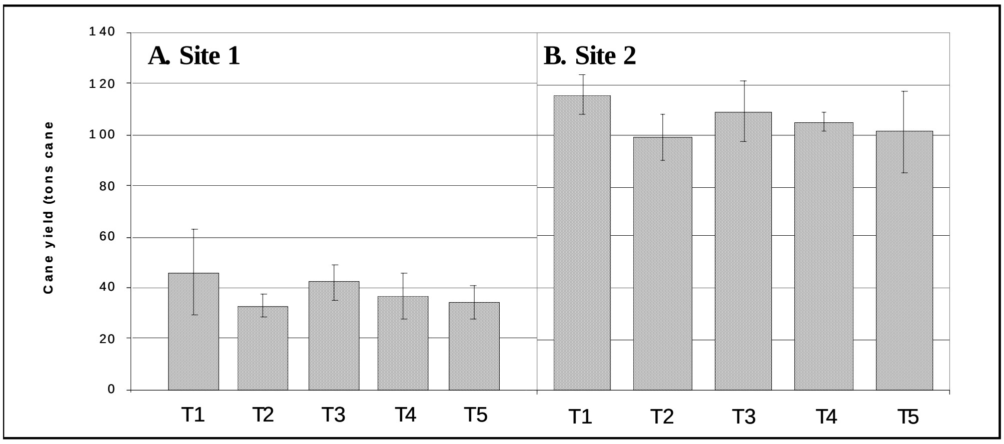

Figure 1. The effect of brown rust on the yield of N29 at (A) trial site 1 (estimated yield) and (B) trial site 2.

The economics of spraying the selected fungicides at trial site 2, where moderate levels of rust were observed in autumn, are shown in Table 1.

Table 1. Cost:benefits of spraying fungicides at trial site 2 in Eston.

Treatment	Period between applications (weeks)	No. of applications	Chemical cost (R/ha)	Average yield (tc/ha)	Income (excluding chemical) (R/ha)	Income (R/ha)
1	1	18	3924	115	16 891	-1390
2	1	18	2106	99	15 813	-2468
3	2	9	1962	109	17 767	-514
4	4	4	872	105	18 133	-148
5				101	18 281	
Commercial				97	17 557	

Assumptions:

Labour/ha/day	R40
Cost/ha Tilt R1282/5 L at 300 ml/ha	R77
Cost/ha Mancozeb at 2,25 kgs/ha	R101
Cost/ha Tilt + Mancozeb	R178
Price/ton cane	R181

The costs show that, with the moderate levels of rust infection and the yields obtained at trial site 2, it was uneconomical to apply fungicides. Growers should thus be cautious when deciding on whether or not to apply fungicides. Because the occurrence and severity of a rust outbreak is difficult to predict, fields of susceptible varieties must be inspected on a regular basis. This is particularly important during the two to six month period after harvesting or planting, when the young cane is prone to infection. For the spray regime to be successful, it is crucial to recognise the elongated yellow fleck symptoms early, and apply the fungicides timeously.

Acknowledgements

The authors thank Shaun Chubb of Thurlow Farm, Eston and Alan Stiebel of Broadacres Farm, Eston, for providing the trial sites.

REFERENCES

Anon (1980). Rust and yield of N55/805. Pathology Report, Nov 1979 to Oct 1980, South African Sugar Association Experiment Station, Mount Edgecombe, South Africa. pp 151-152.

Bailey RA (1995). Coping with disease problems: Changing approaches to the challenges presented to the South African sugarcane crop by diseases. *Proc S Afr Sug Technol Ass* 69: 215-216.

Comstock JC and Ferreira SA (1986). Sugarcane rust: Factors affecting infection and symptom development. *Proc Int Soc Sug Cane Technol* 19: 402-410.

Comstock JC, Shine JM Jr and Raid RN (1992). Effect of rust on sugarcane growth and biomass. *Plant Diseases* 76: 175-177.

Pillay L, McFarlane SA and Rutherford RS (2005). A preliminary report on genetic diversity in populations of sugarcane rust in Kwazulu-Natal. *Proc S Afr Sug Technol Ass* 79: 132-136.