PRELIMINARY OBSERVATIONS ON THE IMPACT OF WHITEGRUB ON SUGARCANE YIELDS IN THE MIDLANDS NORTH REGION OF THE SOUTH AFRICAN SUGAR INDUSTRY

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Abstract

During 1995 to 2001, two research trials and two farms in the Midlands region of the industry were monitored for yield effects attributable to whitegrub (various species of Scarabaeoidea). Although the trials were designed for other purposes, severe whitegrub infestations were observed in the soils on which the trials were situated, and the opportunity was taken to assess the impact of this soil pest on crop yield.

Results showed that there was an average reduction in yield (tons cane/ha) of between 55 and 23%, depending on variety and season. Such losses cannot be entirely explained by factors such as normal yield decline, and it is concluded that these losses may be ascribed to the activity of whitegrub.

Keywords: sugarcane, whitegrub, crop loss

Introduction

The whitegrub species *Hypopholis sommeri* Burm and *Schizonycha affinis* Boh have long been associated with sugarcane and wattle damage in the Midlands, and investigations into their control were carried out as early as the 1970s (Carnegie, 1988). Recent surveys (Anon, 2003) in the Midlands North Local Pest, Disease and Variety Control region, have shown that these pests continue to be widely distributed.

There are no published records in South Africa of the extent of damage caused to sugarcane yield by infestations of whitegrub. This paper is an attempt to estimate yield losses attributable to whitegrub, by comparing reliable yield data over time in crops where outbreaks have occurred and using predicted yields from the Canesim crop model for comparisons.

Methods

Estimates of yield loss (tons cane/ha) over the period 1995 to 2001were obtained from two research trials, as well as farm-scale field records from two farms. Yields so obtained were compared with predicted yields obtained from the Canesim crop model. This allowed yield estimates to be compared with theoretical crop yields attributable to climatic conditions. Any differences were considered to be as a result of whitegrub activity.

All sites from which data were collected were within 15 km of a weather station, data from which was used in the Canesim yield estimates.

Yield data were screened to ensure that the same fields and hence the same two-year crop cycles were used for comparisons. It is also important, when considering yield losses over time, to take into account the normal yield decline that occurs with increasing ratoon age. This was measured from Union Co-operative Limited (UCL) grower records. Only data from members with reliable records (Canepro and Experiment Station field records) were used in this exercise.

Results

Normal yield decline

The normal yield decline was estimated from the UCL database. This ranged from 94 tons cane/ha in the plant crop, to 87 tons cane/ha in the fifth ratoon crop, averaging 1.4% per ratoon over five ratoons. This is an observed characteristic of the two main varieties (N12 – 60% of area and N16 – 30% of area) (Govindsamy, 2003). The analysis took into account factors such as ratoon age of the varieties, crop cycles, soils, aspects, slopes and age at harvest. While this source of yield loss cannot be ignored, it is small enough to be excluded from the calculations for the purposes of this study.

Research trial results

The results shown in Figure 1 were obtained from two research trials, a lime calibration trial (Trial 1) and an estate variety trial (Trial 2).

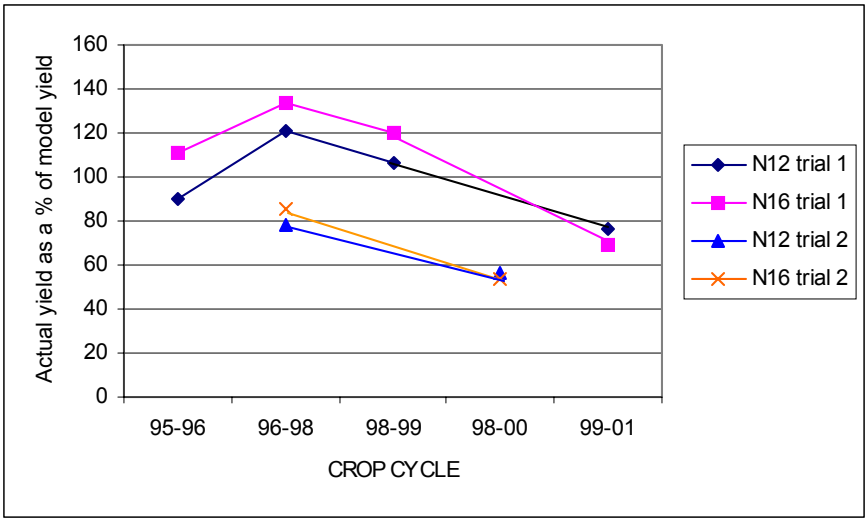

Figure 1. Trends in crop yield estimates expressed as a percentage of Canesim yield estimates for the varieties N12 and N16 in two research trials.

Shown in Figure 1 are the trends of actual yields expressed as a percentage of Canesim estimated yields over progressive crops. Data are presented for the varieties N12 and N16 from both trials. In both trials there is a trend of declining yield from the 1996-1999 crop onwards. In Trial 1, yields dropped from more than 120 to 80% of the crop model, and in Trial 2 from 80% to less than 60% of the model.

The decline in yield was investigated in Trial 1, and sampling showed whitegrub infestations of more than 10 grubs/pit (pit dimensions 30 x 30 x 30 cm) as well as excessive root damage in the crop.

Whole farm results

The results shown in Figure 2 were obtained from the analysis of crop yields from two farms where the whitegrub infestation was initially low, but developed in later seasons.

On farm 1, yields in 1997 were only 80% of the Canesim yield estimates. These declined to between 40 and 50% of the Canesim estimates in 2001. On farm 2, yields were initially 100% or more than those predicted by Canesim. These declined to only 54% in the case of N12, and 75% in the case of N16. On farm 1, records were obtained from between seven and 18 fields. On farm 2, records were obtained from between five and eight fields for N12, but for only one or two fields in the case of N16 and, as a result, the data for N16 must be treated with caution.

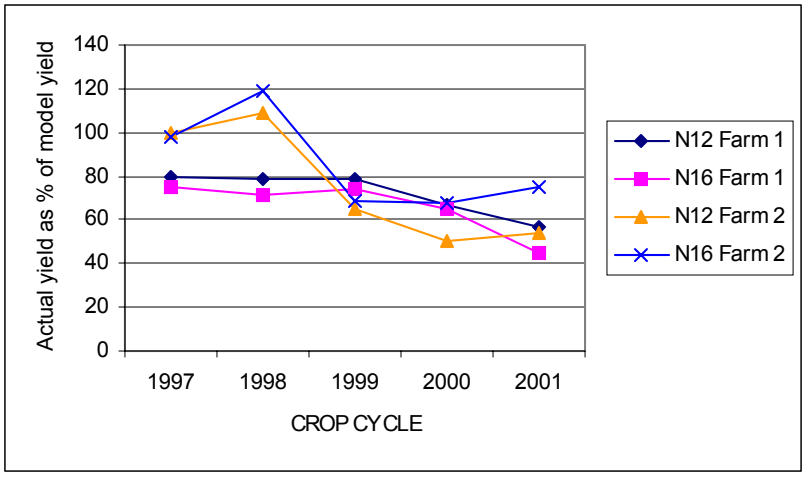

Figure 2. Trends in crop yield estimates expressed as a percentage of Canesim yield estimates for the varieties N12 and N16 from two Midlands farms.

Discussion and conclusions

From these results it is clear that the potential yields, as determined by the crop model, were not realised in most seasons of all trials. Some assessments were made of the incidence of whitegrub, and based on this and the known damage these pests can cause to sugarcane, it is concluded that much of the losses shown can be attributed to the actions of whitegrub, particularly in the later seasons when the incidence of this pest was observed to have increased. Based on the LPD&VCC survey results (data not shown), the average grub infestation in the region where these trials were conducted rose from an average of 2.4 grubs per pit in 1997, to 3.3 and 3.1 grubs per pit in 2002 and 2003 respectively, indicating a trend of increasing numbers of grubs.

While actual values varied, losses in yield ranged from 55 to 23% in the 2000 and 2001 seasons respectively, over the period when whitegrub activity was considered to be highest. Such losses are considered high, even after correction for the expected 1.4% normal yield decline per ratoon.

Such losses agree generally with those estimated in other industries. When whitegrub were a serious problem in Mauritius, losses of between 10 and 15% were recorded (Wilson, 1969). Sosa (1984) estimated a 28% yield reduction in tons cane/ha attributable to *Ligyrus subtropicus* in Florida. In Australia, where whitegrub are the major pest, Allsopp *et al.* (1991) estimated losses (tons cane/ha) attributable to *Antitrogus consanguineus* of between 50 and 90%, depending on ratoon and variety. Additionally, in a series of insecticide trials against *Lepidiota picticollis* and *Antitrogus parvulus,* Allsopp *et al.* (1995 and 1996) showed that there was an average maximum yield difference between treated and untreated plots of 61 and 38% respectively. Differences did vary depending on ratoon and treatment.

Such results indicate the extent of the losses that this group of pests can cause to sugarcane. Yield losses recorded here are substantial and are large enough to be of economic importance. This justifies the work currently being undertaken at the Experiment Station on chemical and biological control, but further work needs to be done in developing integrated control measures.

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