SHORT NON-REFEREED PAPER

ISIDULIS: POINTERS TO YIELD POTENTIAL ON SANDY SOILS?

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Abstract

The low productivity of sugarcane on sandy soils (typically <15% clay) in the coastal areas and midlands of KwaZulu-Natal has received much research attention over the years. A common and striking feature of the crop on these soils is the presence of localised patches of markedly superior growth on the remnants of termitaria. In local vernacular, these patches are termed 'isidulis'. Uncertainty exists regarding the factors responsible for the improved growth on isidulis. This paper deals with an investigation in which crop growth and soil factors relating to isidulis and their immediate surrounds were studied. The isidulis were located on the North Coast and in the Midlands South regions. Mean stalk height of the cane on the isidulis was 73% greater than that of the surrounds. *Eldana saccharina* (stalk borer) damage was low in all fields, with no consistent differences observed between the isidulis and surrounds. High populations of crop-damaging nematodes were present in most fields; however, once again consistent differences between the isidulis and their surrounds were not apparent. In terms of soil properties, samples taken incrementally to depths of 80 cm revealed that clay and carbon were generally higher under the isidulis; however, striking differences were apparent in exchangeable calcium and acid saturation values, with the isidulis having far more favourable levels of these parameters. In a secondary study in which isidulis on a localised area of high pH sands were investigated, differences in populations of harmful nematodes appeared to be the major factor involved in the variable growth. It is suggested that these findings are of value in terms of the identification of management practices for optimising yields on sandy soils.

Keywords: termitaria, isidulis, *Eldana saccharina*, nematodes, soil properties

Introduction

The poor productivity of sugarcane on the so-called 'weak sands' of the coastal areas and midlands of KwaZulu-Natal has long proved a challenge to growers and scientists. Detailed field trial investigations (Thompson, 1985) led to the conclusion that both soil chemical and biological (nematodes) limitations were responsible for poor growth on sandy soils. Common features in sugarcane growing on these soils are the circular patches of exceptionally good growth which correspond to termite mounds levelled in the tillage operations before planting. These patches are known locally as 'isidulis'. Factors responsible for the superior sugarcane growth on an isiduli were studied by Cadet *et al*. (2002). A marked build-up of clay, bases and Si was noted in the isiduli soil; however, the more favourable growth on the isiduli was attributed largely to a lower population of harmful nematodes, coupled with a higher population of beneficial plant-feeding nematodes.

Termitaria also characterise the landscape in the arid south-western areas of South Africa (Ellis, 2002; Fey, 2010). Ellis (2002) studied pedological and chemical characteristics of selected termitaria in these areas and noted marked partitioning of nutrients between the termitaria and their surrounds: bases, Si and pH were all higher in the termitaria.

This short paper reports on an investigation in which crop growth and soil factors relating to isidulis and their immediate surrounds were studied.

Materials and Methods

In the main part of this study, six isidulis were selected for investigation. Three of these were located on the North Coast, and three in the Midlands South region. Crop age at the time of sampling varied at the different sites. Samples were drawn from the central area (usually approximately 9 m^2) of the isiduli where cane growth was visibly greatest and from the immediate surrounds of the isiduli where cane was not visibly affected by the isiduli. At each site, 15 stalks were taken from the isiduli and 15 from its surrounds, with stalk heights and percentage internode damage by eldana being measured. Soil sampling involved the collection of topsoil samples for nematode assays, and samples to depth (800 mm where soil depth was not limiting) for chemical and textural analyses. In addition, simple water infiltration measurements were undertaken using a 160 mm single-ring infiltrometer.

In a secondary study, topsoils of four isidulis and their surrounds on sands in close proximity to Mount Edgecombe were taken for nematode counts and soil chemical properties. These sands, similar to the sand on which Cadet *et al*. (2002) conducted their investigation, have high pH levels as a result of treatment with limed filtercake more than 30 years ago.

Results and Discussion

A summary of mean sugarcane stalk height measurements on the various sites is shown in Figure 1. These data clearly reflect the vastly superior growth on the isidulis, relative to their surrounds. Averaged across sites, stalk height was 73% greater on the isidulis.

In terms of nematode counts, results varied widely from site to site, with no consistent differences between the isidulis and their surrounds being apparent. Water infiltration rates, too, were characterised by considerable variation, with definite trends not being apparent.

Data reflecting differences in soil properties are shown in Table 1. Clay and organic matter contents were higher under the isidulis, an observation that is consistent with the findings of Cadet *et al*. (2002) and Ellis (2002). Soil test P and K were similar on the isidulis and their surrounds. In terms of K, both top and subsoils in five of the six sites were prohibitively low in this nutrient relative to crop requirements for optimum growth, suggesting that K deficiency posed a serious growth constraint on both isidulis and their surrounds on these sites. However, particularly noteworthy in terms of the soil fertility data are the lower acid saturations, higher pH values and elevated levels of Ca, Mg, Si, Cu and Mn in the isidulis. Thus the indication is that while soil acidity posed a serious constraint in the surrounding areas, this was not the case under the isidulis where Ca and Mg levels were seven to eight times higher and acid saturations similarly lower than in surrounding areas.

In the case of the soil samplings from the high pH areas, soil properties were not markedly different in the isidulis relative to their surrounds. However, in three of the four paired sites,

populations of harmful nematodes were very much higher in the surrounding soils than in the isidulis, thus corroborating the findings of Cadet *et al*. (2002).

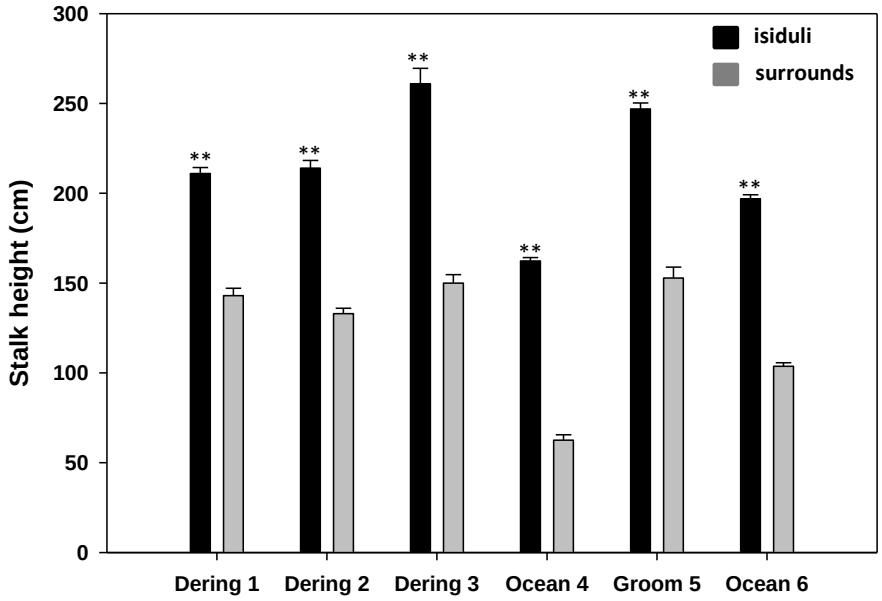

Figure 1. Sugarcane stalk heights on isidulis and their immediate surrounds. The first three sites (Dering 1, 2, 3) were in the Midlands South region, and the remainder on the North Coast (vertical bars indicate standard error of means; **significant difference between isiduli and its surrounds at P<0.01).

Table 1. Soil chemical properties and clay and organic matter contents under isidulis and their surrounds. Data are means from samples taken incrementally to depths of 80 cm.

Parameter	Isiduli	Surrounds	Significance
pH ($CaCl_2$)	4.70 ±0.22	3.99 ±0.15	**
P (mg/L)	26 ±11	31 ±11	NS
K (mg/L)	41 ±15	33 ±12	NS
Ca (mg/L)	1064 ±272	149 ±67	**
Mg (mg/L)	166 ±48	20 ±7	**
Acid Sat %	7.9 ±5.2	55.0 ±10.6	**
Zn (mg/L)	1.0 ±0.4	0.5 ±0.2	NS
Cu (mg/L)	1.7 ±0.2	0.4 ±0.1	**
Mn (mg/L)	10.6 ±2.8	4.4 ±1.5	**
Si (mg/L)	23.4 ±6.2	5.3 ±1.2	**
Clay %	19.8 ±3.7	11.1 ±2.9	**
Organic matter %	1.70 ±0.17	1.13 ±0.19	**

** significant at P<0.01; NS = not significant

Conclusions

Results presented here suggest that elevated nutrient availability and reduced acidity levels coupled with higher clay and organic matter levels are the main factors contributing to the isiduli effect on acid sandy soils. On high pH sands, on the other hand, nematodes appear to be implicated in the enhanced growth of isidulis.

The vastly superior sugarcane growth on isidulis provides an indication of yield potential on coastal and hinterland sandy soils. The findings reported in this paper offer useful pointers in terms of the crop management strategies necessary for optimising growth on these soils.

References

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