

SHORT NON-REFEREED PAPER

THE UMFOLOZI FLATS: OPPORTUNITIES AND CHALLENGES IN A NICHE SUGARCANE PRODUCTION AREA

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Abstract

Sugarcane has been grown on the Umfolozi Flats since 1911, with the current agricultural production area being approximately 10 000 ha. The Umfolozi Flats are eminently suited to sugarcane production due to the deep fertile soils, high heat units and favourable annual rainfall. The location of the sugar mill in the midst of the production area, coupled with the utilisation of a narrow gauge railway, results in a highly efficient and effective transport system. Growers own 75% of Umfolozi Sugar Mill, which puts it in an enviable position to capitalise on other revenue streams derived from sugarcane as a raw material.

Both in terms of industry organisation and natural resources, the Umfolozi Flats differ from sugarcane farming areas in the rest of the South African sugar industry. Growing sugarcane on the deep alluvial soils at a few meters above sea level has presented a number of problems and opportunities which rarely occur in other parts of the industry. By way of example, the inherent fertility of the soils is a major contributory factor in the consistently high yields attained; however, historic flooding and the ever present water table over much of the area create agronomic challenges, not least when it comes to the effective management of irrigation and crop nutrition. In this paper, these and other factors relating to sugarcane production on the Umfolozi Flats are considered. Perceived barriers to further yield improvements and research needs are discussed.

Keywords: Umfolozi, water table, tramline, dryland cane, coastal, nutrition

Introduction

In 1911, a decision was made to plant sugarcane on the Umfolozi Flats. By 1923, it had been surveyed into 80 hectare lots and these were allocated by the then Land Board to any hill farmer in the district. Land on the Flats extended for 30 kilometres from east to west, varying in width from three to 11 kilometres (UCOSP, 1973). An area, covering approximately 20 000 ha, was the natural sediment trap of the Umfolozi River, before the waters entered Lake St Lucia. The Umfolozi Cooperative Sugar Planters (UCOSP) purchased the sugar mill in 1923. Almost from its inception, a tramline system was installed to haul the harvested sugarcane from the farms to the mill. With current infrastructure, administration and management structures, Umfolozi has never been in a better position to benefit from the attentions of industry specialists. This paper aims to highlight areas where research would aid the improvement and sustainability of the 9400 hectares of sugarcane in this high potential production area.

Climate

Umfolozi lies at 28° South and 32° East on the eastern coastal belt of South Africa. The average annual rainfall for the past 15 years has been 917 mm, with a long-term average of 1071 mm (manual measurements taken since 1957). Supplementary irrigation is practised in the lower rainfall area during the high vegetative growth periods of sugarcane. Data from the local weather stations give an average maximum temperature of 27°C and average minimum of 16°C. Umfolozi, therefore, generally has actively growing sugarcane all year round. Due to frequent coastal cloud cover, sub-optimal solar radiation is common, averaging 5730 MJ/m² per annum or 15.7 MJ/m² per day (SASRI weather web) (http://portal.sasa.org.za/weatherweb/weatherweb.wv_menus.menu_frame?menuid=1), where the optimal crop requirements are 6350 MJ/m² (Searle, 2013).

Water Management

Historically, the Umfolozi River water permeated slowly through an enormous expanse of reed and papyrus beds until it gradually reached open tidal water in what is now called the St Lucia Estuary.

A tremendous amount of pioneering work was conducted on the lower flats by a cooperative of early farmers in proving what land was suitable for farming. Farming at Umfolozi requires water management, as regular flooding is a threat to farming operations. Cyclone Demoina in 1984 was the largest of many highly damaging floods to hit the Umfolozi Flats, causing widespread damage and decimating 1 800 ha of sugarcane at Umfolozi which has never been re-established. Following a study commissioned by UCOSP, a model was developed to simulate future flooding scenarios leading to an active flood defence system being implemented in 1986. The flood infrastructure is designed to manage a flood of approximately 10 000 m³/s. Of the 10 000 m³ of water, only 1200 m³/s is contained within the levees of the Umfolozi River, while spillways divert 80% of the water into a sand trap. The water re-enters the lake system via a system of canals leading to the Msunduzi River to the south. The production area and infrastructure is therefore largely protected and further sedimentation is prevented (Van Heerden and Swart, 1986).

As a result of farming at just above sea level, the water table has an influence on yield. In dry periods the water table can act in a similar way as an irrigated system, supplementing the crop. In wetter cycles the water table can have an effect on the root system, with unpredictable consequences. For this reason, crop model predictions based on climate data are unsuitable for Umfolozi (pers comm¹). There is currently no method of monitoring the water table with any accuracy, and therefore no input for the model is available.

One advantage is that many varieties released for irrigation are grown with great success in the dryland areas of the Umfolozi Flats. Variety selection has historically been made in other regions and then assessed for suitability for Umfolozi. Were a variety to be bred to better suit the growing conditions at Umfolozi, agronomic performance could be enhanced. A selection trial site has been identified and will be planted by the end of 2014.

¹ A Singels, South African Sugarcane Research Institute, Mount Edgecombe, South Africa, 2013.

Soil and Nutrient Management

The very high base status alluvial soils typical of the Umfolozi area, with very low acid saturation levels and high Si availability can be attributed to millennia of flood deposits. With typical rooting depth in excess of 1000 mm and a clay % range of 6 to >65% with a mean average of 35%, total available moisture (TAM) in most areas is above 120 mm/m. Recent trial work has indicated that the soils have high amounts of K and K-releasing characteristics (pers comm²). Recommendations arising from the Fertiliser Advisory Service (FAS) at the South African Sugarcane Research Institute are based on crop requirements and do not take into account the variable K-releasing characteristic of Umfolozi Flats soils.

With the water table a major factor on the flats, the need for split application would appear to be most advisable for efficient N use. The inherent fertility of the soils means that the management of N is the highest consideration for growers. With many options available, the variation of clay content and the role of the water table in different areas, means that making the correct decisions for N application can be very difficult.

Loading and Haulage

The original tramline system has grown and now covers over 87 km of narrow gauge railway, delivering almost 800 000 tons of sugarcane annually. Three locomotives tow 1200 x 5.5 ton trucks daily throughout the harvesting season (pers comm³). One locomotive hauls 400 tons in contrast to a road haulage system, hauling approximately 32 tons over the same lead distance. In basic terms, an equivalent road haulage operation would contribute 1555 tons of CO₂ in a given season compared to 725 tons CO₂ for the same season using the narrow gauge rail system. This represents a 53% decrease, making this a very efficient and cost effective haulage system (Searle, 2013).

During the last 100 years of operation, the system has been developed to improve infield loading efficiencies. The three-wheeled Bell loader has been used at Umfolozi with great success. Loading efficiencies, durability and purchase price have made it a popular choice of loader. The average ratoon age at Umfolozi is above 10 years, and incidence of much older ratoons is not uncommon. Infield loading and haulage systems have a 5-7 ton average axle weight and little compaction is noticed. Mobile rail track for infield access has given way to a 'piggy back trailer'. The piggy back trailer winches the empty trucks on for infield loading and then drops them back onto the line when full. Three-wheeled loaders are associated with ratoon damage leading to yield decline, and the piggy back trailer, while efficient, is primitive, with major Health and Safety concerns.

Milling

Apart from a brief few years, the Umfolozi sugar mill has largely been grower owned during its 100-year history. Today it has a 75% grower ownership, including a 10% holding by local small-scale growers. Opportunities arise from this situation that most other areas in the sugar growing region of South Africa do not have. Sugarcane as a raw material has many uses other than producing sugar. With cane supply agreements essentially owned by the growers, other viable revenue streams derived from sugarcane as a raw material can be explored.

² N Miles, South African Sugarcane Research Institute, Mount Edgecombe, South Africa, 2013.

³ UCOSP, Riverview, 2010.

Conclusion

Umfolozi is arguably at the most exciting juncture of its history and there are still many knowledge gaps where further research will help direct the region to a successful and sustainable future. Captured in the table below is a summary of what has been discussed in this communication.

Topic	→ Knowledge gap	→ Research need
Water Management	The water table is very mobile and hard to predict	Monitoring systems for sub surface water
Variety Choice	Many varieties perform well at Umfolozi but none are bred for these specific conditions	Umfolozi variety specific research
Nutrition	FAS recommendations don't accommodate the potential K reserves	Investigate the characteristics of a K releasing soil to make better recommendations
Nutrition & Water Management	What are the best N use practices in the different scenarios when farming with a water table?	Communication of the most suitable N carriers and application methods to achieve optimum N uptake
Tramline	Health and safety of the tramline system	The design of an equally efficient loading system with better health and safety attributes
Loading	What is the true effect and cost to the grower of the three wheeled loader at Umfolozi	Quantify ratoon damage and maintenance vs loading efficiency and purchase price to establish true cost of practice and make recommendations
Milling	Having ownership of cane supply and the milling operation presents some interesting opportunities	Economic research needs to be conducted to present viable paths forward for the future of processing sugarcane at Umfolozi

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