

SELECTION AND MANAGEMENT OF VARIETIES THROUGH THE FELIXTON SEEDCANE SCHEME

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Abstract

Good variety selection is the key to successful sugarcane farming. Making this choice every year can be overwhelming for the individual grower, considering that there are over 30 varieties released for use in the South African sugar industry.

In the Felixton mill supply area, the seedcane scheme is compulsory, requiring all commercial (large scale) growers to order sufficient certified seedcane to replant a minimum of 5% of their area under sugarcane each season. The certified seedcane is first planted into farm nurseries where it is bulked-up and thereafter it is planted into commercial fields. To ensure that commercial co-operators produce sufficient certified seedcane of each variety, growers have to order both the correct amount and the best variety for each field that is to be replanted, two years (seasons) in advance.

A simple method was developed to assist the Felixton growers with correct variety selection. This method takes soils, production potential, pests, diseases and variety characteristics, as well as the variety disposition on the farm at the time, into consideration and involves a visit to individual growers by the Extension Officers and the Pest and Disease Manager. Valuable feedback from growers on the characteristics and potential of the newer varieties is obtained during these visits.

The result is that new varieties entering the Felixton mill supply area are either rapidly accepted or discarded. This paper will demonstrate the value of the organised seedcane scheme to local area crop protection as well as rapid adoption of SASRI varieties.

Keywords: sugarcane, seedcane, seedcane scheme, varieties, variety planning

Introduction

Local Pest and Disease Control Committees were first established in 1982 in each mill area in the South African sugar industry. In 2000 the name was changed to Local Pest, Disease and Variety Control (LPD&VC) Committees. The purpose and objectives of these LPD&VC Committees was to promote the control, and minimise the economic effects, of pests and diseases in each mill supply area.

The Felixton LPD&VC Committee is responsible for a cane area of 33 750 ha. This committee is funded by a levy of R19.20 per hectare from large-scale growers, who have 25 050 ha under cane, and 31 cents per ton cane from the small-scale growers. A manager

and a secretary are employed by the committee to manage the pest and disease inspection programmes, which are carried out by two mobile teams, each with a supervisor, who is also normally the driver, and four inspectors.

The formation of an informal seedcane improvement scheme for the Felixton mill supply area was initiated by the Extension Officer in 1981 to improve the poor quality of seedcane being used in the area (Matthew *et al*, 1990). For the first time, growers were asked to plan ahead for their seedcane requirements. After three years, however, *Leifsonia xyli* subsp *xyli*, or ratoon stunting disease (RSD), was present in 11% of the nurseries and 39% of these contained excessive off-types, while the seedcane from only 37% of nurseries was of an acceptable quality.

In 1984, the Felixton LPD&VC Committee considered the quality of seedcane material to be unacceptable and decided to tighten the control of production and quality of seedcane. A seedcane sub-committee was formed, and in 1985 growers were persuaded to introduce a formal seedcane scheme, which became obligatory for all growers in 1986 (Matthew *et al*, 1990). The sub-committee produced a handbook entitled 'Regulations and Guidelines for Growers in the Felixton Local Pest, Disease and Variety Control Areas', which was distributed to all growers (Mathew *et al*, 1990). This booklet, which is updated regularly, includes the Felixton Seedcane Scheme rules and regulations.

Method and Procedure

The rules and regulations

According to the Felixton Seedcane Scheme rules and regulations, every grower is obliged to participate in the seedcane scheme, and is required to produce sufficient seedcane in his farm nursery for a minimum annual replant of 5% of the area planted to sugarcane. Where growers use an intermediate farm nursery, one ton of certified seedcane is required per 20 ha of the area planted to sugarcane.

Certified seedcane of recommended varieties is produced and sold by commercial co-operators, who have to hot water treat (HWT) the seedcane. Seedcane in certified and farm nurseries must be free of RSD and may not exceed 0.1% *Ustilago scitaminea* (smut), sugarcane mosaic virus (mosaic) or off-types. Seedcane should preferably not have more than five *Eldana saccharina* Walker (Lepidoptera: Pyralidae) (eldana) per 100 stalks.

The first implementation procedure

From inception until 1996, seedcane order forms were posted out to growers. Not all the forms would be returned, largely because growers were often unsure which varieties they should order. In addition, growers were not planning ahead sufficiently, as it takes two years from the time an order is placed to the time the commercial field is planted. Certified seedcane ordered would only be collected the following year for planting into farm nurseries, and the year thereafter commercial fields would be replanted using seedcane from the farm nursery. The result was that when commercial fields were re-established, they were often planted to an unsuitable variety, as that was the only seed that was available.

The 1997 revision of the implementation procedure

As a result of some concern among the growers about the process of ordering the right seedcane, it was decided in 1997 that the Pest and Disease Manager (P&DM) would visit every grower to take seedcane orders. This process was a great improvement and led to the quicker introduction of newer varieties. However, growers were still not planning ahead when it came to placing seedcane orders, and were not matching varieties to field conditions. The variety disposition at the time was also not taken into consideration.

The 2003 revision of the implementation procedure

In 2003, the Extension Officers (EOs) believed that seedcane should be ordered according to the following key agronomic criteria:

- The current variety disposition on the farm
- The level of irrigation management required for each variety (if irrigated)
- The propensity of each variety to flower, especially under irrigation
- The tolerance of each variety to salinity and sodicity
- The tolerance of each variety to poorly drained soils
- The variety's suitability for early-, mid-, or late-season harvesting, or a combination thereof relative to the other varieties.
- The reaction of the variety to smut, mosaic and *Puccinea melanocephala* (rust)
- The reaction of the variety to damage by eldana.

A list of varieties was compiled for both irrigated and rainfed conditions. Only varieties which EOs were confident in recommending were placed on the list of recommended varieties. Popular varieties that were susceptible to either an insect pest or a disease (Anon, 2005), or both, were recommended with caution to minimise crop loss (Goebel and Way, 2003 and Rutherford *et al*, 2003 respectively). A good example of this is variety NCo376, which is susceptible to smut, highly susceptible to mosaic, and susceptible to eldana.

Each variety was rated according to the key agronomic criteria listed above in the Felixton mill supply area (Anon, 2005). In addition, the top four varieties were ranked in order of suitability for each soil type under rainfed conditions. The rankings were based on the industry variety ranking by Redshaw (2004), and adapted to the local conditions. To keep this information as simple as possible, it was displayed on a single sheet of paper (Appendix 1 and Appendix 2).

When the first cane estimate of the season has been submitted to the Felixton Mill Group Board, copies are passed on to the LPD&VC Committee secretary, who captures all field information including the area and the variety in each field. This information is used to determine the variety disposition on each farm, and is captured on a separate sheet for each grower or farm (using Appendix 1 or 2).

From the beginning of April until the end of June each year, every large-scale grower in the Felixton mill supply area is visited by the EO and the P&DM, who work as a team. Using the variety disposition on their farms, growers are asked to comment on each variety grown on the farm. This process gives invaluable feedback to the EO and P&DM on the performance of varieties under commercial conditions. The EO and P&DM discuss each farm's variety disposition in relation to the time of season (early, mid or late) the varieties are to be harvested and their characteristics.

Shortcomings of the existing varieties on the farm, as far as the key agronomic criteria are concerned, are then discussed. Fields that are likely to be re-established in two years' time are identified. The grower, the EO and the P&DM together make a decision on the best variety for each field that is to be replanted in two years' time (Redshaw, 2005), and sufficient seedcane is ordered accordingly. During the visit, the grower is also reminded about the tonnage of certified seedcane of each variety ordered for the current season. The seedbeds are identified on a farm map and a cession is signed for the amount of certified seedcane ordered for the current season. These seedbeds are inspected by the P&DM in June and July to make sure that the previous crop has been eradicated completely, and no volunteers remain.

Payment for seedcane

When the cession has been deducted from cane payments at the end of August, the monies are paid into the Felixton Seedcane Scheme savings account. When the certified seedcane has been collected from the commercial co-operator, the grower signs an acknowledgement of receipt. The commercial co-operator presents the acknowledgement of receipt to the Seedcane Scheme Administrator, who then pays him for the seedcane supplied. Timely payment for seedcane is one of the most important aspects of seedcane production, as commercial co-operators do not want to collect money from fellow growers. The commercial seedcane co-operators are the most important link in the Seedcane Scheme and need to be treated with respect.

Once all seedcane order forms have been completed, the P&DM collates the orders by the end of July (Table 1), and strategically places them with commercial seedcane co-operators who are situated throughout the Felixton mill supply area.

Table 1. Felixton certified seedcane orders (%), 2001 to 2006.

Year	NCo376	N12	N17	N19	N21	N25	N27	N29	N35	N36	N40	N41
2001	–	1	4	4	–	–	42	30	16	1	–	–
2002	–	–	–	–	1	–	53	34	7	5	–	–
2003	1	1	5	1	1	4	57	22	7	1	–	–
2004	–	1	1	3	1	1	37	10	8	4	2	30
2005	–	3	8	3	1	6	25	2	28	6	1	17
2006	–	1	8	5	2	2	14	7	5	42	–	2

Industry bulking-up procedure for new varieties

When a new variety is released by the South African Sugarcane Research Institute (SASRI) for commercial use by the industry, each grower is entitled to a small amount of cane from the bulking plot(s) in each LPD&VC area. This amount may vary depending on the amount of cane in the bulking plot, as well as the demand for, or interest in, the new variety. Because growers normally get about 0.5 ton, it is often planted wherever the grower can find a small area that has not already been planted to cane. This is often near bush lines where the cane is either destroyed by pigs, monkeys and passers-by, or often even burnt because it is part of a commercial field. In such a situation, infection by RSD is possible. There is normally little feedback from these small plots, and information on the performance of each new variety is

dependent on trial results. Seedcane from these little plots is seldom HWT, or the seedcane may not even be used.

Felixton bulking-up procedure for new varieties

New varieties that are released from SASRI into the Felixton mill supply area are treated differently, and follow a bulking-up process similar to the Felixton Seedcane Scheme. The new variety is planted into one or two of the commercial co-operators' certified seedcane nurseries in spring after the field has been fallow for about a year, but is not HWT. The following year the variety is given to the remainder of the commercial co-operators, who HWT the seed and plant it into their certified seedbeds, which is also the year that the first certified seedcane orders for that variety will be taken. The following year growers will plant this variety into their farm nursery, and after another year, this variety will be planted into commercial fields. The first commercial cane from the new variety will be sent to the mill four years after it was planted into the bulking plot.

Results and Discussion

Variety disposition

Because estimates are captured at the beginning of every year, the variety disposition for the Felixton mill supply area is calculated every year. This provides information on which varieties are losing favour and which are gaining favour, and also shows trends (Table 2). By looking at the certified seedcane orders (Table 1), one can determine which varieties are popular, and get an indication of the variety disposition in two years' time.

Table 2. Felixton variety disposition (%), 1998 to 2005.

Variety	1998	1999	2000	2001	2002	2003	2004	2005
NCo376	50	50	39	37	32	28	26	22
N27	Trace	Trace	4	8	12	17	25	29
N19	22	23	21	20	18	16	15	12
Mixed	0.9	0.7	13.7	13.4	15.7	9	9	10
N17	8	8	7	6	7	6	7	7
N12	9	9	7	7	6	5	4	4
N29	–	Trace	0.4	1	3.0	5	7	8
N14	9	7	6	5	4	4	3	3
N25	–	1	0.3	0.8	1.0	2	2	2
N22	1	1	0.8	1	0.8	0.8	0.5	0.5
N21	0.1	0.3	0.7	0.6	0.3	0.4	0.4	0.3
N26	–	Trace	0.1	0.2	0.2	0.2	0.2	0.3
N35	–	–	–	–	–	–	0.5	1
N23	–	–	–	–	–	–	–	0.4
N41	–	–	–	–	–	–	–	0.2

Information on new varieties

As new varieties are introduced into the Felixton LPD&VC area through the seedcane scheme, no seedcane of the new variety goes to waste. Each year the seedcane of the new variety is bulked further, it is HWT and certified. Because certified seedbeds are inspected three times on a line-by-line basis, a good knowledge of its productivity and susceptibility is developed to confirm or refute the information from SASRI on the new variety under local conditions. Feedback is therefore given to growers on the variety in industry variety trials as well as on its performance under local conditions. After growers have ordered seedcane of the new variety in consultation with the EO and P&DM, the seedcane will be used, as it is ordered with confidence.

While visiting every grower personally, the EO and P&DM receive a significant amount of feedback from growers on the performance, and the pest and disease susceptibility, of the different varieties. This information is fed back to SASRI as well as to all growers in the Felixton mill supply area, making them more variety conscious and competent than the growers in the rest of the industry.

Reduction in RSD levels

The Felixton Seedcane Scheme has been responsible for a significant reduction in RSD incidence in the Felixton LPD&VC area. Table 3 shows the slow but steady decrease in the percentage of samples from commercial fields infected with RSD since 1990. These figures are slightly biased as fields suspected of being infected with RSD are often selected for testing. In the past five years (2001 to 2005), not a single certified or farm nursery was found to be infected with RSD.

Table 3. Felixton ratoon stunting disease survey results in commercial cane (1990 to 2005).

Year	No. of samples tested	No. of samples infected	% samples infected	No. of farms tested	No. of farms infected	% farms infected
1998	363	49	13	50	22	44
1999	369	35	9	51	24	47
2000	264	35	13	30	13	43
2001	146	18	12	26	10	38
2002	277	14	5	33	9	27
2003	224	5	2	35	5	14
2004	221	22	10	28	12	43
2005	200	7	4	35	6	17

Reduction of smut levels

The mean smut levels in the Felixton LPD&VC area have also decreased significantly, largely due to the decrease in the area planted to the susceptible NCo376 variety. Figure 1 shows the decrease in the mean smut level of all the fields inspected since 1997/98, the decrease in the mean smut level of NCo376 fields, as well as the smut incidence in a combination of all the varieties excluding NCo376. From these graphs it is clear that NCo376

is responsible for the high smut levels in the area, but that growers eager to hold onto NCo376 are rouging this variety vigorously in order not to lose it. Figure 1 also demonstrates that the newer, resistant varieties show very low levels of smut.

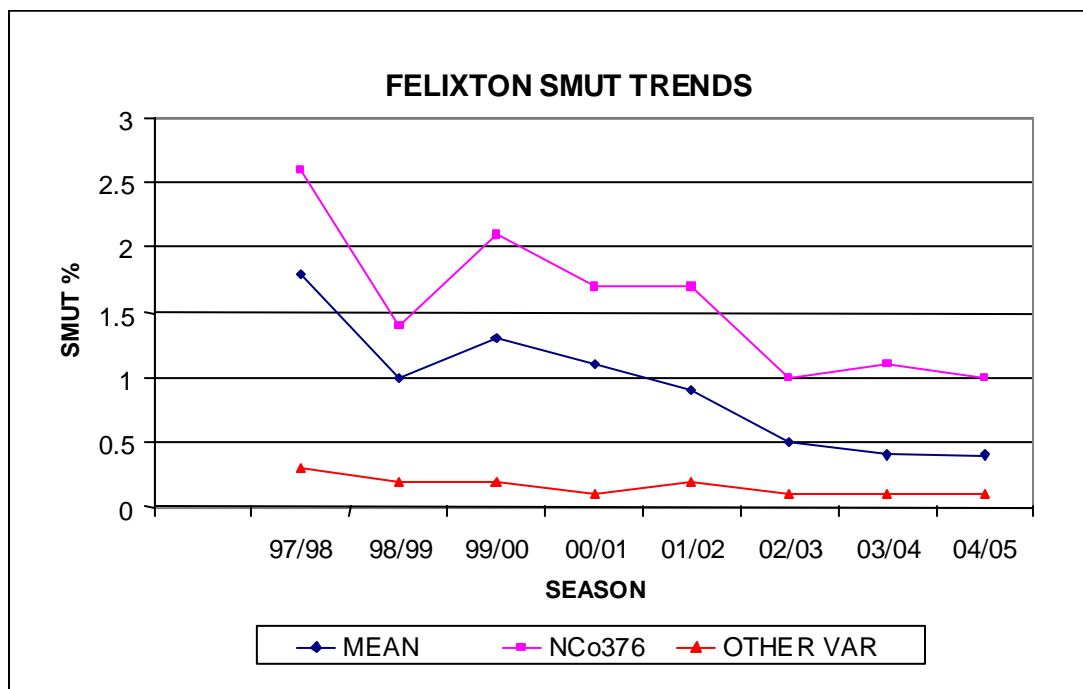


Figure 1. Felixton smut trends from 1997 to 2006 showing the mean incidence of smut in all varieties in comparison to NCo376, and to all other varieties (excluding NCo376).

Precision farming

One of the most important objectives of the personal visits is to get growers to move closer to precision farming. This has been achieved by planting good quality, healthy seedcane (Brenchley, 2002, 2003; McFarlane, 2003) of those varieties that are resistant to pests and diseases of significance in the Felixton LPD&VC area. The best varieties need to be selected for each soil type, for the growing conditions that normally prevail, and for harvesting at the correct time of the season. This has generally been achieved over the past three seasons, as growers have adapted to harvesting varieties at a time during the season when the Recoverable Value is the highest. Unfortunately, it will take about 10 years before every field is planted to the correct variety.

Conclusion

The objective of approaching the selection of the most suitable variety for each field in a simple, yet more scientific and structured way has generally been achieved. It would be desirable to add more variables to the selection criteria, like ratooning ability for example, as long as it does not make the process too complicated.

Growers are more aware of the risks that NCo376 brings, when it comes to smut susceptibility. This is demonstrated by the decrease in the proportion of the area planted to this variety, and the increase in effective rouging by growers who are reluctant to lose it.

If a formal and effective seedcane scheme were not in place in the Felixton mill supply area, it would not be possible to recommend and plant the most suitable variety into each field that is to be replanted in any one season.

The incorporation of the new variety bulking plots into the seedbeds of certified seedcane co-operators has worked extremely well, especially in monitoring the new varieties for pests and diseases, their performance under local conditions, and keeping them free of off-types. This has resulted in the rapid bulking-up of promising new varieties in the area.

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APPENDIX 1

Felixton Dryland Varieties - Seedcane Orders 2005										
Recommended										Date:
% Area	Variety	Flowering	Tolerance to poorly drained soils	Early Season	Mid Season	Late Season	Smut	Mosiac	Rust	Eldana
	N19	Sparse	Intolerant	X			Resistant	Susceptible	Resistant	Intermediate/Susceptible
	N12	Moderate	Tolerant	X	X		Intermediate	Intermediate	Resistant	Intermediate/Resistant
	N35	Moderate	Intolerant	X	X	X	Resistant	Resistant	Intermediate	Intermediate/Susceptible
	N36	Moderate	Intolerant	X	X		Intermediate	Intermediate	Intermediate	Intermediate/Susceptible
	N41	Rare	Intolerant	X	X		Intermediate	Intermediate	Intermediate	Resistant
	N42*	Profuse	?	X	X		Resistant	Resistant	Intermediate	Resistant
	N27	Profuse	Tolerant		X		Resistant	Resistant	Intermediate	Susceptible
	N21	Sparse	Moderate		X	X	Intermediate	Resistant	Resistant	Resistant
	N17	Profuse	Intolerant			X	Resistant	Intermediate	Resistant	Intermediate/Resistant
Use With caution										
	N29	Profuse	Intolerant	X	X		Resistant	Intermediate	Susceptible	Resistant
	NCo376	Moderate	Moderate		X		Susceptible	Highly Susceptible	Resistant	Susceptible
	N33	Sparse	?		X	X	Intermediate	Intermediate	Susceptible	Resistant
Soil Parent Material										
	Alluvium						1st Choice	2nd Choice	3rd Choice	4th Choice
	Dolerite/Granite						N41	N27	N36	N19
	Dwyka						N27	N35	N36	N41
	Lower/Middle Ecca						N27	N17	N21	N12
	Red Recent Sands						N27	N41	N42*	N17
							N17	N27	N41	N42*

APPENDIX 2

Felixton Irrigated Varieties - Seedcane Orders 2005

Recommended													
% Area	Variety	Irrigation management	Flowering	Tolerance to salinity	Tolerance to poorly drained soils	Early season	Mid season	Late season	Date:				Eldana
									Smut	Mosaic	Rust	Intermediate/Susceptible	
	N22	Good	Sparse	Intolerant	Intolerant	X			Highly Resistant	Resistant	Resistant	Resistant	Intermediate/Susceptible
	N40	Good	Moderate	Intolerant	Intolerant	X	X		Resistant	Resistant	Resistant	Resistant	Intermediate
	N41	Dryland/Moderate	Sparse	Intolerant	Intolerant	X	X		Intermediate	Intermediate	Intermediate	Intermediate	Resistant
	N42	Dryland/Moderate	Profuse	Unknown	Unknown	X	X		Resistant	Resistant	Intermediate	Intermediate	Resistant
	N25	Moderate	Sparse	Moderate	Moderate	X	X	X	Intermediate	Intermediate	Resistant	Resistant	Intermediate/Resistant
	N35	Dryland/Moderate	Sparse	Intolerant	Intolerant	X	X	X	Resistant	Resistant	Intermediate	Intermediate	Intermediate/Susceptible
	N36	Moderate	Moderate	Intolerant	Intolerant	X	X	X	Intermediate	Intermediate	Resistant	Resistant	Intermediate/Susceptible
	N14	Good	Profuse	Moderate	Moderate		X		Intermediate	Intermediate	Intermediate	Intermediate	Susceptible
	N23	Moderate	Profuse	Moderate	Intolerant		X		Resistant	Intermediate	Resistant	Resistant	Intermediate
	N27	Dryland/Moderate	Profuse	Moderate	Tolerant		X		Resistant	Resistant	Intermediate	Intermediate	Susceptible
	N17	Dryland/Moderate	Profuse	Tolerant	Intolerant		X	X	Resistant	Intermediate	Intermediate	Resistant	Intermediate/Resistant
Use with caution													
	N19	Moderate	Sparse	Tolerant	Intolerant	X			Resistant	Susceptible	Resistant	Resistant	Intermediate/Susceptible
	N29	Dryland/Moderate	Profuse	Intolerant	Intolerant	X	X		Resistant	Intermediate	Susceptible	Susceptible	Resistant
	N12	Dryland/Moderate	Moderate	Tolerant	Tolerant	X	X		Intermediate	Intermediate	Intermediate	Resistant	Intermediate/Resistant
	NCo376	Dryland/Moderate	Moderate	Tolerant	Moderate		X	X	Susceptible	Highly susceptible	Resistant	Resistant	Susceptible