

N12: A SUCCESS STORY

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Abstract

Harvest records from 1983–1991 for a midland farm have been studied. Comparisons have been made using tc/ha, tc/ha/m, ts/ha and ts/ha/m as performance indices to determine the advantage, if any, of N12 over NCo376. The performance of both varieties was compared for the whole farm and for two specific ecological areas. Ratooning ability was analysed by comparing the yield of individual crop stages with that of the dominant crop stage. It was clear that the performance of N12 was better than NCo376 on a whole farm analysis (26% for tc/ha/m and 30% for ts/ha/m). The advantage of N12 in the north (drier, better soils) was at least 22% more compared with the advantage in the south (wetter, poorer soils). There was no evidence of a marked decline in genetically related ratooning ability for either variety, although some circumstantial evidence exists for NCo376. The success of N12 on Beaumont farm is clearly evident and is an issue of great importance to both CG Smith Sugar and the sugar industry.

Introduction

NCo376 was released into the sugar industry in 1955, and was widely planted. Since then the sugarcane breeding programme has released numerous 'N' varieties. These have

specific attributes which determine the region(s) of the industry in which they are released. It is now possible to select the variety which is best suited to a particular set of conditions, and which has attributes superior to those of NCo376.

NCo376 has been the standard for the breeding programme and for all the variety release trials. There is evidence from the results that variety N12 has a number of advantages over NCo376. These include greater sucrose yields, drought tolerance and intermediate resistance to major pests and diseases. This experimental evidence is very important, but just as important is the evidence from a commercial situation.

Beaumont farm, which is part of the CG Smith Sugar Ltd Illovo Miller-cum-planter sector, has provided the opportunity to determine the benefits of N12. The 4 038 ha farm was purchased by CG Smith Sugar Ltd in 1981 from Saiccor, when it was producing timber only. The farm has undergone a substantial development programme during which large areas, initially of NCo376 (1981–1983) then N12 (1984–1992), have been planted.

Management decided to discontinue planting of NCo376 after 1983, as there was a clear indication from the industry that N12 was better adapted to conditions in the Natal midlands. In 1991 it was decided that a study of yield data would elucidate the consequences of this decision.

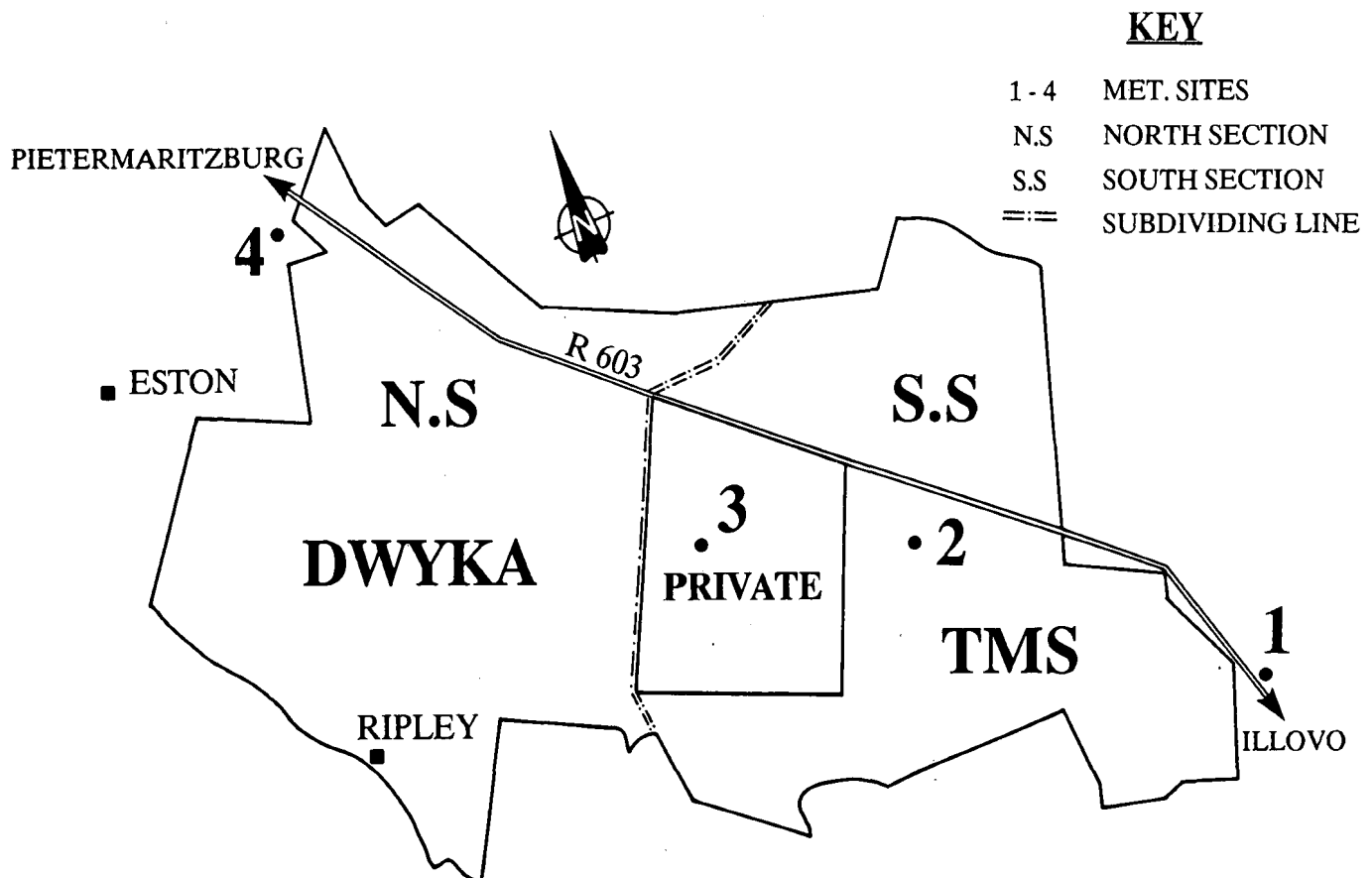


FIGURE 1 Beaumont farm

Methods and Materials

Due to the size, shape and orientation of Beaumont, a considerable variation exists over the area. The first exercise therefore was to determine climatic and geological differences that might influence the study. The factors considered were rainfall, soil parent material and soil properties. Harvest records of NCo376 and N12 from the 1983/84–1991/92 seasons were used. The performance indices considered were tc/ha, ts/ha, tc/ha/m and ts/ha/m. Weighted means were calculated for all indices (based on area) and comparisons between the varieties for the whole farm, ecological areas and crop stages were made. The weighted age and the number of records making up the mean of each group were determined. In the comparison tables the performance of N12 is expressed as a percentage of NCo376 to indicate the advantage or disadvantage over NCo376.

Results and Discussion

A survey of the local meteorological sites and reliable private records indicated a downward trend in the mean annual rainfall from the southern to the northern boundary of the farm (Table 1). A geological survey of the farm revealed a dominance of two soil parent materials and related soil properties. These are Dwyka Tillite and Table Mountain Sandstone (TMS) in the north and south respectively. On this basis two ecological areas were outlined and considered. The ecological boundary divides the farm into two almost equal areas at The Recess (Figure 1).

Table 1
Long term mean annual rainfall

Location	Rainfall (mm)	Years of record
1. Gumtree store	861	10
2. Beaumont office	849	10
3. The Recess	747	9
4. Eston Housac	603	11

Whole farm comparison

The performance indices showed a definite advantage of N12 over NCo376. The advantage reached 26% and 31% for the tons cane and tons sucrose indices respectively. The weighted age was similar for both varieties and was typical for the midlands (Table 2).

Table 2

Whole farm comparison by variety

Variety	Records	Age (m)	tc/ha	ts/ha	tc/ha/m	ts/ha/m
N12	232	22,2	105,1	14,5	4,72	0,65
NCo376	204	22,2	83,4	11,1	3,75	0,50
% of NCo376	114	100	126	131	126	130

The yield advantage of N12 for the various crop stages is not consistent, as seen below in Table 3. In addition the plant crop of N12 is on average the highest yielding stage when compared with the ratoons, whereas for NCo376 the first ratoon crop is the highest yielding stage.

Table 3

Whole farm comparison by variety and stage

Variety	Stage	Records	Age (m)	tc/ha	ts/ha	tc/ha/m	ts/ha/m
N12	P	119	23,3	116,3	15,5	5,00	0,67
	1	70	20,4	91,2	13,0	4,47	0,64
	2	39	21,9	96,5	14,0	4,41	0,64
	3	4	21,1	100,1	15,5	4,73	0,73
	4	0	0	0	0	0	0
NCo376	P	46	21,1	80,7	10,0	3,82	0,47
	1	58	22,3	86,6	12,1	3,88	0,54
	2	55	23,3	86,2	11,7	3,68	0,50
	3	33	22,0	79,5	10,6	3,60	0,48
	4	12	12,5	79,6	10,7	3,70	0,50
% of NCo376	P	259	110	144	155	131	143
	1	121	91	105	107	115	119
	2	71	94	112	119	120	128
	3	12	96	126	146	131	152
	4	0	0	0	0	0	0

The ratooning ability of the two varieties can be determined by expressing the performance indices of the plant and ratoon crop for N12 and NCo376 respectively as 100%, and comparing the other stages with them. The first and second ratoons of N12 performed at 88% and 95% in relation to the plant crop for tc/ha/m and ts/ha/m respectively. There were only four records for the third ratoon, which showed

Table 4

Comparison for north and south regions by variety

Region	Variety	Records	Age (m)	tc/ha	ts/ha	tc/ha/m	ts/ha/m
North North	N12	162	22,1	109,6	15,0	4,96	0,68
	NCo376	71	21,8	81,7	10,6	3,74	0,49
	% of NCo376	228	101	134	142	133	139
South South	N12	70	22,7	94,9	13,3	4,18	0,59
	NCo376	133	22,4	84,4	11,5	3,76	0,51
	% of NCo376	53	101	112	116	111	116
North South	N12	162	22,1	109,6	15,0	4,96	0,68
	N12	70	22,7	94,9	13,3	4,18	0,59
	% of South	231	97	115	113	119	115
North South	NCo376	71	21,8	81,7	10,6	3,74	0,49
	NCo376	133	22,4	84,4	11,5	3,76	0,51
	% of South	53	97	97	92	99	96

a better performance (109%) than the plant crop for ts/ha/m and lower performance (95%) for tc/ha/m. The results for NCo376 showed that for tc/ha/m the plant, second, third and fourth ratoons performed 98%, 95%, 93% and 95% in relation to the first ratoon respectively. The ts/ha/m values were 87%, 93%, 89% and 93% for the same criteria. The results were fairly consistent for the performance of progressive crop stages, which indicated no appreciable decline in the ratooning ability of either variety for a whole farm comparison.

Ecological areas comparison

The results in Table 4 support those of the whole farm comparison, and they indicate also how the yield advantage of N12 differed between the northern and southern ecological areas of the farm.

The percentage yield advantage of N12 over NCo376 in the north was at least 22% more compared with the N12 advantage in the south. This difference can primarily be attributed to the higher yields of N12 in the north than in the south. Drought tolerance and the ability to respond to the higher clay percentage soils, which tend to hold water for longer, have contributed to the advantage of N12 in the north. NCo376 is yielding marginally better in the south than in the north, due primarily to the more favourable climatic conditions in the south. These results support the evidence that NCo376 is an adaptable variety, whereas N12 is site specific and thus responds differently to different conditions.

An analysis of ratooning ability for N12 was consistent with the results of the whole farm comparison for both north and south ecological areas. In contrast to this the ratooning ability for NCo376 seemed to differ between the two ecological areas (Table 5).

commercial crop (1983/84) harvested on the old timber lands, and nutrient status may have been variable; the annual rainfall for 1981 and 1982 was below average (76%) and this was the most northern area planted to NCo376.

In the south, records indicated a downward performance trend from the plant to fourth ratoon stages for NCo376. Most of the area planted to NCo376 in the south has been on weak, sandy Cartref soils. The absence of records for 14 plant fields which were used as seedcane happen to concern the area of lower potential. This may explain why the remaining plant crop performance (higher potential areas) was greater than the first ratoon, which includes both the higher and lower potential fields. During the initial stages of development the acquisition of healthy, disease-free and true-to-type seedcane was a major problem, and seedcane had to be carefully selected even if the fields were in a lower yield potential area.

The third and fourth ratoons have performed 17% and 40% lower than the first ratoon crop respectively. The reason for this low performance was not directly related to genetic ratooning characteristics, but rather to the effect of prevailing circumstances. The replanting of fields with N12 has been a programme in which strip planting techniques and logistical factors have been considered. It has consequently not always been possible to replant the weaker fields first. A study of the data showed that the NCo376 third and fourth ratoon fields were harvested during 1989–1991. It was evident that the prevailing floods of September 1987 (338 mm), January and February 1988 (228 mm and 210 mm respectively) and November 1989 (349 mm) had a marked effect on the weak, sandy and highly erodible soils, and subsequently on the performance of these ratoons. The primary effects would have been lodging of mature cane and leaching of nutrients causing a reduction in plant population and thus overall yield.

Conclusions

It has been shown from both the whole farm and ecological areas study that N12 performance was better than that of NCo376, and that N12 has been a success on a midland farm such as Beaumont. The dominant crop stages were identified as the plant and first ratoon for N12 and NCo376 respectively. There was no conclusive evidence of a genetically related decline in ratooning ability for either variety.

The ecological areas comparison clearly showed that N12 is a site specific variety which can take advantage of marginally better soils, even when rainfall is a limiting factor; whereas NCo376 is an adaptable variety performing only marginally lower under the given conditions in the north. Another contributing factor to the success of N12 on Beaumont is the fact that allowance is made for the slow germination and early growth, with the overall weighted age recorded as 22,2 months.

Apart from the agronomic aspects of the success of N12 on Beaumont, the commercial aspect has been one of substantial monetary gain. Assuming that 52% of the entire cane area (2 700 ha) is harvested annually, and based on the results of the current study, the sucrose yield of an entire N12 crop disposition, as opposed to the same for NCo376, will be about 4 760 tons per annum higher, thus increasing the profitability of the farm.

Finally, it is evident from this study that the decision to replace NCo376 and continue further development with N12 in 1984, increased the potential of Beaumont and has certainly been a success.

Table 5

Ratooning ability of N12 and NCo376 by ecological area

Variety	Stage	Records	Age (m)	% tc/ha/m	% ts/ha/m
N12 North	P	87	22,9	100	100
	1	48	20,7	91	97
	2	23	21,9	88	96
	3	4	21,2	91	106
	4	0	0,0	0	0
NCo376 North	P	16	20,2	70	65
	1	16	22,3	100	100
	2	15	23,0	93	93
	3	14	22,3	97	95
	4	10	21,3	99	93
N12 South	P	32	24,3	100	100
	1	22	19,4	86	92
	2	16	21,8	92	97
	3	0	0,0	0	0
	4	0	0,0	0	0
NCo476 South	P	29	21,6	121	109
	1	43	22,3	100	100
	2	40	23,5	94	92
	3	19	21,7	83	83
	4	2	22,8	63	60

In the north, the plant stage for NCo376 performed less well than one would expect when compared with the first ratoon. The possible reasons for this are that it was the first