

THE SEARCH FOR ALTERNATIVE VARIETIES TO NCo 376 IN RHODESIA

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Abstract

A review of 22 trials conducted over the past 10 years, involving over 100 varieties is presented. The early, mid- and late season yields of those varieties which compared favourably with NCo 376 are discussed. Varietal smut resistance ratings are also included in the tables. The data show that very few varieties consistently out-yield NCo 376.

Introduction

As the number of released varieties available to the Rhodesian industry is so limited at present, and the major variety NCo 376 is highly susceptible to smut infection, there is consequently a burgeoning interest in the performances throughout the season of newly introduced as well as known varieties. The tables presented in this paper are a condensation of those published by James,⁷ which recorded cane and sugar yields of over one hundred varieties involved in the twenty-two trials conducted in the lowveld over the past ten years for early (April-June), mid (July-September), and late season (October-December). Both cane and sugar yields, for those varieties which compared favourably with NCo 376, are expressed as a percentage of NCo 376 through the cropping cycle (plant and ratoons), and as a mean over all the crops. The mean yields for each variety are a percentage of NCo 376 over the same number of crops and the varieties are arranged in the tables with reference to sugar yields. The varietal smut resistance ratings are taken from previously published results (James^{5, 6}) together with additional data from both variety trials and smut exposure trials, and the key below is based on the system proposed by Hutchinson⁴ for standardizing disease resistance ratings.

Smut resistance ratings key

0 — Immune	5 — Intermediate average
1 — Very highly resistant	6 — Intermediate susceptible
2 — Highly resistant	7 — Susceptible
3 — Resistant	8 — Highly susceptible
4 — Intermediate resistant	9 — Very highly susceptible

Results

The following observations can be made on these trials:
Early season: April-June (Table 1)

Released varieties

As NCo 310 has been withdrawn from the list of released varieties (Anon¹), only Co 462, CP 29-116 and NCo 376 are available to the industry for general planting. Of these three, only NCo 376 has been included in early season trials, and though this variety maintains good yields even in later ratoons, it is highly susceptible to smut infection.

Pre-released varieties

Up to 10% of a farm or section may be planted with each of the varieties on this list, which includes Co 1001, M 31-45 and N 52-219.

Co 1001 has given outstanding sugar yields in plant, first and second ratoon crops; but it appears to deteriorate in later ratoons relative to NCo 376. While Co 1001 has a low popu-

lation of heavy stalks, lodges badly and consequently gives rise to weed problems where the canopy opens up, it is very highly resistant to smut disease.

The sugar yields of N 52-219 are on a par with those of NCo 376 over three crops. It would appear that these sugar yields improve with successive ratoons but observations over a longer period will be needed to confirm this. While N 52-219 lodges slightly more than NCo 376 — but certainly not as badly as Co 1001 — the canes break easily. Although N 52-219 has a tendency to flower more profusely than NCo 376 in certain years, it has a very high resistance to smut.

The cane and sugar yields of M 31-45 are better than those of NCo 376 in plant and first ratoon crops; however, they deteriorate in later ratoons. M 31-45 is very highly resistant to smut infection.

Promising varieties

While both the cane and sugar yields of Co 740 and B 57150 are much higher than NCo 376 in the plant crop, there appears to be a definite deterioration in later crops. Therefore the subsequent performances of Co 740 and B 57150 will be observed. Both varieties are moderately susceptible to smut infection.

Mid season: July-September (Table 2)

Released varieties

In comparison to NCo 376, the yields of Co 462 are much lower, but it appears that the performance of the latter variety improves with later ratoons. Nevertheless, while it is very highly resistant to smut, its yields overall are 7% less than those of NCo 376.

Though the plant crop sugar yields of CP 29-116 are very much higher than those of NCo 376, these yields deteriorate very significantly with ratoons. As the mean sugar yield of CP 29-116 over ten crops expressed as a percentage of NCo 376 was 86.7, the data for CP 29-116 are not included in Table 2. CP 29-116 has a moderate resistance to smut infection.

NCo 376 is the best of the released varieties, and maintains good sugar yields even in ninth ratoon.

Pre-released varieties

The sugar yields of Co 1001 are very much lower than those of NCo 376 when harvested mid season. Conversely, while the cane yields are lower, the sugar yields of N 52-219 are slightly higher than those of NCo 376. M 31-45 has much poorer cane and sugar yields in mid season than early in the season.

Promising varieties

With the limited yield results available, Mex 59-1828 would appear to be very promising but this variety is very much more susceptible to smut than is NCo 376.

From a small number of crops the sugar yields of F 146, L 61-67, L 62-68, Mex 56-476, Q 85, Waya and Woden are similar to those of NCo 376. However, it is disappointing to note that L 62-68, L 62-96 and Mex 56-476 are highly susceptible to smut infection.

*Late season: October-December (Table 3)**Released varieties*

CP 29-116 and NCo 376 have given similar sugar yields from a plant crop and six ratoons.

Pre-released varieties

Though the sugar yields of Co 1001 deteriorated when harvested mid season, they appeared to rally in late season harvests. Subsequent observations in other trials will elucidate whether this is an anomaly or not.

In comparison to early and mid season harvests, the sugar yields of N 52-219 declined significantly compared to those of NCo 376.

Promising varieties

The sugar yield of Q 70 compares favourably with that of NCo 376 when harvested late in the season, and it has a moderate resistance to smut infection.

With the sugar yield results from only one crop, B 51129, B 57150, B 60267, Co 740, CP 52-68, CP 56-59, CP 61-37, CP 62-374, CP 63-588, M 305-51, Q 85 and Trojan show promise, and therefore the subsequent performances of these varieties, which have a moderate to high resistance to smut, will be observed.

Discussion

From the evidence presented here it can be seen that Co 1001 has a definite place in the range of varieties suitable for commercial planting in the Rhodesian Lowveld. To ensure that the yields of which this variety is capable are achieved, Gosnell³ recommended that special efforts should be made to obtain a full stand, because yields suffer seriously where gaps occur. A full stand can be achieved by double planting and closer row spacing (1,00 m instead of the normal 1,52 m). Whilst up to 14 tons seedcane/ha are required compared to 7 tons/ha or less with NCo 376 at normal spacing, the additional yields of the Co 1001 plant crop alone resulting from a full stand at close spacing will offset additional seedcane costs. The data presented in Table 1 show that Co 1001's role is as an early season variety, and these facts are substantiated by the excellent milling results in the early part of the season. The high sucrose content of Co 1001 combined with low fibre content and low invert ratios would seem to make this variety a miller's delight.

N 52-219's potential is as an early to mid-season variety and, in addition, the virtual immunity of this variety to smut is a great advantage.

The advantage which Co 462 has due to its very high resistance to smut is outweighed by the fact that its sugar yields are significantly lower than those of NCo 376 over all and it lodges severely, resulting in growth reduction. Due to these features, and the fact that other smut resistant varieties with greater agronomic potential are now available, the planting of Co 462 is no longer recommended (Gosnell²).

The data in Tables 1 and 2 show M 31-45 to be an early rather than mid-season variety. The advantages of M 31-45 are that it appears to be relatively drought resistant should irrigation fall behind and that it is resistant to smut. Nevertheless, whilst its sugar yields in early season are higher than those of NCo 376 in plant and first ratoon crops, these appear to deteriorate in subsequent ratoons.

Gosnell² has reported that CP 29-116 is probably the hardest variety in the Rhodesian industry, being well adapted to poor gravelly or sandy soils, and it recovers well from water stress. However, it is susceptible to frost damage and lodges moderately. The field resistance to smut of CP 29-116 is acceptable, and flowering is moderate. The sugar yields, whilst being disappointing when harvested mid-season, are on a par with those of NCo 376 late in the season.

NCo 376 is still the best of the released varieties, and gives good yields throughout the season. Furthermore, it maintains these yields in ratoons. From the data presented it can be seen that very few varieties outyield NCo 376, though certain of the newly introduced varieties appear to be very promising from the limited number of crops harvested so far (Table 3). However more results must be obtained before any definite conclusions can be drawn on their real potential. The task still lies ahead to find alternative varieties as "management tolerant" as NCo 376.

REFERENCES

1. Anon. 1972. NCo 310 withdrawn. *Sugarnews* 18, 4.
2. Gosnell, J. M. 1972. The current varietal situation. *Sugarnews* 13, 7.
3. Gosnell, J. M. 1972. Has Co 1001 a place in the Lowveld? *Sugarnews*, 18, 3.
4. Hutchinson, P. B. 1967. Disease resistance ratings. I.S.S.C.T. Sugarcane Breeders' Newsletter 20, 90.
5. James, G. L. 1972. A summary of varietal resistance ratings to smut in Rhodesia 1963-71. *Sugarcane Pathologists' Newsletter* 8, 14.
6. James, G. L. 1972. Smut incidence in variety trials. S.A.S.T.A. Proc., 43, 85.
7. James, G. L. 1974. Results of Lowveld variety trials up to December, 1973. R.S.A.E.S. Miscellaneous report, 27 pp.

TABLE 1

Cane and Sugar Yields from April-June expressed as a Percentage of those of NCo 376

Variety	No. of crops	CANE YIELD							SUGAR YIELD							Smut resistance rating
		P	1R	2R	3R	4R	5R	Mean	P	1R	2R	3R	4R	5R	Mean	
Co 1001	14	106,2	96,5	95,4	93,4	79,0	75,4	91,9	111,4	109,7	107,7	102,8	101,7	94,7	105,4	1
NCo 376	19	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	8
N 52-219	4	102,5	94,4	97,0	—	—	—	98,4	94,4	100,3	105,0	—	—	—	99,3	1
NCo 310	10	108,6	87,8	86,9	79,3	—	—	91,8	102,1	98,0	93,0	98,5	—	—	98,3	9
Co 740	3	121,8	107,4	90,5	—	—	—	108,1	108,1	99,2	79,7	—	—	—	97,1	6
B 57150	3	109,3	83,5	86,8	—	—	—	94,5	107,2	88,0	88,1	—	—	—	95,7	5
B 42231	6	100,5	100,9	92,8	104,7	92,4	87,9	96,9	103,0	106,0	90,8	99,6	84,2	82,4	95,5	7
B 47419	3	123,9	105,6	96,8	—	—	—	110,1	93,3	99,2	94,4	—	—	—	95,4	1
M 383-41	11	81,0	92,7	87,5	85,0	80,0	76,0	83,8	94,9	103,7	98,9	89,7	98,7	82,6	95,1	4
M 31-45	6	103,7	101,3	83,1	93,4	83,3	80,6	91,7	108,4	103,1	83,7	92,2	77,8	86,2	93,3	1
Q 70	11	97,9	93,1	104,3	93,6	84,2	82,2	92,9	93,3	90,9	100,9	87,1	101,0	84,5	93,0	4
Pindar	14	89,7	95,1	83,9	80,6	71,7	73,1	101,4	91,5	102,1	99,6	81,7	88,4	82,5	91,3	6
Co 776	4	91,0	90,7	78,1	92,3	—	—	88,4	87,2	89,7	76,4	82,0	—	—	90,7	4
CP 43-47	6	81,0	76,4	70,9	75,7	72,2	69,2	74,6	104,1	99,0	81,1	86,4	84,5	80,5	90,5	6
PR 980	3	118,3	107,0	93,0	—	—	—	107,3	91,0	93,1	86,5	—	—	—	90,3	5
N 53-216	11	92,6	91,9	99,3	93,3	84,6	87,0	91,5	94,1	90,0	97,3	85,8	89,6	81,2	90,1	7

TABLE 2

Cane and Sugar Yields from July-September

Variety	No. of Crops	CANE YIELD										Mean
		P	1R	2R	3R	4R	5R	6R	7R	8R	9R	
Mex 59-1828	3	99,1	108,6	106,1	—	—	—	—	—	—	—	104,5
F 146	2	82,7	101,5	—	—	—	—	—	—	—	—	91,8
N 52-219	4	86,7	99,9	97,0	92,9	—	—	—	—	—	—	94,0
Woden	2	90,8	91,4	—	—	—	—	—	—	—	—	91,1
L 62-68	3	94,2	90,2	91,5	—	—	—	—	—	—	—	92,1
NCo 376	39	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Waya	2	91,8	98,5	—	—	—	—	—	—	—	—	95,1
Mex 56-476	3	82,8	84,2	85,1	—	—	—	—	—	—	—	84,0
L 62-96	3	78,4	96,5	94,3	—	—	—	—	—	—	—	89,5
L 61-67	3	78,1	89,4	91,4	—	—	—	—	—	—	—	86,1
Q 85	2	83,0	96,9	—	—	—	—	—	—	—	—	89,8
Co 740	2	90,8	92,6	—	—	—	—	—	—	—	—	91,6
Q 70	20	87,5	80,7	84,1	84,8	91,8	96,2	—	—	—	—	87,3
NCo 310	17	98,2	88,1	84,8	87,0	77,5	84,0	77,7	77,7	84,1	88,6	85,2
NCo 293	10	130,6	100,9	96,0	94,0	80,7	83,2	77,5	75,6	74,3	77,9	90,5
N 55-805	4	85,1	97,6	85,5	78,8	—	—	—	—	—	—	86,9
B 57150	2	80,8	98,1	—	—	—	—	—	—	—	—	89,2
Co 462	11	85,1	87,3	90,8	90,4	90,9	93,1	95,5	—	—	—	94,0
Mex 54-81	3	89,5	86,5	98,6	—	—	—	—	—	—	—	91,4
Co 678	11	117,4	102,5	89,5	99,4	101,6	119,0	—	—	—	—	105,0
M 383-41	19	83,2	85,1	81,5	85,2	88,4	95,9	—	—	—	—	86,4
Q 57	6	94,8	88,6	82,0	91,9	83,6	78,4	—	—	—	—	86,9
NCo 79	7	83,7	82,7	83,5	86,2	86,5	85,0	86,6	—	—	—	84,7

expressed as a Percentage of those of NCo 376

SUGAR YIELD											Smut Resistance Rating
P	1R	2R	3R	4R	5R	6R	7R	8R	9R	Mean	
110,1	115,1	114,0	—	—	—	—	—	—	—	113,1	9
97,0	108,0	—	—	—	—	—	—	—	—	102,5	5
100,6	106,3	98,9	97,4	—	—	—	—	—	—	100,9	1
103,5	98,0	—	—	—	—	—	—	—	—	100,7	2
109,1	94,7	95,6	—	—	—	—	—	—	—	100,1	8
100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	8
97,1	101,3	—	—	—	—	—	—	—	—	99,2	2
103,6	93,6	98,4	—	—	—	—	—	—	—	98,4	9
92,4	103,7	97,7	—	—	—	—	—	—	—	98,0	8
98,9	92,4	99,1	—	—	—	—	—	—	—	96,7	6
92,3	98,8	—	—	—	—	—	—	—	—	95,6	2
97,4	93,0	—	—	—	—	—	—	—	—	95,2	6
90,8	89,5	91,8	93,7	96,8	108,7	—	—	—	—	95,0	4
104,9	86,7	93,2	91,2	89,9	96,9	91,8	91,1	94,3	105,3	94,5	9
125,2	98,1	96,4	86,2	86,6	91,6	88,9	84,8	86,2	90,1	93,9	9
99,2	104,8	83,9	86,1	—	—	—	—	—	—	93,7	9
90,5	96,4	—	—	—	—	—	—	—	—	93,5	5
97,3	79,5	92,3	92,2	91,9	96,2	103,2	—	—	—	92,9	1
92,9	85,9	100,0	—	—	—	—	—	—	—	92,8	8
91,8	90,9	85,5	94,6	84,6	108,4	—	—	—	—	92,5	5
108,2	96,0	85,3	97,2	78,5	82,4	—	—	—	—	91,6	9
92,8	91,2	85,9	90,6	84,1	101,4	—	—	—	—	91,0	4
96,4	80,7	88,1	82,7	96,6	93,3	95,3	—	—	—	90,3	8

expressed as a Percentage of those of NCo 376

SUGAR YIELD								Smut Resistance Rating
P	1R	2R	3R	4R	5R	6R	Mean	
110,0	106,6	108,1	101,3	95,6	—	—	104,5	1
107,7	114,5	88,4	98,1	97,2	94,9	101,7	100,5	5
100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	8
118,8	90,8	104,2	92,8	78,9	—	—	97,3	4
105,4	87,9	93,1	91,7	79,2	—	—	91,6	4
93,2	86,7	95,5	84,6	90,6	—	—	90,2	1
129,3	—	—	—	—	—	—	129,3	8
115,9	—	—	—	—	—	—	115,9	9
110,8	—	—	—	—	—	—	110,8	8
110,7	—	—	—	—	—	—	110,7	2
109,7	—	—	—	—	—	—	109,7	5
107,5	—	—	—	—	—	—	107,5	8
106,6	—	—	—	—	—	—	106,6	6
105,6	—	—	—	—	—	—	105,6	6
105,5	—	—	—	—	—	—	105,5	5
103,1	—	—	—	—	—	—	103,1	0
103,0	—	—	—	—	—	—	103,0	5
102,6	—	—	—	—	—	—	102,6	2
102,3	—	—	—	—	—	—	102,3	2
101,2	—	—	—	—	—	—	101,2	5
96,9	—	—	—	—	—	—	96,9	5
96,0	—	—	—	—	—	—	96,0	0
94,0	—	—	—	—	—	—	94,0	7
93,6	—	—	—	—	—	—	93,6	0
93,1	—	—	—	—	—	—	93,1	2
91,5	—	—	—	—	—	—	91,5	5
91,1	—	—	—	—	—	—	91,1	2