*CONFIDENTIAL

3.4 **INVESTIGATIONS INTO THE USE OF PROPICONAZOLE FOR THE CONTROL OF FOLIAR DISEASES IN SUGAR BEET, 1990** NAS 744 1st year
(Not SBREC funded, partly sponsored by Ciba-Geigy)

Summary

A trial was set up to examine the use of propiconazole (Tilt) and sulphur for the control of foliar diseases in sugar beet. Three dates of application were examined with single and sequential treatments of each fungicide. Powdery mildew did not appear until late in the season and was patchy in nature. It appeared earlier on the older leaves but these died off in the drought conditions prevailing. Insufficient *Ramularia* was present to make an assessment. Assessments of brown rust were made at regular intervals. 0.5 l/ha Tilt applied on 7 August reduced the level of brown rust at the early assessment on 31 August, but the effect had completely disappeared by harvest. A double spray of Tilt applied on 7 August and 10 September reduced the level of brown rust to less than that of the single sprays when assessed on 18 October, but the differences between treatments had disappeared by 7 November. Sulphur was completely ineffective in reducing brown rust.

Yields of clean beet and sugar were not affected by treatment.

Object

To examine the use of Tilt (propiconazole) and sulphur for the control of powdery mildew, brown rust and *Ramularia* in sugar beet (variety Rex).

	Fungicide	Product/ha	
1.	Sulphur	10 kg	7 August
2.	Tilt	0.5 l	"
3.	Sulphur	10 kg	31 August
4.	Tilt	0.5 l	"
5.	Tilt	0.5 l	10 September
6.	Sulphur	10 kg	7 August and 31 August
7.	Tilt	0.5 l	7 August and 10 September
8.	Untreated		
9.	Untreated		

A simple randomised block design replicated four times was used for the trial. The experiment was carried out at Morley, Norfolk. Broad-leaved weeds were controlled by overall application of appropriate herbicides. Scores of brown rust were made on 31 August, 13 and 25 September, 18 October and 7 November and beet scores were made on 13 September and 9 November. The trial was harvested on 16 November 1990 and sugar content, clean beet and sugar yields were assessed.

*NOT FOR PUBLICATION WITHOUT THE DIRECTOR'S CONSENT. This report deals primarily with only one year's work so any conclusions given are only provisional.

Results

Powdery mildew

No powdery mildew appeared on the trial until late September and was in small patches only. It was present on the older leaves which subsequently died off in the dry conditions.

Brown rust

Brown rust scores 1990
(Scores used 0 to 6 scale when 0 = nil and 6 = very severe)

	31 August		13 September		25 September		18 October	
	(trans. data)*		(trans. data)*		(trans. data)*		(trans. data)*	
(LSD)	(0.274)*		(0.426)*		(0.324)*		(0.298)*	
1. 10kg sulphur applied 7 August	1.3	(1.49)*	2.5	(1.87)*	3.8	(2.16)*	3.8	(2.17)*
2. 0.5l Tilt applied 7 August	0.0	(1.00)	0.5	(1.18)	0.8	(1.32)	1.5	(1.57)
3. 10kg sulphur applied 31 August	2.0	(1.72)	2.5	(1.85)	3.5	(2.12)	4.0	(2.23)
4. 0.5l Tilt applied 31 August	1.8	(1.64)	1.3	(1.47)	1.8	(1.65)	1.0	(1.41)
5. 0.5l Tilt applied 10 September	2.0	(1.72)	2.3	(1.77)	2.0	(1.72)	1.5	(1.57)
6. 10kg sulphur applied 7 & 31 August	2.0	(1.72)	3.3	(2.05)	3.3	(2.06)	3.5	(2.11)
7. 0.5l Tilt applied 7 Aug. & 10 Sept.	0.5	(1.21)	0.0	(1.00)	0.6	(1.26)	0.5	(1.21)
8. Untreated	2.0	(1.73)	3.3	(2.02)	3.5	(2.10)	3.3	(2.05)
9. Untreated	2.0	(1.73)	2.8	(1.90)	4.3	(2.28)	3.0	(1.99)
S.E. per plot (24 d.f.) =	±0.60		±1.02		±0.86		±0.77	
or as % G.M. (finite data)	39.9%		50.4%		33.1%		31.7%	

*Figures in brackets transformed to $\sqrt{x+1}$ for statistical analysis.

The initial score on 31 August, 24 days after the first spray, but before the second spray, showed that only 0.5 l/ha Tilt had reduced the level of brown rust compared with the untreated, and the level of infestation was significantly lower than that following the 10 kg/ha sulphur spray.

At the second assessment on 13 September the difference between Tilt and sulphur applied on 7 August was still apparent. Tilt applied on 31 August reduced brown rust to a level significantly less than the untreated, but the difference between the levels of brown rust on the Tilt and sulphur treatments applied on 31 August was not statistically significant at this assessment, but was at the next assessment on 25 September. At this later date, Tilt applied on 7 August, or on 7 August followed by 10 September, reduced the level of brown rust to less than the level achieved by single sprays on 31 August or 10 September.

On 18 October all application timings of Tilt were still significantly better than the untreated and the sulphur treatments, but the double sprays of Tilt applied on 7 August and 10 September kept the level of brown rust to less than that following the single sprays on 7 August or 10 September.

Brown rust scores, 7 November 1990
(Scores used 0 to 6 scale when 0 = nil and 6 = very severe)

	Old leaves	New leaves (trans. data)*	
(LSD)	(1.00)		(0.274)*
1. 10kg sulphur applied 7 August	4.0	1.3	(1.49)*
2. 0.5l Tilt applied 7 August	4.0	2.8	(1.93)
3. 10kg sulphur applied 31 August	4.0	1.8	(1.64)
4. 0.5l Tilt applied 31 August	1.5	0.5	(1.21)
5. 0.5l Tilt applied 10 September	1.8	0.8	(1.31)
6. 10kg sulphur applied 7 & 31 August	4.8	2.0	(1.72)
7. 0.5l Tilt applied 7 Aug. & 10 Sept.	1.3	0.8	(1.31)
8. Untreated	3.3	1.5	(1.57)
9. Untreated	4.8	2.0	(1.73)
S.E. per plot (24 d.f.) =	±0.69	±0.56	
or as % G.M. (finite data)	21.1%	37.8%	

*Figures in brackets transformed to $\sqrt{x+1}$ for statistical analysis

At the final assessment on 7 November all plots sprayed with Tilt, except the single first spray (7 August) had significantly less brown rust on the older leaves than the untreated, but there was no significant difference between these treatments. Only Tilt applied on 31 August reduced brown rust infection on new leaves compared to the untreated. However, there was much variability between treatments.

Beet populations

Beet populations were not affected by treatment.

Beet vigour

Beet vigour scores
(Scores used 0 to 10 scale where 0 = dead and 10 = healthy)

	13 September	9 November
(LSD)	(NS)	(1.40)
1. 10kg sulphur applied 7 August	9.0	7.3
2. 0.5l Tilt applied 7 August	8.8	8.5
3. 10kg Sulphur applied 31 August	8.5	7.0
4. 0.5l Tilt applied 31 August	8.5	8.3
5. 0.5l Tilt applied 10 September	8.8	8.5
6. 10kg sulphur applied 7 & 31 August	9.0	7.3
7. 0.5l Tilt applied 7 Aug. & 10 Sept.	9.0	9.8
8. Untreated	9.0	7.0
9. Untreated	9.0	7.5
S.E. per plot (24 d.f.) =	±0.47	±0.96
or as % G.M.	5.4%	12.1%

Beet vigour scores showed no significant differences on 13 September, but a late score on 9 November (just before harvest) showed that beet vigour on the Tilt treatment applied on 7 August and repeated on 10 September was significantly greater than that on the untreated controls, all sulphur treatments, and where Tilt was applied on 31 August only.

Beet yields

Yields of clean beet and sugar yield were not significantly affected by treatment, but sugar content on the sulphur treatment applied on 10 September was significantly lower than those on all the Tilt treatments, the double spray of sulphur (7 and 31 August) and on the untreated. The highest sugar content was achieved on the Tilt treatment applied on 10 September, and this was significantly greater than that on the untreated, and on all the sulphur treatments except the double spray on 7 and 31 August. However the variability of these results casts doubt on these differences in sugar content.

Conclusions

0.5 l/ha Tilt applied to sugar beet on 7 August reduced the level of brown rust and the effect was still noticeable on 18 October but had disappeared by early November. Later sprays were more persistent, as was the double spray on 7 August and 10 September. No effects were seen on beet and sugar yield.

1990 was a year when sugar beet at Morley suffered badly from the prevailing dry conditions. Foliage growth was severely restricted and wilting and leaf senescence occurred during August. Soil moisture deficit was 177 mm on 27 August and no appreciable rain fell until late September. Some regrowth of foliage took place in October, but was not appreciable until late in the month. Yields were high, probably because of the good initial growth earlier in the season.

Despite the significant control of brown rust by Tilt, no statistically significant yield differences resulted. The disease was slow in developing and was too late to effect yields. This agrees with previous work at Morley on

foliar disease control, where control of mildew did not result in statistically significant yield increases because of the late arrival of the disease.

However, fungicide treatment might well have helped lifting by top lifting machines such as Armer Salmon types.

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APPENDIX - NAS 744

INVESTIGATIONS INTO THE USE OF PROPICONAZOLE FOR THE CONTROL OF FOLIAR DISEASES IN SUGAR BEET, 1990

Field data, experimental details and dates

	Morley
Soil type	Sandy Loam
Fertiliser	10 October 89 Mag Morley
Previous cropping	1988 Winter barley 1989 Winter barley
Ploughing	30 November 89
Variety	Rex
Drilled	29 March
Plot size	4 rows x 20 m
Row width	50 cm
Cultivations	Dutch harrow
Nitrogen	30 March 43 kg/ha as urea 2 May 82 kg/ha
Pre-em. herbicide	-
Post-em. herbicide	2 May 2.0 l/ha Betanal Tandem + 1.25 kg/ha Goltix WG 11 May 2.0 l/ha Betanal Tandem + 1.25 kg/ha Goltix WG
Other sprays	29 May 0.25 l/ha Decis + 0.4 l/ha Metasystox

Spray dates

7 August

Weather conditions at spraying	20°C, cloudy, sunny spells, wind NW force 0 to 1. Dry. Showers early the previous day, otherwise warm and dry.
Crop growth stage	80% crop cover. Some older leaves dead, only slight wilting of mature leaves. No mildew.

31 August

Weather conditions at spraying	20°C, sunny, wind SW force 2 to 3, dry and dry previous week except for 2 mm on 29th.

Crop growth stage	65 to 70% crop cover. Very little mildew. Less than 1% brown rust.

10 September

Weather conditions at spraying	17°C, cloudy, wind NNW force 1 to 2, dry. Dry previous two days.
Crop growth stage	60% crop cover

Assessment dates

Brown rust scores	31 August 13 September 25 September 18 October 7 November
Beet vigour scores	13 September 9 November

Brown rust scores were done on a 0 to 6 linear scale where 0 = no infection and 6 = very severe. Beet vigour scores were made on a 0 to 10 linear scale, where 0 = dead and 10 = completely healthy.

Beet counts were made on two 18 m row lengths of the two centre rows per plot. Harvest area was also two 18 m row lengths. The trials were sprayed with a 'back-pack' sprayer using CO_2 Cornelius vessels at 2 bar pressure to give a spray volume of 240 l/ha when fitted with Spraying Systems 8003 TeeJet nozzles for Tilt. The sulphur was applied in a spray volume of 500 l/ha using Spraying Systems 8004 TeeJet nozzles at 2 bar pressure. The trial was harvested by a single row Standen Cyclone harvester modified for plot purposes.

Beet population ('000/ha) on 7 November 1990

	(LSD) (NS)
1. 10kg sulphur applied 7 August	86.8
2. 0.5l Tilt applied 7 August	86.4
3. 10kg sulphur applied 31 August	87.5
4. 0.5l Tilt applied 31 August	85.7
5. 0.5l Tilt applied 10 September	89.3
6. 10kg sulphur applied 7 & 31 August	84.2
7. 0.5l Tilt applied 7 Aug. & 10 Sept.	83.9
8. Untreated	85.8
9. Untreated	82.5
S.E. per plot (24 d.f.) =	±5.66
or as % G.M.	6.6%

Harvest yields

	Clean beet yield (t/ha)	Sugar (%)	Sugar yield (t/ha)
(LSD)	(NS)	(0.40)	(NS)
1. 10kg sulphur applied 7 August	59.5	17.6	10.5
2. 0.5l Tilt applied 7 August	59.9	17.8	10.6
3. 10kg sulphur applied 31 August	62.1	17.3	10.7
4. 0.5l Tilt applied 31 August	59.9	17.9	10.7
5. 0.5l Tilt applied 10 September	57.5	18.2	10.5
6. 10kg sulphur applied 7 & 31 August	59.7	17.9	10.7
7. 0.5l Tilt applied 7 Aug. & 10 Sept.	61.8	17.9	11.1
8. Untreated	59.9	17.7	10.6
9. Untreated	58.0	17.8	10.3
S.E. per plot (24 d.f.) =	±3.41	±0.27	±0.56
or as % G.M.	5.7%	1.5%	5.3%