

South African Sugar industry
Agronomist's Association

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Project no: 5110
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Title: Response of sugarcane to various green manure crop combinations in the Umhlali area (Rosemead Farm).

1. Particulars of the project:

This crop	: Plant cane	Soil Analysis: 18/05/2001				
Site	: Rosemead farm,	pH	OM%	Clay%	Sand%	N cat
Region	: Umhlali, KwaZulu-Natal	4.48	2.3	23	17	2
Soil system	: Vryheid Sediments	Ppm				
Soil form	: Glenrosa	P	K	Ca	Mg	Zn
Design	: Randomised blocks	19	89	193	78	2.1
Variety	: N27	Al				
Fertilizer	: N P K	Age: 10.4 (25/09/01 – 7/08/02)				
(kg/ha)	76 33 90	Rainfall: 900mm				
	Split into 2 applications	Irrigation: Nil				

2. Objective:

2.1 To establish the yield response of sugarcane to various green manure crops and green manure crop combinations.

3. Treatments:

Sugarcane following:

- TO Bare fallow control
- T1 Lupins
- T2 Oats
- T3 Lupins + Oats
- T4 Giant English Rape + Oats
- T5 Grazing Vetch + Oats
- T6 Grazing vetch
- T7 Lupins taken through to seed; seed harvested

Notes on treatments:

- Phase 1: The cover crops were grown for a period of 85 days planted on 16 May 2001, and then incorporated into the soil with light discing 85 days later.
- Phase 2: Sugarcane was planted in the trial plots 28 days after incorporating the green manure crops, and harvested just over 10 months later, in August 2002.
- The first ratoon was harvested on the 12th of November 2003, at 15.2 months.
- The second ratoon was harvested on the 2nd of November 2004 at 11.6 months.
- This report combines the sugarcane yield results for harvests from the plant and first two ratoon crops.

4. Results and Discussion:

The green manure species included in the trial were grown over the winter period when cane land often lies fallow until spring planting. Nutrient loading rates are presented in Table 1, and dry matter production in Figure 1.

Table 1: Cover crop nutrient content at 78 days after planting.

Cover crop	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)
T1 Lupins	27.55	1.88	25.00
T2 Oats	37.19	3.57	58.02
T3 Lupins Oats	25.55	1.91	26.44
T4 Rape Oats	37.89	3.39	47.55
T5 Vetch Oats	39.05	3.35	53.68
T6 Vetch	27.78	2.62	33.17
T7 Lupins to seed	29.14	2.17	24.20

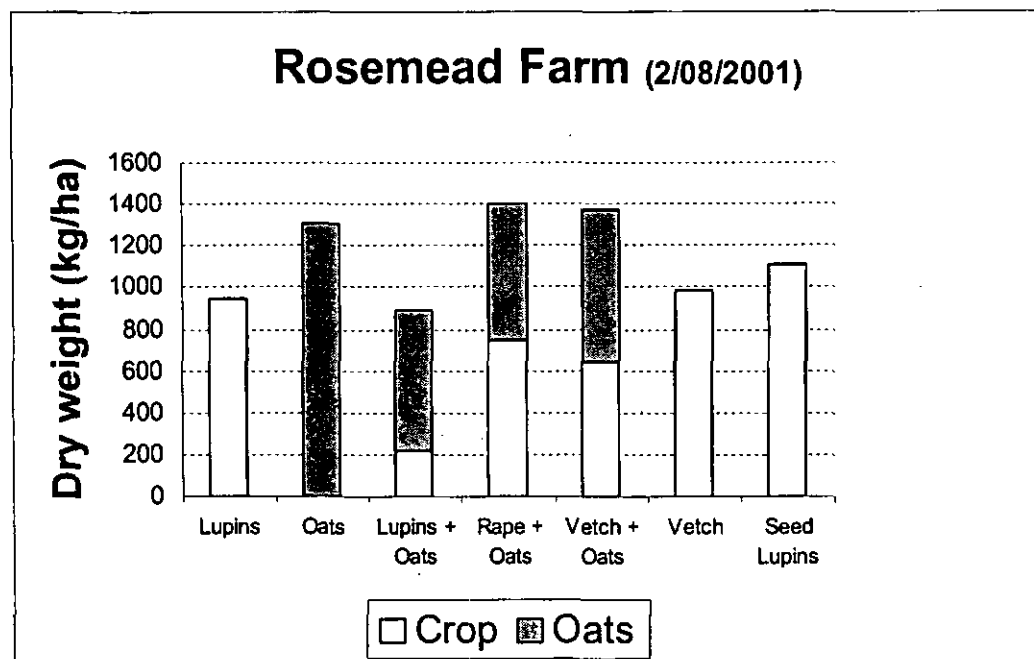


Figure 1: Dry matter production of green manure crop combinations on Rosemead Farm

Oats, Rape + Oats and Vetch + Oats treatments produced significantly higher biomass during the short growing period than the other treatments). All three crops appeared well suited to growing in the area at this time of year, and can be considered suitable as green manure crops. Results from the (oats + lupins) treatment suggested that these

crops were antagonistic towards one another, as their combined biomass was less than either crop grown in isolation.

The green manure crops 'catch' and return nutrients, which will be available to the following cane crop, to the soil (Table 1). The oats, oats + vetch and rape + oats treatments in particular return close to 40kg of N per hectare. It is important to remember, however, that not all of this N will be in a form that is available to the cane. Care should be taken when reducing N applications in the subsequent plant cane crop.

After the green manure crops were disced into the soil, N27 was planted into the trial plots. It was grown for 10.4 months, after which time it was harvested and assessed for yield and quality. Two further ratoons were harvested. The harvest data are recorded in Table 2.

Table 2: Average of cane properties and yields at harvest.

Crop	Treatment: Cane after	Cane yield t/ha	ERC t/ha	Sucrose t/ha
Plant (Aug 02)	T0 Bare fallow	45.5	6.2	6.8
	T1 Lupins	51.1	6.7	7.4
	T2 Oats	49.3	6.9	7.5
	T3 Lupins + Oats	50.8	7.1	7.7
	T4 Rape + Oats	52.3	6.9	7.6
	T5 Vetch + Oats	48.0	6.4	7.0
	T6 Vetch	52.1	7.4	8.0
	T7 Lupins to seed	54.9*	7.2	8.1*
	SED	3.48	0.60	0.62
	LSD _{0.05}	7.12	1.23	1.26
1 st Ratoon (Nov 03)	T0 Bare fallow	55.3	6.0	6.8
	T1 Lupins	58.1	6.0	7.0
	T2 Oats	60.2	6.4	7.4
	T3 Lupins + Oats	59.9	6.8	7.8
	T4 Rape + Oats	60.4	5.9	7.1
	T5 Vetch + Oats	57.0	5.7	6.7
	T6 Vetch	59.8	6.0	7.2
	T7 Lupins to seed	76.1*	8.9*	10.2*
	SED	3.94	0.64	0.67
	LSD _{0.05}	8.08	1.32	1.37
2 nd Ratoon (Nov 04)	T0 Bare fallow	67.2	9.4	10.4
	T1 Lupins	68.3	9.3	10.4
	T2 Oats	67.0	8.7	10.0
	T3 Lupins + Oats	66.4	8.7	9.9
	T4 Rape + Oats	68.1	9.2	10.3
	T5 Vetch + Oats	72.6	9.9	11.1
	T6 Vetch	69.5	9.6	10.7
	T7 Lupins to seed	73.9	10.1	11.4
	SED	5.90	0.91	0.98
	LSD _{0.05}	12.08	1.86	2.00

* = Significantly different from the control plots (P < 0.05)

As evidenced in Table 2, most green manures tested did not significantly increase cane yield, ERC or sucrose content of the subsequent cane crops over the yield obtained after a bare fallow. In the plant crop, only lupins taken to seed significantly improved the cane and sucrose yield per hectare over that of the bare fallow. Interestingly, this effect was found even though the lupin seeds (and therefore a source of protein and nutrients) were harvested. In the first ratoon, the lupins taken to seed again significantly increased not only cane and sucrose, but also ERC yield per hectare. Again, no other green manure crops had this effect. In the second ratoon, there were no significant differences between the yields after green manures, and those in the control fields. In fact, some of the green manure fields yielded lower cane crops than did the control field. *Of all the green manure combinations, however, the lupins taken to seed again promoted a higher yield than any other.*

5. Conclusions

In this trial, no green manure crops, except the lupins taken to seed, showed significant sugarcane yield increases above the bare fallow. Although the lupins taken to seed still showed a yield benefit in the third ratoon, the increase was not significant. The trial was thus terminated.

It would have been of interest to have a cane-on-cane control, as well as the bare fallow, as this would give a more accurate indication of the potential benefits of green manuring – cane yield is often increased after a bare fallow as well. The variety N27 is also known to be susceptible to nematodes and the potential benefits in terms of effects on nematodes of these green manure crops on sandier soils is currently being investigated.