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# Closed-Loop Wool Carpet Recycling

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# Closed-loop Wool Carpet Recycling

By

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# Canesis Network Ltd

- Who are we?
- Canesis was formerly WRONZ (The Wool Research Organization of New Zealand)
- Wool Interiors is a division of Canesis and owns the Wools of New Zealand Brand.
- Wool Interiors works with spinners, carpet manufactures and other technology suppliers around the world.
- We have 290 partners in 25 Countries

# Background

Disposal of post-consumer carpets, and waste from manufacturing and installation, produces large volumes of waste for landfills, where it does not readily degrade, eg USA almost 5 billion pounds per annum (Watson, 2005).

An increasing number of consumers are using environmental considerations when choosing floor coverings (Watson, 2005).

Incineration is only possible in regions with the necessary infrastructure and increasing environmental pressures make the future of incineration uncertain.

*Watson, S.A., 2005. Environmentally responsible carpet choices. Journal of Family Consumer Science 97(1), 27-32.*

# Some of the recycling options investigated for wool carpets

Carpets have been made with wool pile, primary backing, secondary backing, and a latex substitute based on wool hydrolysate, to increase the options for recycling (Macdonald et al., 1995).

Wool carpets have the potential for closed-loop recycling, involving returning the used carpet to the soil as a fertiliser.

In wool producing countries, these nutrients would be available to help grow more wool. In non-wool growing countries, it would still be a useful fertiliser/soil conditioner.

*Macdonald, R.J., et al., 1995. "Green" recyclable wool carpets: dream or reality? 9th International Wool Textile Research Conference, Biella, Italy, 1, 146-154.*

# Experimental

We performed 2 small-scale trials in which post-consumer wool carpet was mechanically ground-up, returned to the soil, and the effect on grass yield and grass nutrients measured.

Ground-up  
carpet



# Trial 1

The trial was conducted on soil considered to have a high fertility, (7% organic matter, pH 5.6, free draining, few stones, latitude 43° south). The pasture had been long established with grass before the trial and had not been regularly fertilised.

A 5 by 5 m section of pasture was rotary hoed and divided into four plots, each 2.5 by 2.5 m. The ground-up carpet was rotary hoed into two diagonally opposed plots at 1.04 kg/m<sup>2</sup> and given 14 days to start decomposition.

Ryegrass sown at 5 g/m<sup>2</sup> in early spring over all plots. The plots were watered every 2-3 weeks, as conditions were dry.



**Immediately  
after digging-  
in ground-up  
carpet**

**6 weeks  
after sowing**

**5 weeks after  
first harvest**

# Grass yield (kg) for the four plots given different soil treatments

Days after planting	State of grass	Control plots		Ground-up carpet plots		Mean yield increase due to carpet (%)
		NE	SW	NW	SE	
105	Freshly cut	20.04	17.71	25.28	25.01	33
105	Dried	5.34	5.51	6.58	6.91	24
174	Freshly cut	4.18	4.66	6.14	11.08	95
174	Dried	1.03	1.26	1.59	2.58	82

# Elemental analysis of carpet and application levels

Element	Level in carpet (ppm)	Mass added to soil (g/m <sup>2</sup> )
Nitrogen	54,900	57.1
Phosphorous	550	0.57
Potassium	1,300	1.35
Sulphur	12,000	12.5
Calcium	108,000	112
Carbon	326,000	339
Chromium	4.5	$4.7 \times 10^{-3}$
Magnesium	770	0.80
Zinc	2,370	2.47

# Elemental analysis of grass (ppm on dry weight)

	105 days		174 days	
	Control	Fertilised	Increase (%)	Increase (%)
<b>Nitrogen</b>	20,000	23,836	19	19
<b>Phosphorous</b>	2,556	1,663	-35	-8
<b>Potassium</b>	35,556	32,151	-10	-6
<b>Sulphur</b>	2,667	2,882	8	19
<b>Calcium</b>	4,333	4,324	0	0
<b>Carbon</b>	515,556	512,195	-1	0
<b>Chromium</b>	0.61	0.59	-3	0
<b>Magnesium</b>	2,556	2,550	0	7
<b>Zinc</b>	31	51	65	61

# Conclusions from trial 1

Ground-up carpet improved yield and nutrient levels of grass

High level of zinc in carpet (from backing latex) may limit frequency of application. Can levels in carpet be reduced?

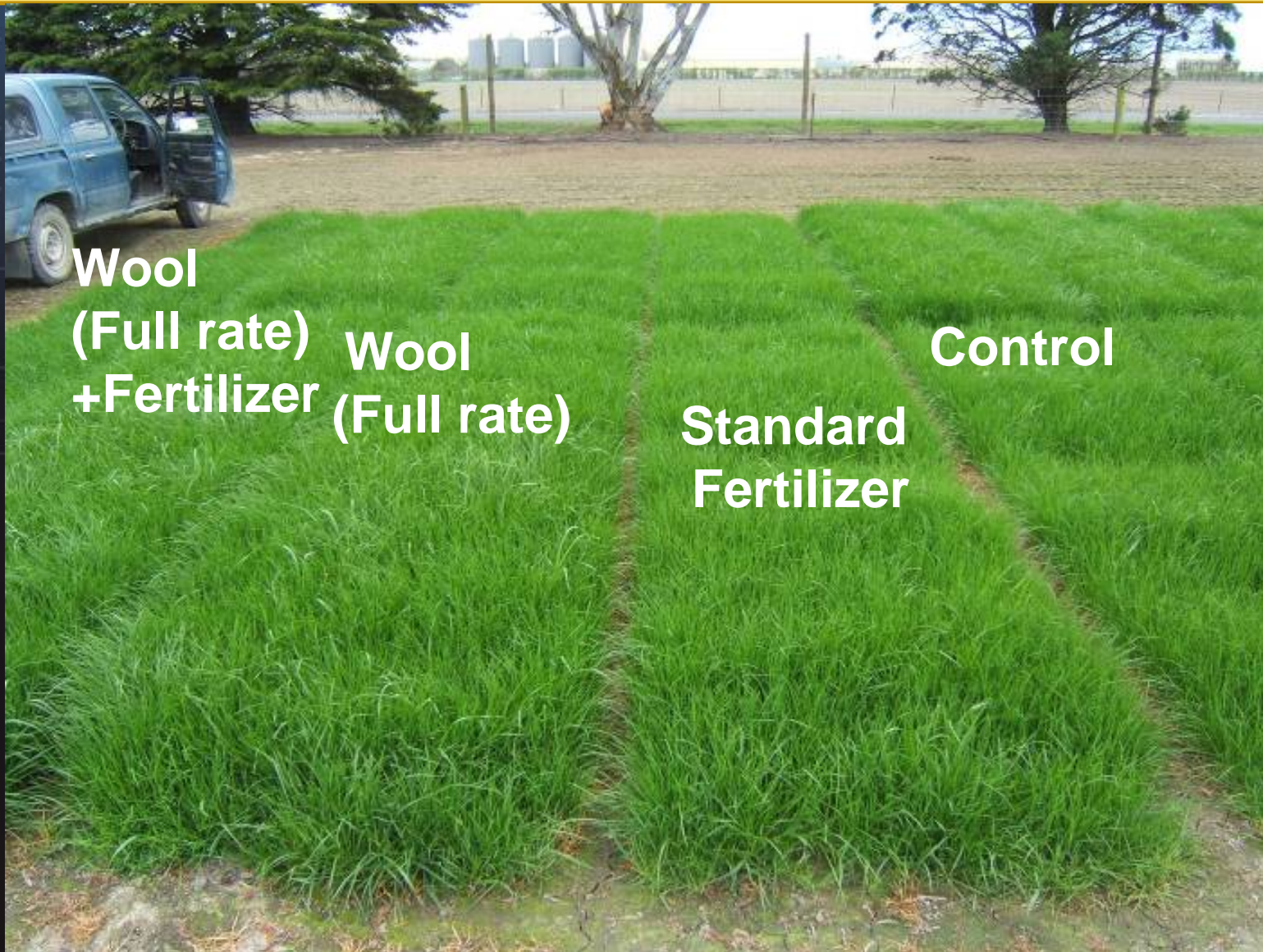
No Increase in chromium

# Trial 2: Underway

## Small plots treated with

1. Control, no additives
2. Ground-up carpet, at 2 levels
3. Inorganic fertiliser
4. Ground-up carpet + Inorganic fertiliser

# Trial 2



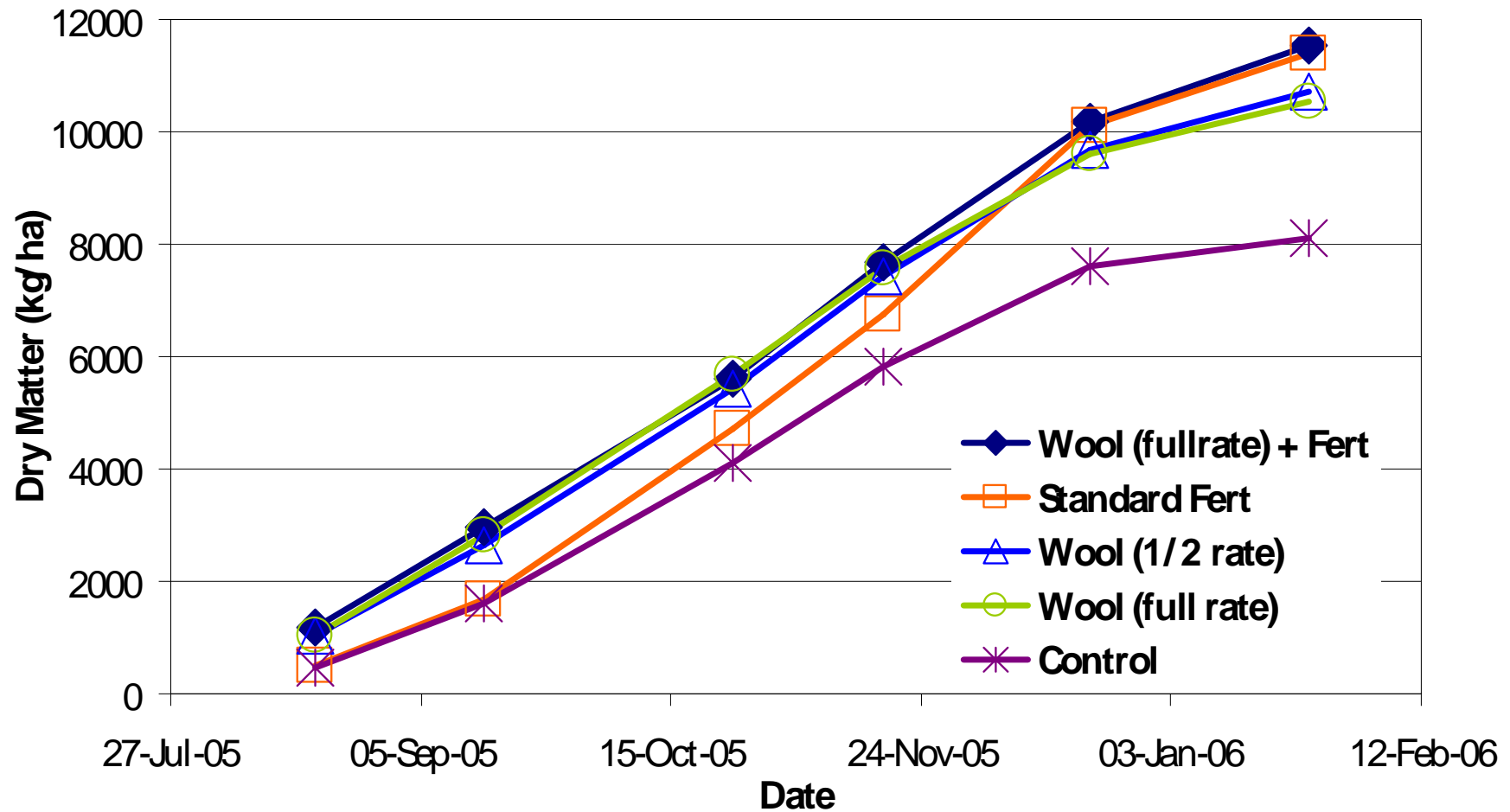
**Wool  
(Full rate)  
+Fertilizer**

**Wool  
(Full rate)**

**Standard  
Fertilizer**

**Control**

# Trial 2: Cumulative Grass Biomass



# Conclusions

Ground-up wool carpets can be used as a fertiliser, increasing the yield and nutrient levels of grass.

This closed-loop cycle, grass-wool-carpet-grass is an efficient form of fibre recycling