

# Polymer technology to improve uptake efficiency of copper in pastures

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## Abstract

A single application to a dairy pasture in March 2017 of polymer coated (Surflex™) fertiliser incorporating copper (Cu) as CuO, to the surface of single super phosphate (SSP) was compared with a conventional standard trace element product (SSP+CuSO<sub>4</sub>) and a control of SSP-only. The trial was run over three harvests with yield and plant analysis completed at each harvest. Plant uptake, and uptake efficiency of Cu was significantly greater for the Surflex treatment over all harvests (P<0.001), and for each individual harvest (P<0.5-0.01) compared with the standard treatment.

## Introduction

Overcoming trace element (TE) deficiencies in crops, pastures and livestock has a long history in New Zealand, where one solution has been to mix trace element compounds as powder and granules with macro-elemental fertilisers. These are then spread over the pasture to increase the TE concentration in the plant and thus, reduce the incidence of deficiency symptoms or poor thrift in the crop, pasture or livestock. However, the risk of uneven TE application increases with, the smaller the per hectare rate of TE application and combined with the difference in TE particle size compared to the macro nutrient granule size, which may encourage product settling during transport. In addition there is an urgent need to increase the plant nutrient uptake efficiency of all nutrients to reduce loss to the environment and to get more value from the nutrients applied.

## Materials and methods

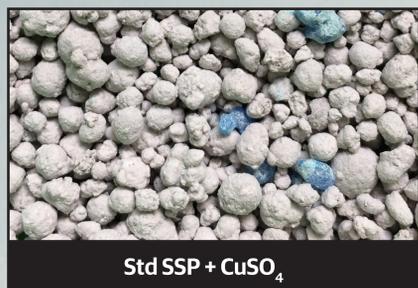
A pasture plot trial was set up in March 2017 on a perennial ryegrass-white clover pasture at the Lincoln University Research Dairy Farm (LURDF; 43 38 16S 172 27 29E) on a Paparua sandy loam. The trial consisted of three Cu treatments replicated 17 times in a randomized block design (plots 5m x 1m). Treatments were all superphosphate (SSP) based products applied at 40kg P/ha, where the TE's were either combined in a polymer-coating (Surflex™) to the main fertiliser or admixed as solid granules.

The pasture was mown down to 1600kg DM/ha at each harvest (3 in total over 6 months) to simulate a grazing event prior to trial establishment. Climate data was taken from the climate monitoring station at the research farm.

Treatments were:

1. Control (SSP-no TE)
2. Std SSP + CuSO<sub>4</sub>
3. Surflex™-Cu coated SSP

Mown pasture herbage for each plot was weighed for DM yield and a sample dried at 60°C for DM% before being sent off for laboratory analysis (Analytical Research Laboratory - ARL). Statistical ANOVA was conducted using Genstat 9.



Std SSP + CuSO<sub>4</sub>



Surflex Copper 10 SSP

SSP mixed with copper granules at 10kg elemental copper per tonne

Surflex™ coated SSP granules at 10kg elemental Copper per tonne

Figure 1: Visual comparison of the two products.

The mixes were made for each product targeting a Cu concentration of 15,600 mg Cu kg<sup>-1</sup> SSP. These were subsequently tested for variation in TE content and were as per Table 1.

Table 1: Target and actual Cu content of each product		
Target copper concn. (mg Cu kg <sup>-1</sup> SSP)	Actual	
	SSP-CuSO <sub>4</sub>	Surflex-CuO coated
15,600	18,700	15,100
6.9 Per hectare equivalent (kg Cu/ha)	8.3 Per hectare equivalent (kg Cu/ha)	6.7 Per hectare equivalent (kg Cu/ha)

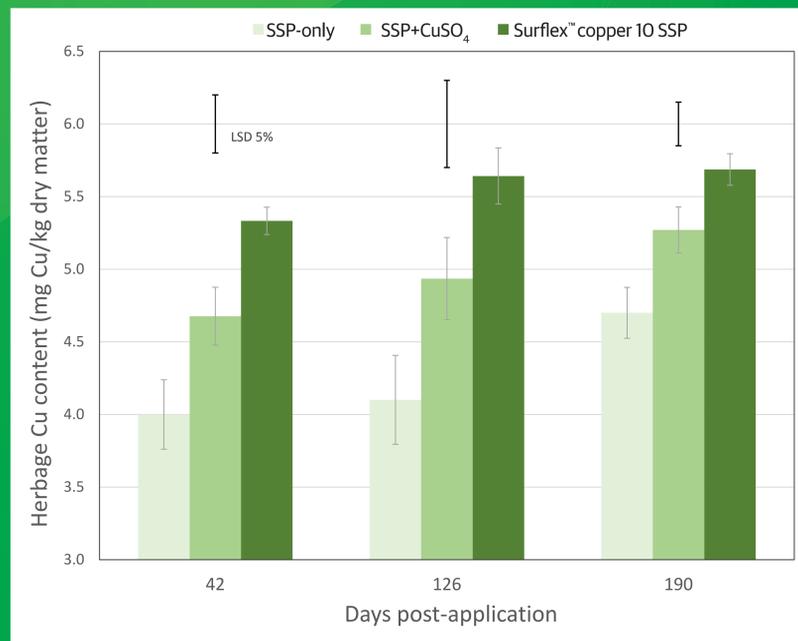


Figure 2. Comparison of application method on plant uptake of Copper (concentrations adjusted for differences in Cu application rate).

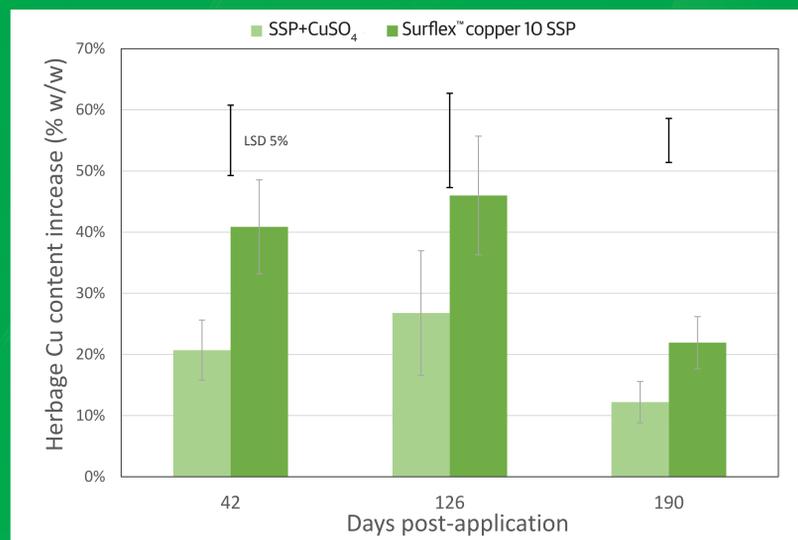


Figure 3. Relative copper plant uptake efficiency for the Surflex-Cu treatment compared with the traditional TE application method (over the control- SSP-only).

## Discussion

The use of the Surflex™ technology significantly increases pasture plant uptake of copper. Further work is required to understand the mode of action behind this increase, however there is a hypothesis that the probable increase in copper distribution across the paddock, and the use of copper oxide which is insoluble in water, has some influence over the increased nutrient uptake efficiency.

In addition to the increased plant nutrient uptake, the lift in product quality was observed at time of dispatch, and when applied by the trial operators. In addition, the polymer also binds a large proportion of dust and fine particles to the SSP. This has benefits both environmentally for a potential reduction in product drift when aerially spread, and health and safety of people handling and loading the product.

These results are seen as very encouraging for the use of trace elements applied to major nutrient fertilisers in a polymer form.



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