# Diverse Species Pasture

***Highly diverse pasture mix: Impact***

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# Contents

# Purpose

***This project aimed to monitor the impact of highly diverse pasture (19+ species in each individual mix – see slide 4) on milk quality, soil root penetration, animal behaviour, pasture composition and soil organic matter/soil biology over the three year life of the project.***

**Table 1. Mixed species pasture composition for Mixes I, II and III**

| | Mix I | Kg/ha | Mix II | Kg/ha | Mix III | Kg/ha |
|---|---|---|---|---|---|---|
| 1 | Cocksfoot | 4.19 | Cocksfoot | 0.5 | Cocksfoot | 0.5 |
| 2 | Plantain | 0.5 | Plantain | 0.5 | Plantain | 0.5 |
| 3 | Chicory | 1 | Chicory | 0.5 | Chicory | 1 |
| 4 | Timothy | 2.09 | Timothy | 1 | Timothy | 2 |
| 5 | White clover - large | 0.5 | White Clover | 1.5 | White clover - large | 1 |
| 6 | White clover - medium | 0.5 | Balensa Clover | 0.5 | White clover - medium | 0.5 |
| 7 | White clover - small | 0.5 | Strawberry Clover | 1 | White clover - small | 0.5 |
| 8 | Alsike clover | 1 | Arrowtas Clover | 0.3 | Alsike clover | 0.5 |
| 9 | Red clover | 1 | Red Clover | 1.5 | Red clover | 1.5 |
| 10 | Brome | 2.19 | Brome | 3 | Brome | 2.5 |
| 11 | Prairie Grass | 2.19 | Prairie Grass | 3 | Prairie Grass | 2.5 |
| 12 | Parsley | 0.8 | Black Oats | 3 | Vetch | 2 |
| 13 | Lucerne | 1 | Lucerne | 2 | Lucerne | 2 |
| 14 | Birdsfoot Trefoil | 0.5 | Vetch | 2 | Birdsfoot Trefoil | 0.5 |
| 15 | Sheeps Burnett | 0.4 | Sheeps Burnett | 0.5 | Sheeps Burnett | 0.5 |
| 16 | Yarrow | 0.3 | Phacelia | 0.2 | Phacelia | 0.2 |
| 17 | Tall Fescue | 4.09 | Fescue | 4 | Tall Fescue | 4 |
| 18 | Red Fescue | 4.09 | Festulolium | 2 | Red Fescue | 4 |
| 19 | Meadow Fescue | 4.09 | Ryegrass | 2 | Meadow Fescue | 4 |
| 20 | | 30.93 | Perennial Ryegrass | 4 | Festulolium | 2 |
| 21 | | | Buckwheat | 1 | Buckwheat | 1 |
| 22 | | | | 34.00 | Arrowtas Clover | 0.3 |
| 23 | | | | | Strawberry Clover | 0.5 |
| | | | | | | 34.00 |
| 5 | Clovers | 3.5 | 5 | 4.8 | 7 | 4.8 |
| 2 | Other legumes | 1.5 | 2 | 2 | 3 | 2.5 |

# Description

Drilling of highly diverse pasture mixtures into 5 different sites across four different dairy farming properties in the North Otago/South Canterbury regions of the South Island.

Three different mixes were utilized.

Aiming to determine if the grazing of diverse mixtures would produce milk with lower levels of sodium thiocyanate (NaSCN) and to identify other benefits arising from the implementation and utilization of highly diverse pastures.

# Explanation

All milk contains sodium thiocyanate (ST), can be toxic to humans in high quantities. Milk produced in New Zealand (NZ) does not contain dangerous levels, but recent study testing samples from NZ, The Netherlands and China found NZ had highest levels, just over 10mg/kg.

Milk testing, a thorough literature review and an earlier research project clearly demonstrated high clover diets produce high ST levels in milk. Works against farmers seeking to reduce synthetic N fertiliser (and therefore nitrate leaching) by utilising biological sources of nitrogen (i.e. clover) in order to deliver improved environmental performance.

Looked at alternative highly diverse pasture mix (between 19 and 23 different species) vs. the standard mix, to see if grazing a diverse pasture mix lowers ST levels in milk. Over three years on five farms in North Otago/South Canterbury – became four farms.

Also looked at other impacts including animal behaviour (welfare), root penetration (deeper root penetration is associated with lower nutrient loss and improved soil organic matter levels), pasture establishment and performance, soil organic matter/soil biology (soil productivity and carbon sequestration factors), and productivity (milk production).

View that the study could assist making on-farm management changes delivering improved environmental outcomes (reduced synthetic nitrogen use, increased SOM/soil biology etc.)

# Methods + Analysis

Management of the project

Sodium thiocyanate levels

Milk production

Pasture root penetration

Soil carbon/soil biology

- Soil carbon %, soil organic matter and soil biology
- Hot water extractable carbon method

Pasture composition

Cow behaviour

# Challenges

One additional established site was lost due to contractors mistakenly spraying out the wrong paddock.

- 5 down to 4 farms

Participants viewing it as a trial of different mixtures

Fitting into existing management system/grazing rotation

Too small an area to obtain a long period of grazing to impact on cows/milk.

- ST, production etc.
- Information not supplied

Seasonal fluctuations

Drilling/establishment

# Results

Rooting Depth

Soil Carbon

- OM, superior for all except site 2

Milk Production and cow behaviour

Sodium thiocyanate (NaSCN)

Soil Biology

# Conclusions

Small leaf clover main driver of Sodium thiocyanate (NaSCN) levels; Climate is a key determinant of NaSCN levels in milk from pasture based systems

Diverse pasture mixes not the same as ryegrass or ryegrass/clover mixes

Plantain and chicory most persistent, prevalent and well performed
- Plantain number one, chicory performed well in summer but less visible during winter

Diverse mixtures deeper rooting

Potentially available nitrogen superior under the diverse mixtures

OM largely superior under diverse grazing mixtures
- At times significantly (63%)

Soil biology consistently superior under diverse mixtures
- Except in the case of Mix II and in general this was by a material amount

Superiority of soil biology may result in superior productive and environmental performance and is supportive of further study to identify and evaluate actual benefits arising from this identified advantage

# Practical Guidelines for Farmers

Attitude

Drilling/Establishment

Management

External Input

Record, review, report