

RESILIENT ROTATIONS: NITROGEN USE EFFICIENCY SOUTHERN PRAIRIES



Research has shown the benefits of diversifying crop rotations, and yet most Prairie farmers keep their rotations short and simple with cereals and oilseeds being intensively grown. For the past four years, researchers across Western Canada have compared different crop rotations to measure the drawbacks and benefits. This work is designed to help farmers make crop rotation decisions that are the best fit for their operation, based on local research.

Six different crop rotations were studied in Alberta, Saskatchewan and Manitoba to represent growing conditions in the Canadian Prairies. This factsheet looks at the differences between rotations for **nitrogen use efficiency**.

NITROGEN USE EFFICIENCY

Nitrogen use efficiency was calculated as the ratio of grain yield (expressed as canola equivalent yield, CEY) to available nitrogen (soil mineral nitrogen + applied nitrogen fertilizer).

The nitrogen fertilizer rates were determined by soil test recommendations except for the market driven rotation treatment which received 1.2 times the recommended nitrogen fertilizer rate to maximize yield.



**Integrated Crop
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SOIL MINERAL NITROGEN + APPLIED NITROGEN FERTILIZER = AVAILABLE NITROGEN (lbs actual N/ac) for the six crop rotation treatments at the two experimental sites in the Southern Prairies

Rotation Treatment	Lethbridge, AB		Swift Current, SK	
	Soil Mineral N	Applied N Fertilizer	Soil Mineral N	Applied N Fertilizer
Control	79	63	53	52
Intensified	57	37	42	36
Diversified	62	29	41	27
Market Driven	69	62	74	65
High Risk	73	29	46	36
Soil Health	58	26	46	24

Averaged across the two sites, the **market driven** rotation had the highest rates of applied nitrogen fertilizer while **diversified** rotation and the **soil health** rotations had the highest proportion of soil mineral nitrogen.



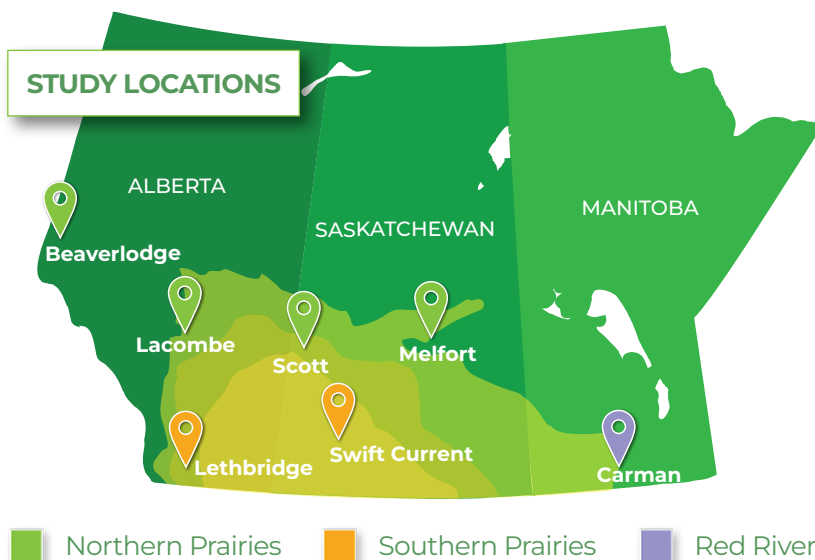
NITROGEN USE EFFICIENCY (NUE) BY CROP ROTATION IN SOUTHERN PRAIRIES, 2018-2021

Rotation Treatment	Crop Species Used Based on Local Growing Conditions				Nitrogen Use Efficiency Ranking of Various Crop Rotations*	
	Year 1	Year 2	Year 3	Year 4	Lethbridge	Swift Current
Control	Fallow	Durum	Malt Barley	Durum	●	●
Intensified	Lentil	Durum	Chickpea	Durum	●	●
Diversified	Lentil	Canola	Pea	Durum	●	●
Market Driven	Flax (Swift Current) Canola (Lethbridge)	Wheat	Lentil (Swift Current) Wheat (Lethbridge)	Feed Barley (Swift Current) Malt Barley (Lethbridge)	●	●
High Risk	Soybean	Canary Seed (Swift Current) Corn (Lethbridge)	Faba Bean	Durum	●	●
Soil Health	Forage Pea Green Manure	Barley Pea Intercrop	Faba Bean Barley Intercrop	Durum	●	●

Nitrogen Use Efficiency Ranking*

● = good nitrogen use efficiency ● = statistically lower nitrogen use efficiency ● = statistically lowest nitrogen use efficiency

*Nitrogen use efficiency ranking is calculated by location



THE BOTTOM LINE

- The **intensified** and **diversified rotations** consistently had the highest nitrogen use efficiency in the southern Prairies. This is likely attributed to having pulse crops in the rotation for two of four years.
- The **soil health** rotation significantly reduced the amount of nitrogen fertilizer applied by approximately half of what was applied to the control rotation; however, the **soil health** rotation did not have a high nitrogen use efficiency because of its low yield.

FOR MORE INFORMATION

More information on how these crop rotations stack up in terms of yield and yield stability, precipitation use efficiency and net returns have been covered in separate factsheets as part of this series.

These results are based on the first four years of the study. More robust results are expected if a second four-year cycle of the study is completed.

This factsheet is part of a series by Resilient Rotations – a project of the Integrated Crop Agronomy Cluster – led by Kui Liu, AAFC Swift Current – the project examines the benefits and drawbacks of different crop rotation options for farmers across Western Canada.

To find out more visit wgrf.ca/resilient-rotations-factsheet/