Soil
FACTSHEET

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Fertility Management and Placement in Peace River Conservation Tillage Systems

INTRODUCTION

Loss of soil organic matter has been a concern on the prairies. Cultivation has encouraged the oxidation process of organic matter. Increasing use of nitrogen fertilizer can also accelerate organic matter decomposition, especially when broadcast and incorporated onto fields.

The interest in conservation tillage has resulted in the retention of high amounts of crop residues at or near the soil surface. Crop residue management has many impacts on soil fertility management that need consideration when aiming for good crop yields.

NITROGEN

1. Crop Residue Management

Residue decomposition is an interaction of physical, chemical, and microbial soil processes. The most significant factor in crop residue decomposition is by activity of the soil's microbes.

Microbial activity relies on warm soil temperatures, moist soil, and an energy and nutrient supply (mainly carbon and nitrogen) to quickly decompose soil organic matter. These conditions only occur during the growing season in the Peace River region.

When residues are left at the soil surface, decomposition slows down, and organic matter levels increase. This has beneficial results in improving soil structure and increasing the resistance to soil erosion, but there are some aspects of fertility management that have to be considered.

High surface crop residue volumes require microbial activity to decompose the residue and release crop available nutrients and by-products which improve soil structure. Nitrogen is in high demand by soil microbes. Broadcasting nitrogen fertilizer without incorporation onto a soil with high surface residue volumes, can result in reducing the amount available for crop growth.

Most producers now place nitrogen in the soil either with separate banding operations, in bands near, below or with the seed. Banded nitrogen is separated from the decomposing crop residue at the soil's surface.

2. Denitrification

Denitrification refers to the process where microbes strip oxygen off the nitrate-nitrogen during periods of water saturation. This process requires warm soil temperatures, and a supply of decomposing organic matter. Deep placed nitrogen will not be affected to the same degree due to the lower bacterial activity. However, even banded nitrogen may be lost from soils if saturated for a long time.

Zero tilled soils have shown that they have a higher tendency of undergoing denitrification than tilled soils, especially in the first few years after no tillage has occurred. This may be due to the initial increase in surface density, and increasing surface organic matter levels which will retain water in the soil. There have been 3 out of the last 12 seasons in which denitrification has been a problem on no-tilled grain crops in the Peace River region.

The lack of nitrogen may be alleviated by top dressing (applying on a standing crop without incorporation) with nitrogen fertilizer once the field can be driven on. Once soil conditions will allow tractors and fertilizer spreaders to travel with little surface damage, the soil has drained sufficiently to apply more nitrogen without further losses to denitrification. Further precipitation is required to move the surface applied nitrogen down into the rooting zone. Excessive rainfall will start another round of denitrification.

Appropriate nitrogen fertilizers that can be used for top dressing are ammonium nitrate (34-0-0) and ammonium sulphate (21-0-0-24S). Urea fertilizers should be avoided as the fertilizer is prone to volatilization.

PHOSPHORUS

1. Seed Placement or Banding

Phosphorus availability is lower in cool soils. Concentrating phosphorus into bands or by placing it with the seed ensures that there are sufficient amounts available for the early crop development.

Soil temperature in early spring under no-till is often lower than in cultivated soils. This is due to shading at the surface, and the higher water content in the no-till soils. However, by the third week in May (based on long-term averages), soil temperatures at the seeding depth may be very similar.

Broadcasting and incorporating phosphorus encourages complexing reactions with soil minerals that may make phosphorus unavailable, or very slowly available to the crop.

Research into the rooting patterns of developing cereal crops shows that there is an optimum depth at which the root systems use fertilizers most efficiently. Banding fertilizers approximately 1.5 – 2 inches to the side and 2 inches below the seed row has given the best performance over other banding or broadcast applications especially in dry soils. The fast growing root systems are further promoted to reach to lower soil depths with this kind of placement, and not concentrate in the surface soil.

Banding has advantages in very acid soils (less than pH 5.5) by reducing the phosphorus fertilizer to soil contact area. This improves phosphorus availability by reducing the amount of phosphorus that complexes with aluminum in acid soils, and is unavailable for crop growth.

Seed placed phosphorus has advantages over broadcast in a similar way as banded phosphorus. Disadvantages are that the amount that can be placed with the seed is limited; and placing phosphorus near the surface may promote root branching in a drier surface soil as compared to deep band placement.

SULPHUR

Sulphate sulphur is mobile in soils, and placement is not critical. But since most sulphate is applied with a nitrogen carrier, then the same restrictions apply as to the amount to be placed with or near the seed. Elemental sulphur will need specific bacterial action to be converted to sulphate and mixing with the soil will assist in speeding up the process. Banding sulphur has not shown extra advantages.

BORON

Most cereal crops do not require boron and crop scorching damage can occur from small amounts of added boron. Canola has high requirements for boron, but boron should not be seed placed. Banding in moist soils is effective, especially when not close to the seed row and when at very low boron rates. Surface applications are suitable as it moves through the soil profile, but at a slower rate than nitrates or sulphates.

GENERAL FERTILIZER RECOMMENDATIONS

Soil testing is always recommended to establish the nutrient requirements of crops. However, general recommendations on amounts and placement can be made. The recommendations are for crops following stubble.

FERTILIZER RECOMMENDATIONS

Grains -	Nitrogen	60-80 lbs N/acre
	Phosphorus	20-40 lbs $P_2 0_5$/acre
	Potassium	0-15 lbs $K_2 0$/acre
	Sulphur	0-15 lbs S/acre
Canola -	Nitrogen	60-90 lbs N/acre
	Phosphorus	15-30 lbs $P_2 0_5$/acre
	Potassium	0-15 lbs $K_2 0$/acre
	Sulphur	0-20 lbs S/acre
	Boron	0-2 lbs B/acre

PLACEMENT

A. Deep Banding

1. Andrydrous Ammonia

Fall banding as a separate operation from seeding is preferred in a minimum or zero till situation. Spring banding often causes too much soil disturbance. Recommended depth – 4 to 5 inches due to the higher soil moisture conditions.

2. Below and/or side of seed

Band fertilizer at a minimum 1.5 inches distance and a maximum 2.5 inches below the seed for optimum response. When the band is placed over and down from the seed row, the maximum distance should be 2 inches.

B. Seed Placed Fertilizers

1. Nitrogen

1.1. Cereals

Do not apply more than **30 – 40** lbs N/acre with seed on moist loam to dry soils; 20 – 30 lbs N/acre on sandy loams. Apply less on dry soils.

1.2. Canola/Flax

1.

Do not apply urea or ammonium nitrate at rates more than **10 – 15** lbs N/acre. The upper rate could be used with air seeder shoes that fan the fertilizer out and reduce potential seed contact with the fertilizer.

C. Broadcast

Without incorporation -

Surface broadcast fertilizers are subject to volatilization losses, especially urea. Surface broadcasting should only be considered in an emergency situation such as after nitrogen deficiencies develop due to denitrification. Preferable fertilizers for top dressing are:

- ammonium nitrate 34-0-0
- ammonium sulphate 21-0-0-24(S)

With incorporation -

Nearly all nitrogen carriers are adequate when broadcast and incorporated. Phosphorus carriers (12-51-0 etc.) are not efficient when broadcast and incorporated for supplying phosphorus to a growing crop.

FOR FURTHER INFORMATION CONTACT
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