A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

Printed: April, 1997
ISSN 1188-4770, Group 9 (f)

Research Update 731

Seed Placing Fertilizer?

Don't Gamble With Fertilizer Rates!

Use risk analysis to minimize yield loss with seed-placed nitrogen.

PAMI has just completed a multi-year project looking at seed-placed fertilizer rates with three different types of soil openers and three different crops. This report summarizes how to determine the safe rates of nitrogen that can be placed with either cereal or canola seed in a single pass. Read on for more details.

It's clear from the growing body of research that direct-seeding cuts equipment investment and operating costs, and saves labour. The surge in direct-seeded acres in recent years is evidence that farmers agree.

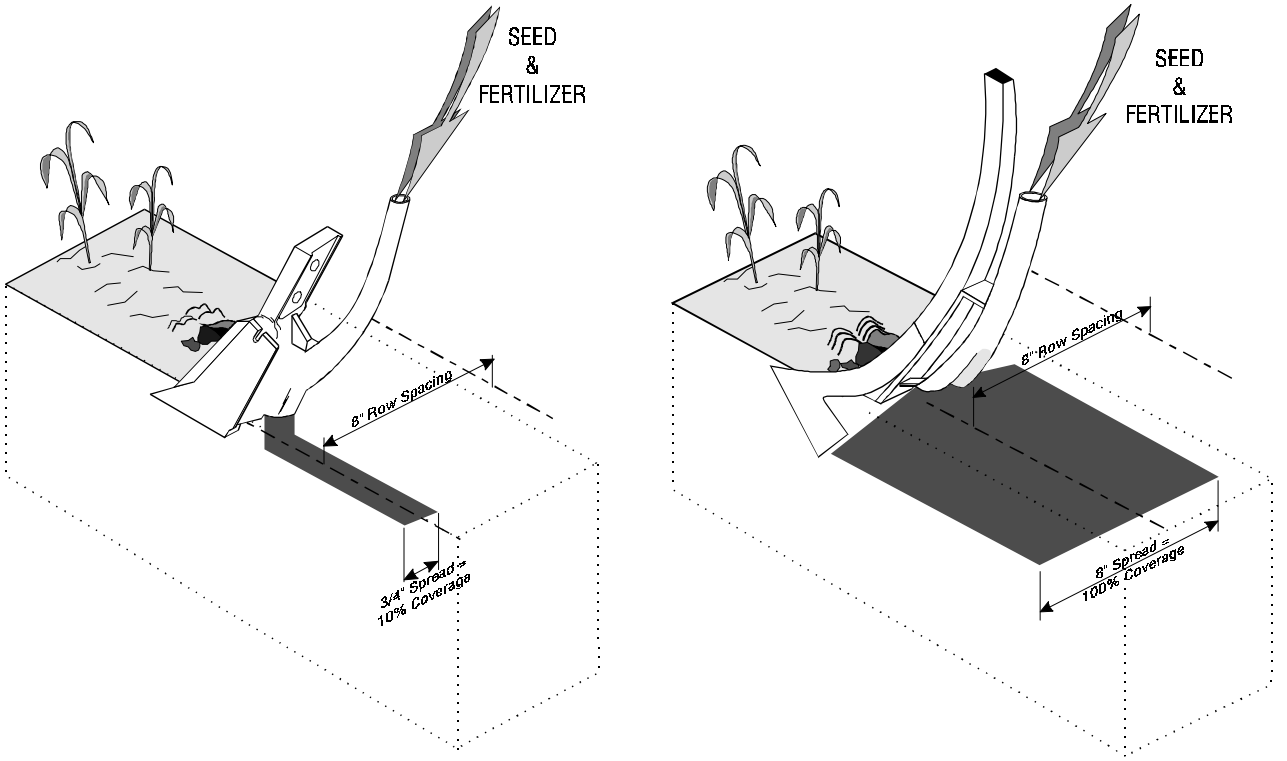
Air seeders or air drills that can double-shoot or side-band are ideal one-pass systems. The risk of seed injury and yield reductions are minimized with a good seed to fertilizer separation. One-pass systems that place seed and nitrogen (N) together can also be used successfully, but the risks are higher.

The $64 question for farmers who want to seed-place N is: how do you determine safe rates?

It's a two-step risk analysis that weighs all the factors or conditions on your farm. The first step involves the factors row spacing, and the spread pattern of seed and N. The two factors are used to calculate Seed Bed Utilization, or SBU . It's a reading of the relative risk of emergence damage and

Continued on page 2

NOTE: Most test plots used in this study had medium soil texture and excellent moisture conditions at seeding depth. Readers should understand that results will vary with different soil textures, moisture conditions, and row spacings.



The traditional knife opener at left places fertilizer in a narrow band (3/4") with the seed. Fertilizer rates that are too high will burn the emerging seedling and adversely affect plant vigour, resulting in poor weed competition and delayed maturity. The sweep opener at right places fertilizer in a wide band (8") with the seed. Higher rates can be applied because seed-to-fertilizer contact is minimized by the wide spread.

Clockwise, from top left: Spoon, Sweep, Knife. PAMI applied rates of 0, 35, 70 and 105 pounds (7.7, 15.4, 23.1 kg), respectively, of N as urea with the seed on 8" centres. Seed and N were spread 3/4 inches (19 mm) with a knife, 2 inches (50 mm) with a spoon, and 7 inches (175 mm) with an 8 inch (200 mm) sweep. Preliminary results suggest the knife presents the most risk to emergence damage and yield loss, and the sweep the least. ***Note: Spread width is not usually the same width as the opener. PAMI used a special spreader boot and a high fan speed to achieve the wide spread pattern with the sweep.***

yield reduction with seed-placed N.

To calculate the SBU, divide the width over which the seed and N spread by the row spacing and multiply by 100. For a more detailed explanation of SBU, see the box "How to Interpret SBU".PAMI research confirms that SBU is a good indicator of emergence damage and yield loss risk for wheat, barley and canola.

Rates of 0, 35, 70 and 105 pounds (7.7, 15.4, 23.1 kg), respectively, of N as urea were placed with the seed on 8" centres. Seed and N were spread 3/4 inches (19 mm) with a knife, 2 inches (50 mm) with a spoon, and 7 inches (175 mm) with an 8 inch (200 mm) sweep.

The SBUs for a 3/4 inch (19 mm), 2 inch (50 mm) and 7 inch (175 mm) seed and N spread on an 8 inch (200 mm) spacing, respectively, are: 9%, 25% and 88%. This suggests the knife presents the most risk to emergence damage and yield loss, and the sweep the least.

Wheat and Barley

Here's the results for the three-year research project (which generally confirms the first year results published in Interim Research Update 718 on the same project) on wheat and barley:

• The knife caused emergence and yield to decrease as the N rate increased, except for wheat yields which increased as rates rose. The maximum safe seed-placed N rate for the knife appears to be about 35 lb/ac (39.2 kg/ha) for barley and possibly higher for wheat.

• The spoon caused emergence to decrease at the higher N rates. However, yields were not reduced. This suggests the safe seed-placed N rate using a 2 inch (50 mm) spoon is about 50 lb/ac (56 kg/ha) for wheat and barley.

• The sweep had the least impact on emergence, and yields were generally higher with higher N rates. This suggests safe rates of 70 lb/ac N (78.5 kg/ha) or possibly higher with the seed.

(See the graphs depicting three different application rates and their results on seedling emergence and yield on page 4.)

Canola

Here's the results for the four-year research on canola:

• As the rates of seed-placed N increased, emergence decreased with all three openers. However, compared to the spoon and sweep, damage was reduced as SBU increased.

• Yield with the knife was reduced at all N rates above 35 lb/ac, and yield with the spoon was reduced at the 105 lb/ac rate. The sweep demonstrated incremental increases in yield up to the 105 lb/ac rate.

Growers are warned that the delayed emergence and resulting uneven maturity caused by narrow spreads of seed and high rates of N can cause grade reductions and yield losses in short seasons. (See the graphs depicting three different application rates and their results on seedling emergence and yield on page 4.)

What about other factors?

The second part of the risk analysis, to assess the impact of the other factors, is more difficult. For instance, what emphasis do you put on soil moisture, soil texture, fertilizer source, and crop type?

A previously published Interim Research Update (#718) on first year emergence results of this seed placed fertilizer project included results on the Swede Side Bander opener, because little information on side banding openers was available at that time. However, comparing side banding openers to seed placed fertilizer openers is not a valid comparison, since it's impossible to seed place fertilizer and side band fertilizer at the same time. Since then, PAMI has started research comparing different side banding openers. These results will be published in a future Research Update.

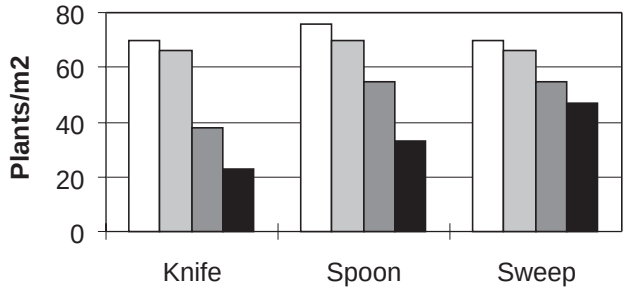
In PAMI's canola research, soil moisture played a key role in the safe seed-placed N rates. The drier the soils, the lower the emergence damage. But the opposite was found to be true for wheat and barley. This contradicts other research and traditional results. More work is required to verify this finding.

It's a gamble placing high rates of N with the seed. By using SBU and understanding all the other factors involved, producers can minimize the risk to emergence damage and yield loss. Provincial crop specialists, PAMI specialists, and others can help farmers fine-tune seed-placed N rate decisions.

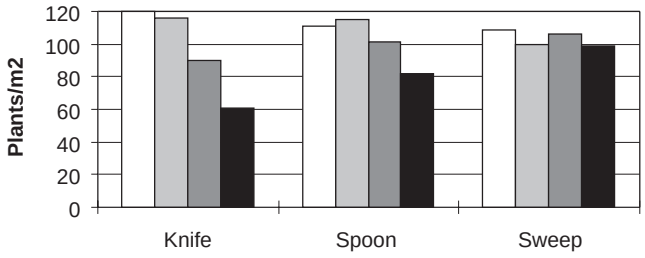
The graphs on page 4 illustrate the impact of three rates of nitrogen applied with three different openers. The message is clear— openers that give the widest N spread pattern present the least risk to emergence damage.

How N Affects Emergence

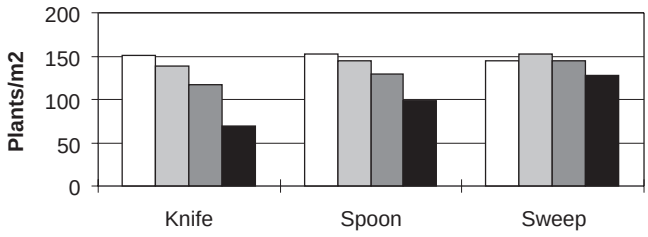
Effect of Seed Placed N on Canola* Emergence



Effect of Seed Placed N on Barley Emergence

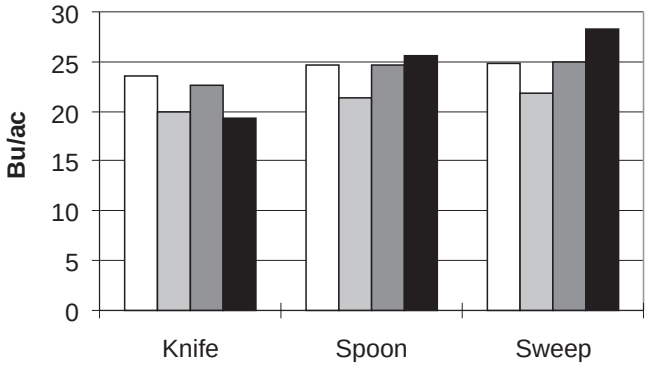


Effect of Seed Placed N on Wheat Emergence



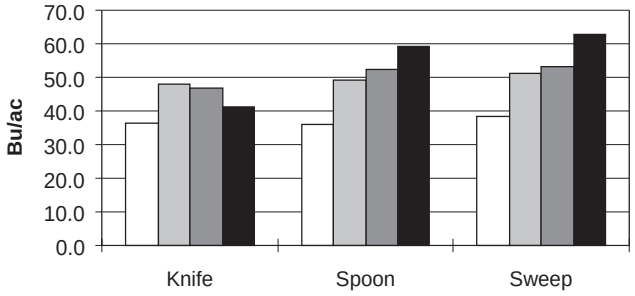
How N Affects Yield

Effect of Seed Placed N on Canola* Yield

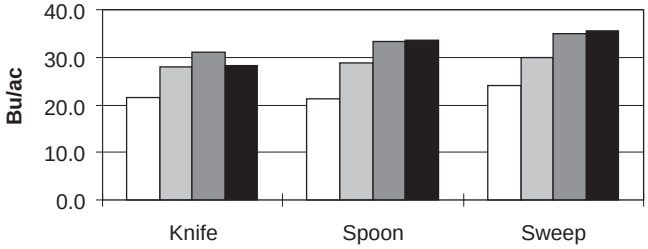


** At the client's request, the canola check plots (the bar representing 0 lbs/ac seed placed fertilizer in graphs above) benefited from 70lb/ac broadcast N after seeding, to reflect typical producer practice when seeding canola. While post-seeded broadcast N does not typically affect emergence results, it will skew the yield results when making comparisons against other seed placed fertilizer rate results. Readers should keep this in mind when interpreting the graphs.*

Effect of Seed Placed N on Barley Yield



Effect of Seed Placed N on Wheat Yield



Note: Canola results are averaged over four years, barley and wheat over three years.

How To Interpret SBU

SBU is a formula that equates the spread pattern of seed and nitrogen (N) relative to row space. It's the amount of seedbed over which the N has been spread expressed as a percentage:

(spread ÷ row spacing) × 100

SBU is a risk analysis tool to help determine the potential for emergence damage and crop reduction. The lower the SBU, the higher the risk of seed damage and crop loss.

For example, a 5 inch (125 mm) seed and N spread (using a sweep) on a 10 inch (250 mm) row spacing produces a 50% SBU [(5÷10)×100]. This means seed and fertilizer are spread over half of the soil sub-surface area.

Switching to a 1inch (25 mm) seed and N spread (using a knife) on a 10 inch (250 mm) row spacing, will reduce the SBU to 10%. Since risk to yield losses rises as SBU falls, then it's clear a knife has five times the risk of crop loss.

Use SBU when purchasing equipment, when changing opener design, and when changing row widths.

Once SBU has been determined, examine the other factors that impact on how much seed-placed N can be used before making a rate decision. See "Seven Guidelines" for a look at the factors involved in determining safe seed-placed N rates.

A word about agronomic studies...

Farmers traditionally use yield as the measuring stick for successful crops, but emergence results can provide useful information early in the growing season.

Emergence results generally support yield results. However, unusual growing conditions can sometimes play with results, so it's important to make careful observations and recognize when growing conditions are above or below average.

Emergence results don't support yield results in every case A long growing season allows late maturing treatments to recover from early seedling damage and perform as well as undamaged treatments.

These variations in growing conditions make it even more important to replicate studies in different areas and over a series of years. The results in this report are based on three years of data for wheat and barley, and four years of data for canola. Averaging the results over several year provides conclusive information.

Eight Guidelines

for safe seed-placed nitrogen applications this spring

• Soil Texture. The lighter the soil texture, the higher the risk to emergence damage and yield loss.

• Seedbed Moisture Conditions at Seeding. The lower the seedbed moisture, the higher the risk to emergence damage and yield loss. For dry soils, reduce the N rates shown in the cereal table (on the back page of this report) by at least 50%. Canola may be an exception some years .

• Fertilizer Source. Ammonium nitrate (34-0-0) is less of a risk to emergence damage and yield loss then urea (46-0-0). For cereals, safe N rates can be increased by about 25% when using 34-0-0. For canola, the risk is identical for both forms of N.

• Row Space. The wider the row spacing, the higher the risk to emergence damage and yield loss. Row space and width of spread are used to calculate SBU.

• Width of Spread. The narrower the N spread pattern, the higher the risk of emergence damage and yield loss.

• Crop Type. Smaller seeded crops are more sensitive to emergence damage and yield loss to a given rate of N. Be cautious with high N rates placed with canola. Some special crops, such as peas and lentils, are very sensitive to seed placed N.

• Application Rate. The higher the N rate, the higher the risk to emergence damage and yield loss. Doubling the rate, for example, doubles the risks.

• Organic Matter: Higher levels of organic matter will reduce emergence damage.

Consider the above factors, and then refer to the Saskatchewan Agriculture and Food publication, *Revised Guidelines for Safe Rates of Fertilizer Applied with the Seed*, to help determine rates of N to be placed with cereal and canola seed. This publication is available from the following sources:

World Wide Web site: http://www.gov.sk.ca/agfood/

or

Communications Branch,
Saskatchewan Agriculture and Food
Room B5, 3085 Albert Street
Regina, Saskatchewan, Canada
S4S 0B1
Phone: 306-787-5140

Need Results?

Crop Clubs, Producer Groups, Research Organizations, and Seed, Chemical and Fertilizer companies can all have the benefit of PAMI's displined approach and specialized expertise to contract applied research and development.

PAMI has been involved in researching the interaction between soils and crops, and the machinery used to plant, grow, and harvest crops, for over twenty years.

We have also developed specialized equipment to test different components and management techniques. PAMI's plot drill is specially designed to do applied research on the interaction between machinery, soils, and crops.

You can contact PAMI (1-800-567-7264) to discuss the research needs of your organization or crop club/producer group.

ACKNOWLEDGMENTS

The direct-seeding research for wheat and barley was carried out with funding from the Canada/Saskatchewan Green Plan in cooperation with the Naicam Crop Club, Foam Lake/Kelliher Crop Clubs, the Unity Group, and Saskatchewan Wheat Pool/Westco.

The direct-seeding research for canola was funded by the Saskatchewan Canola Development Commission in cooperation with the Canola Council of Canada.

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:

P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080