



Planning nitrogen management strategies for winter wheat by Bruce Barker

Timing, source, and environment are important factors.

Fertilizing winter wheat used to be easy. Apply little or no nitrogen (N) fertilizer at seeding, then broadcast ammonium nitrate in the early spring. The rationale: excess N at planting was thought to decrease winter survival, overwinter leaching and denitrification losses could be avoided, and risk could be managed by seeing if the winter wheat survived before an investment in N fertilizer was required.

Then the Oklahoma City bombing of the Federal Building on April 19, 1995, changed everything. Fertilizer manufacturers withdrew production and sale of ammonium nitrate fertilizer because of the concern surrounding its use in making explosives. "The most common practice now recommended by government extension is to broadcast urea in the spring," says the International Plant Nutrition Institute's (IPNI) Northern Great Plains director Tom Jensen at Saskatoon, Saskatchewan.

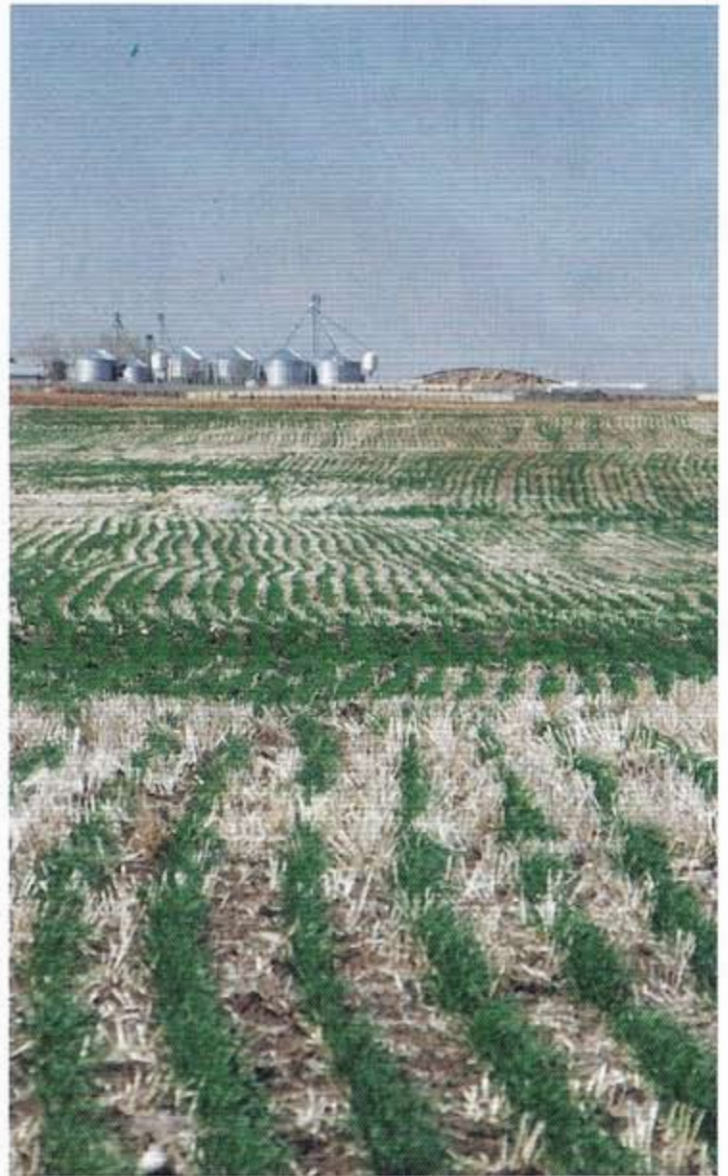
However, because urea fertilizer has a volatilization risk, alternate N application methods are also recommended by various provincial and state organizations, including side-band urea at planting, side-band urea treated with inhibitors or enhancing compounds, controlled-release urea in seed-row or side-banded, broadcast urea treated with inhibitors or enhancing compounds in the fall (Agrotain plus (dicyandiamide [DCD]) or spring (Agrotain), and surface band urea ammonium nitrate in early spring with or without Agrotain.

Jensen says each strategy has advantages and disadvantages. Research across the Prairies has continued to look at the best strategies.

For example, research by Dr. Ross McKenzie of Alberta Agriculture and Rural Development at Lethbridge, Alberta, found that urea side-banded, or environmentally smart nitrogen (ESN) in the seed row were effective ways of fertilizing a winter wheat crop. However, ESN broadcast in the spring was not effective because the N did not release quickly enough for crop response.

In 2007, IPNI was involved in research at Beiseker, Alberta, and the results highlight the options and risks of various fertilizer approaches. The trial compared urea, ammonium nitrate, Agrotain-treated urea, Super Urea and ESN (also known as controlled-release urea). Time of application and fertilizer rates were also compared. Although the trial covers only one year, it provides general trends on best nitrogen fertilizer management practices.

In the Beiseker trial, early spring nitrogen applications tended to produce higher yields. Regular urea broadcast in



Urea, with or without Agrotain, and ESN at planting provided the best N management options in winter wheat.

PHOTO BY BRUCE BARKER.

the spring did quite well, but side-banded urea in the fall did not do as well. Jensen says there were above average moisture conditions in the fall and spring of the study, and there was likely denitrification of the banded urea that was converted to the nitrate form of N in the fall. "From our results, I would not recommend side-band urea in the fall if conditions are wet," says Jensen. "In a dry year, it has worked quite well, as shown by Ross McKenzie's research, and it has worked well in Montana, also under drier conditions."

Agrotain-treated urea as a side-band at planting treatment did not provide any further benefit than uncoated urea. However, as a spring broadcast application, Agrotain-coated

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Comparison of N placement at 90 kg N/ha rate

Form	Placement	Yield (kg/ha)	Statistical significance*
Agrotain	Broadcast spring	6229	a
Ammonium nitrate	Broadcast spring	6145	a
Urea	Broadcast spring	6092	ab
ESN	Seed-row planting	5917	abc
Super Urea	Broadcast spring	5768	bc
Super Urea	Band at planting	5738	c
ESN	Band at planting	5280	d
Urea	Band at planting	4659	e
ESN	Broadcast spring	4520	e
Agrotain	Band at planting	4515	e
Ammonium nitrate	Band at planting	3447	f
Check		2818	g
		LSD 336 at 0.05	

*Treatments with different letters are significantly different.

SOURCE: JENSEN, IPNI.

urea resulted in a greater average yield but was not significantly better than uncoated urea in this study.

Super Urea, which includes both a nitrification and urease inhibitor, helped improve sideband at planting performance. There was not a significant difference between spring broadcast of Super Urea or side-band Super Urea at planting. "This shows that the DCD nitrification inhibitor is working."

The old standby ammonium nitrate, as expected, performed well when broadcast in the spring, but was the worst treatment when sidebanded at planting. Ammonium nitrate contains 50 percent nitrate-N, making it susceptible to leaching or denitrification losses. "The ammonium nitrate results show that the right form at the right time makes a huge difference," says Jensen.

Like McKenzie's research, the Beiseker trial found ESN performed well if seed-placed at planting, but had poor results as a spring broadcast application.

Jensen says the 90 kg of N per hectare (80 lbs of N per acre) rate provides a good illustration of the "4R principle" of "the right source at the right time at the right place at the right rate." In the trial, the top performing N applications as shown by yield response included three spring broadcast treatments and ESN at planting.

Jensen again cautions that the trial was only one year, but it provides good insight into how to manage winter wheat N fertilization. "If someone asks you what the best way is to manage nitrogen, ask them what the weather is going to be like. Under the wetter conditions that year, spring broadcast and ESN at planting worked best. But under drier conditions, side-band urea works fine," explains Jensen. "Tell me what spring will be like and I'll give you the best recommendation." ■