

## ICM EXPERIMENTS WITH WHEAT IN SASKATCHEWAN, 1986

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### INTRODUCTION

The European concept of "intensive cereal management" involves the optimization of inputs and management to achieve maximum yields. While the economic realities are somewhat different in North America, the goal of profit maximization is the same. This paper summarizes the 1986 results of a research project initiated by the University of Saskatchewan in 1985, in which a number of the chemical inputs typical of ICM programs were tested. Cost effectiveness of the responses is also considered.

### MATERIALS AND METHODS

Sites were established in the spring of 1986 on good early season stands of farmer-sown Norstar winter wheat, and Columbus or Katepwa hard red spring wheat, as available. The environmental gradient from semiarid to subhumid was represented by sites at Elrose, Outlook (irrigated), and Birch Hills. Additional tests were conducted at the Kernen Crop Research Farm at Saskatoon, and a test with Owens soft white spring wheat at the Saskatchewan Irrigation Development Centre at Outlook. Refer to Tables 1-9.

In addition to soil test recommended fertilization, nitrogen as ammonium nitrate (34-0-0) was broadcast postemergently at rates of 0, 56, and 112 kg/ha, the latter in a split application 3-4 weeks apart.

The fungicides Bayleton<sup>1</sup> (triadimefon) and Tilt<sup>2</sup> (propiconazole) were applied at 250 g/ha and 500 ml/ha, respectively, to the fully extended flag leaves (Zadoks Growth Stage 37-45).

The plant growth regulating (PGR) chemicals Cycocel Extra<sup>3</sup> (chlormequat chloride) and Terpal C<sup>4</sup> (ethephon + chlormequat) were applied at Zadoks 31 (detection of the first node) and 32-31 (between detection of the second node and appearance of the flag leaf collar), and rates of 2.5 and 2.0 l/ha, respectively. Additional rates and timings of these PGR's, as well as Cerone<sup>5</sup> (ethephon), were conducted as time and space allowed at Saskatoon. For details, refer to Tables 6 and 8<sup>6</sup>.

Fungicides and PGR's were applied through 80° Tee-jets in 220 of water per ha, with a three-point hitch mounted sprayer. Bo were compared to check (no application) plots. The nitroge fungicide and PGR treatments were applied in all combination with three replications per site.

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<sup>1</sup> Bayleton is a registered trademark of Bayer AG, Chemag Limited is the user.

<sup>2</sup> Tilt is a registered trademark of Ciba-Geigy Canada Ltd.

<sup>3</sup> Cycocel Extra is a registered trademark of Cyanamid Canada Ltd. BASF is the user.

<sup>4</sup> Terpal C is a registered trademarks of BASF.

<sup>5</sup> Cerone is a registered trademark of Union Carbide.

<sup>6</sup> Note: Fungicides and PGR's used in these experiments a not necessarily registered for use on wheat in Western Canada.

Yields were determined from a 7.5 m cut with a 1.25 m Hege plot harvester, and converted to an equal moisture basis.

#### RESULTS AND DISCUSSION

Tables 1 - 9 summarize the yield responses over the 9 sites. Table 10 indicates the positive and negative responses to the factors in 1986; table 11 summarizes responses over the two years of the experiment. In 1986, three negative yield responses due to PGR's occurred on winter wheat, all following Terpal C. Reduced kernels per head can account for the decrease in all instances. According to present theory, the crops may have been under stress near the time of application of this chemical. Losses due to similar treatments were obtained by other researchers at Scott, but not at Melfort or Indian Head (Kirkland, 1986; Bowren et al., 1986; Lafond et al., 1986).

There were 10 responses to fungicides among 7 of the sites in 1986. The high incidence of leaf and stem rust, as well as control of Tan Spot (Pyrenophora tritici-repentis) and Septoria in the Outlook Owens site, were responsible for this high number of responses.

Three yield increase and 1 yield decrease due to high nitrogen seems reasonable, considering the shape of a nitrogen response curve and the risk factor applied in soil test recommendations. Similar responses were obtained in 1985. Nitrogen interacted with PGR's in affecting yield at two HRS wheat sites. These were

negative interactions with Cycocel and positive interactions with Terpal C.

Lodging occurred throughout the Saskatoon HY320 site, and near one end of the Owens SWS wheat site. The HY320 lodged during the long, damp period which delayed harvest. High N fertilization enhanced lodging. While not statistically reduced, Cerone appeared to be the best control. At the Owens site, Terpal C and Bayleton appeared to control lodging, while Tilt treated plots appear to have been more prone to lodging, likely since more heads matured with greater kernel weight, causing more leverage

Of the 19 statistically increased yields over the two years, only 6 can be considered cost effective. Refer to Table 12. Another treatment that was not significant but is of some interest here is the higher rate of Cerone on the Saskatoon HY320, which cost \$112. Note that this was the same treatment to give the best (non-significant) lodging control. The Terpal C treatment of the Outlook Soft White Spring Wheat was not quite significant. This treatment was rained on less than 10 minutes after application

#### SUMMARY AND CONCLUSIONS

ICM inputs can be of economic benefit in a few instances in Saskatchewan conditions. However, the depressed grain price necessitates a much larger response to any input than can normally be expected. Reduced grain grade (which occurred following Terpal C application at 3 somewhat stressed sites), make economic

benefits look even more doubtful. In the Saskatchewan situation, short growing season and variable, low moisture availability reduce the probability of a positive response, regardless of the commodity prices. Further research on low ethephon rates may allow the PGR's to be considered as a viable option for special "high management" situations, just as high nitrogen rates and fungicide treatments are now.

#### REFERENCES

- Bovren, K.E., Noble, G.S. and Krause, B.** 1986. Effect of ethephon and chlormequat chloride on Norstar winter wheat. E.C.W. Research Report (Western Section) Vol. 3, p255.
- Kirkland, K.J.** 1986. Intensive management of winter wheat in the Dark Brown Soil zone. E.C.W. Research Report (Western Section) Vol. 3, p258.
- Lafond, G., Derkson, D.A. and Gossard, D.** 1986. Response of Norstar winter wheat at two growth stages to Terpal C and Cycocel. E.C.W. Research Report (Western Section) Vol. 3, p257.

Table 1. Effect of N, fungicides and PGR's on Norstar winter wheat at Elrose, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	2700	67	78.9	12.0
56 KG N/HA	2630	66	78.6	12.8++
112 KG N/HA	2730	67	78.3	12.8++
NO FUNGICIDE	2620	66	78.5	12.3
BAYLETON	2710	67	78.8	12.6
TILT	2790	68	78.6	13.0+
NO PGR	2710	71	78.7	12.4
CYCOCEL	2820	73	79.2	12.3
TERPAL C	2530--	57--	78.0--	12.9++
MEAN	2690	67	78.6	12.5

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 2. Effect of N, fungicides and PGR's on Norstar winter wheat at Saskatoon, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	1370	47	74.4	13.7
56 KG N/HA	1400	47	74.0	14.2++
112 KG N/HA	1450+	46	74.6	14.4++
NO FUNGICIDE	1310	47	73.2	14.1
BAYLETON	1420++	48	74.6++	14.0
TILT	1580++	46	76.4++	14.2
NO PGR	1520	49	74.2	13.8
CYCOCEL	1470	49	74.2	14.1++
TERPAL C	1240--	42--	74.6	14.4++
MEAN	1410	47	74.3	14.1

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 3. Effect of N, fungicides and PGR's on Norstar winter wheat at Birch Hills, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	2840	61	79.1	13.3
56 KG N/HA	2860	59-	78.1--	14.0++
112 KG N/HA	2910	61	77.7--	14.2++
NO FUNGICIDE	2720	60	77.6	13.6
BAYLETON	3010++	63+	78.7++	14.0++
TILT	3040++	59	79.2++	14.3++
NO PGR	3010	64	78.5	13.9
CYCOCEL	2990	65	78.7	14.1
TERPAL C	2610--	52--	77.7--	13.7
MEAN	2870	60	78.3	13.9

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 4. Effect of N, fungicides and PGR's on Columbus HRS wheat at Elrose, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	2570	80	77.3	12.3
56 KG N/HA	2700+	80	77.6	13.8++
112 KG N/HA	2710	80	77.3	14.8++
NO FUNGICIDE	2630	79	78.2	13.7
BAYLETON	2660	82+	77.2--	13.7
TILT	2710	81	76.1--	13.5
NO PGR	2640	86	77.5	14.0
CYCOCEL	2750	86	77.4	13.6
TERPAL C	2590	68--	77.3	13.4
MEAN	2660	80	77.4	13.6

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 5. Effect of N, fungicides and PGR's on Katepwa HRS wheat at Outlook, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	3770	96	76.9	14.1
56 KG N/HA	3780	96	76.1--	14.5++
112 KG N/HA	3740	96	75.4--	15.2++
NO FUNGICIDE	3700	96	75.6	14.6
BAYLETON	3630	97	76.4++	14.5
TILT	4000+	95	77.0++	14.4
NO PGR	3800	102	76.7	14.4
CYCOCEL	3700	97--	75.5--	14.6++
TERPAL C	3800	88--	76.2	14.7++
MEAN	3760	96	76.2	14.6

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 6. Effect of N, fungicides and PGR's on Katepwa HRS wheat at Saskatoon, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	3040	83	73.9	14.5
56 KG N/HA	3140	83	71.8--	15.6++
112 KG N/HA	3110	84	71.1--	16.0++
NO FUNGICIDE	2980	83	72.0	15.4
BAYLETON	3060	83	72.1	15.4
TILT	3240++	83	72.8++	15.3
	*			
NO PGR	3090	86	72.7	15.3
CYCOCEL E 1.0	3250	87	73.3	15.5
CYCOCEL E 1.5	3140	86	72.4	15.5
CYCOCEL L 1.0	3130	84	74.4	15.1
CYCOCEL L 1.5	3040	81	72.1	15.4
CERONE 0.32	3020	83	72.5	15.4
CERONE 0.48	3010	82	72.1	15.4
TERPAL C 1.00	3180	81--	71.5-	15.5
TERPAL C 1.50	3000	77--	71.5-	15.2
MEAN	3100	83	72.2	15.4

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

\* Numbers represent application rate, l/ha.

E = Zadoks 21-24; L = Zadoks 30-31



Table 7. Effect of N, fungicides and PGR's on Katepwa HRS wheat at Birch Hills, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	2010	69	73.2	14.4
56 KG N/HA	2600++	70	72.6--	15.8++
112 KG N/HA	2540	74++	71.7--	16.6++
NO FUNGICIDE	2380	71	72.2	15.6
BAYLETON	2470	72	72.4	15.6
TILT	2580++	72	73.2++	15.5
NO PGR	2470	74	72.8	15.7
CYCOCEL	2440	71--	72.4--	15.6
TERPAL C	2440	69--	72.3--	15.5
MEAN	2450	72	72.5	15.6

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 8. Effect of N, fungicides and PGR's on HY320 Prairie Spring wheat at Saskatoon, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	4190	85	71.9	12.4
56 KG N/HA	3890--	85	69.7--	14.0++
112 KG N/HA	3700	85	69.1--	14.9++
NO FUNGICIDE	3840	86	69.9	13.7
BAYLETON	3800	85	70.1	14.0
TILT	4140++	84	70.8++	13.7
	*			
NO PGR	3910	86	70.2	13.7
CYCOCEL 1.00	3870	86	69.4-	14.1
CYCOCEL 1.50	3880	86	70.0	13.7
CYCOCEL 2.00	3880	86	70.3	13.5
CERONE 0.32	3950	85	70.4	13.7
CERONE 0.48	4100	86	70.6	13.7
TERPAL C 1.00	3890	83--	70.2	14.2
TERPAL C 1.50	3900	83--	70.8	13.6
MEAN	3920	85	70.3	13.8

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

\* Numbers represent application rate, l/ha.

Timings as per Materials and Methods.

Table 9. Effect of N, fungicides and PGR's on Owens SWS wheat Outlook, Sask., in 1986.

Treatment	Wheat Yield, kg/ha	Plant Height cm	Hectoliter Weight, Kg	% Protein
ON	4220	82	74.1	12.6
56 KG N/HA	4170	80	73.9	12.6
112 KG N/HA	4160	82	73.9	12.7
NO FUNGICIDE	3810	81	72.9	13.0
BAYLETON	4200++	81	74.3++	12.5--
TILT	4880++	82	75.8++	12.0--
NO PGR	4100	84	74.3	12.6
CYCOCEL	4130	81--	73.8	12.6
TERPAL C	4310	79--	73.8	12.7
MEAN	4180	81	74.0	12.6

+, - = Significant increase or decrease at P=0.05

++, -- = Significant increase or decrease at P=0.01

Table 10. Summary of Main Effects on Yield (by Site), 1986

	Increases	No Significant Effect	Decreases
N	3	5	1
F	7	2	0
R	0	6	3

Table 11. Summary of Main Effects on Yield (by Site), 1985-86

	Increases	No Significant Effect	Decreases
N	7	10	2
F	8	11	0
R	1	13	5

Table 12. Cost Effective Treatments (based on yields significantly different from the relevant check)

Site	Increase	Source	Cost \$/tonne of increased yield
Outlook Winter Wheat 1985	14%	N-56	83*
	15%	Cycocel	53*
Saskatoon Winter Wheat 1986	6%	N-112	738
	9%	Bayleton	366
	21%	Tilt	147
Shellbrook Winter Wheat 1985	17%	Bayleton	56*
Birch Hills Winter Wheat 1986	10%	Bayleton	143
	11%	Tilt	124
Elrose Hard Red Spring 1986	6%	N-56	233
Outlook Hard Red Spring 1986	8%	Tilt	131
Saskatoon HRS 1985	8%	N-56	112
	1986	Tilt	157
Birch Hills HRS 1985	8%	N-56	98*
	1986	N-56	77*
	9%	Tilt	192
Saskatoon HY320 1985	8%	N-56	83~
	1986	Tilt	132
Outlook Soft White Spr. 1986	10%	Bayleton	106
	28%	Tilt	37*

\* = treatments that were cost effective (based on Canadian Wheat Board 1986-87 initial prices basis Saskatoon, and input costs provided by suppliers)