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INTENSIVE CULTURE OF WHEAT IN CANADA

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Intensive Culture of Wheat in Canada

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PART 2: MANITOBA

INTENSIVE CULTURE OF WHEAT IN CANADA

PROJECT OBJECTIVES

To determine the agronomic and economic potential of production systems incorporating intensive culture techniques for wheat production in the main wheat producing regions of Canada.

To more fully assess the potential for profitable intensive management in the various regions of the country, a package of agronomic practices will be developed and field tested by cooperating scientists and producers during the period of April 1, 1985 to October 31, 1988.

Specifically, the project will:

1. Evaluate the potential of intensive culture of triple-M (semi-dwarf) and winter wheats.

2. Evaluate the management x cultivar interactions.

3. Determine optimum crop density including row spacing and seeding rates.

4. Evaluate fertility management, specifically nitrogen rates, and method and timing of applications.

5. Evaluate plant growth regulators (PGR) for their effect on yield enhancement in both lodging and non-lodging crop conditions.

6. Evaluate the need for and effectiveness of pest control agents such as fungicides and insecticides.

7. Monitor environmental conditions in order to assess the impact of the various moisture and temperature regimes found both within and between regions on the effectiveness of intensive cereal management.

INTENSIVE CULTURE OF WHEAT IN CANADA

SUMMARY OF FINDINGS - 1987

Note: Observations and conclusions drawn in this report are based primarily on 1987 results, which may not reflect long term trends due to weather variations. Thus the reader is urged to interpret the results with caution. Weather summaries are given for each of the major trial sites to assist with interpretation.

1. The original objective of the Intensive Culture of Wheat project was to evaluate the potential of intensive culture of triple-M and winter wheats. During the second and third years of the study, trials were also initiated to examine the response of conventional hard red spring wheat to intensive management. Within the Manitoba section a small amount of work also focused on measuring the response of durum wheat and soft white spring wheat to intensive management.

2. Intensive wheat management trials were established in Alberta, Manitoba and Quebec. Conditions for establishment of both winter wheat and spring wheat were good to excellent at all three locations, with the exception that an anticipated large scale winter wheat trial near Edmonton was not planted due to a late wet fall. Establishment of winter wheat in northern Alberta is often hampered by delays in harvesting the previous crop. The Alberta research group, however, has been very successful in establishing winter wheat on barley stubble where the barley has been taken off as silage. While crop establishment was good at all locations, adverse weather, primarily heat and/or drought stress were experienced to varying degrees at all locations. At western locations, hot dry conditions in late May-early June significantly reduced tillering and spike development. Winter wheat was most seriously affected. Increased kernel development in spring wheat helped to compensate for some of the earlier losses in yield components thereby helping to maintain respectable yields. The weather patterns in Quebec were almost opposite to the western conditions. The eastern trials experienced drought at the end of the growing season which dramatically reduced the yields of the spring sown cultivars.

Quebec reported their highest winter wheat yield to date, with the cultivar Danko yielding 8.5 tonnes/ha. The highest yielding spring wheat cultivar in the Quebec trial was CFQB-08 at 4.8 tonnes/ha. The Alberta trial also set a record measuring the yield of Neepawa on the large scale trial to reach 5.5 tonnes/ha. Winter wheat yields in the Alberta trials reached a maximum of 5.7 tonnes/ha in the plant growth regulator trial. Due to extremely hot dry conditions in late May the yields in the Manitoba trials were down from previous years. The maximum yields were approximately 4.4 tonnes/ha for winter wheat and 4.7 tonnes/ha for spring wheat.

3. Despite the fluctuating weather patterns between years, significant response to added inputs continues to be found in many of the trials. Extra inputs applied to the spring wheat cultivars grown in Quebec gave an average yield increase of 456 kg/ha, with some cultivars giving responses of up to 1200 kg/ha. Large responses to extra inputs were also measured in Quebec winter trials. In the extreme case, added inputs increased winter wheat yields 94% (2729 to 5296 kg/ha). Yield increases of 21 to 41% were found when added inputs were applied to a range of spring wheats in Manitoba. Grain protein in the spring wheat was increased from 12.2% to 15.4% when the extra inputs were added. Winter wheat, however, responded negatively to extra inputs, with yield reductions of up to 1000 kg/ha. This phenomenon is directly linked to the high degree of heat and drought stress which was experienced at the critical growth stages of the 1987 Manitoba winter wheat crop. By following product label recommendation and common sense a commercial farmer would not likely have applied the extra inputs under the conditions which presented themselves.

   The addition of a package of extra inputs were generally not found to be advantageous to increasing yields in the cultivar x management trial in Alberta. The lack of response was attributed to high soil fertililty and low disease pressure. However, in large scale trials conducted at Spruce Grove, added inputs increased the yield of Oslo and Neepawa by 1300 and 1163 kg/ha respectively.

4. Increasing the seeding rates in an effort to increase yields has not met with much success in any of the locations. The only exception was a 470

kg/ha increase in yield when the seeding rate of Norwin winter wheat was increased from 200 to 400 viable seeds/m2 in a Manitoba trial. Increased seed rates were noted to be beneficial in Alberta by decreasing the days to maturity for both spring and winter wheats but had no impact on yields. Conventional seeding rates appear to provide enough plants/unit to capture the existing yield potential. While only limited amounts of data have been collected on the effect of row spacing, decreased row spacing once again has shown positive results (see Manitoba 1985). Reducing the row spacing from 15 cm to 12 cm increased the yield of Katepwa and HY320 by as much as 700 and 900 kg/ha respectively in 1987 Manitoba trials.

5. Foliar diseases were reported at all sites again in 1987. Powdery mildew was reported in Alberta and Quebec. Tanspot and septoria were common at all areas to varying degrees. Rust levels were low in 1987. The yield responses to applied fungicides were variable in 1987. Alberta trials showed little yield response; Quebec trials showed smaller yield increases (200 kg/ha) than in previous years. Hot dry weather in the second half of the Quebec growing season reduced yield potential and spread of the foliar diseases. Manitoba fungicide trials showed variable results. Norstar winter wheat and early seeded spring wheats gave negative responses to foliar fungicides. However, Norwin winter wheat and later seeded spring wheat (cultivar x management trial) responded positively to applications of foliar fungicides. Yield increases of up to 570 kg/ha were found with Norwin, whereas the yields of spring wheat were increased by as much as 1430 kg/ha. Fungicides also significantly increased protein content in Manitoba spring wheat trials (Table 1).

TABLE 1. EFFECT OF FUNGICIDE APPLICATIONS ON PROTEIN CONTENT IN SPRING WHEAT, MINTO, MANITOBA 1987

VARIETY	YIELD (KG/HA)		PROTEIN INCREASE
	WITHOUT FUNGICIDE	WITH FUNGICIDE	WITH FUNGICIDES (% PROTEIN)
HY320 (CPS)	3075	4146	.4%
OSLO (CPS)	2899	4130	.4%
KATEPWA (HRS)	2836	3506	2.3%
ARCOLA (DURUM)	2976	3777	3.1%

6. Nitrogen response was very location specific in 1987. Alberta small plot trials were characterized by a lack of response to applied nitrogen due to high soil fertility; however, large responses to nitrogen applied over the conventional recommendations were achieved on the large scale trials at Spruce Grove. The average yield increase attributed to the extra nitrogen was 814 kg/ha. Extra nitrogen was not beneficial in small scale winter wheat trials at Minto but increased yields 390 and 1600 kg/ha in large scale winter wheat trials at Minto and Portage, respectively. Extra nitrogen (60 kg/ha) increased yield of spring wheat (small plot - Minto) by an average of 250 kg/ha over 8 cultivars. Protein across all varieties was increased from 12.2 to 13.6% due to the extra N application. The most responsive cultivar was Oslo which gave a 630 kg/ha yield increase to the extra nitrogen. The large scale spring wheat trials gave yield increases of 300 and 100 kg/ha for Minto and Portage, respectively. Split applications of nitrogen were more beneficial for HY320 as compared to either Katepwa or Norstar in the 1987 Manitoba trials.

   Both winter wheat and spring wheat responded favourably to applied nitrogen in the Quebec trials with optimum yield response obtained from 180-210 kg N/ha rates for spring wheat and 120-220 kg N/ha rates for winter wheat.

7. Lodging was not found to be a problem in either the Manitoba or Quebec trials in 1987. However, significant lodging was associated with the tornado which hit Edmonton during the summer of 1987. Significant differences in lodging susceptibility were detected between wheat cultivars grown in Alberta. Plant growth regulators were also found to be effective in helping to reduce lodging. Cerone or Cycocel followed by Cerone were found to give good lodging protection to Norstar winter wheat. Although Cycocel alone did not adequately control lodging in winter wheat, a single Cycocel application resulted in a 27% yield increase. Cycocel followed by Cerone was also effective in controlling lodging in some spring cultivars such as Bluesky; a 17% yield advantage was measured.

   Despite the lack of lodging in the Manitoba trials, selected plant growth regulator treatments were found to have a positive effect on yields.

Terpal C applied to Arcola durum or HY320 spring wheat resulted in yield increases up to 700 kg/ha. Plant growth regulators were not found to be beneficial in the 1987 Quebec trials.

8. Crop yields are always limited by the factors which are in the most limited supply (or in case of detrimental factors such as plant diseases or excess heat, by factors which are excessive). Farmers face a continual challenge to supply the optimum growth environment for their crop in a way which will allow the least cost of unit of output. The Intensive Wheat Management project has been able to demonstrate that opportunities exist for Canadian farmers to use more intensive management and input practices to increase yields and lower unit costs in wheat production.

During the three years of the project, economic conditions have changed dramatically with top grades of Western Hard Red spring wheat falling from a farm gate price of $140/tonne to $96/tonne. Lower quality wheats such as HY320 or Hard Red winter wheats have experienced even greater declines in price. However, even with the current low prices, careful use of intensive management can still return dividends. For example, using conventional management for Katepwa wheat grown in Manitoba the net return was $56/ha; using more intensive management, the returns could be increased up to $108/ha. The net return-ranking of the various cultivars under test have also been shown to change considerably depending on the price.

TABLE 2. NET RETURNS TO VARIOUS CULTIVARS*

VARIETY	CLASS	LOW INPUT MANAGEMENT CWB**	LOW INPUT MANAGEMENT CWB OR NON-BOARD PRICE***	HIGH INPUT MANAGEMENT CWB**	HIGH INPUT MANAGEMENT CWB OR NON-BOARD PRICE***
HY320	CPS	-28	21	-6	61
OWENS	SWW	28	50	78	107
WHEATON	FEED	-18	47	-20	71
KATEPWA	HRS	56	56	83	83
ARCOLA	DURUM	69	69	88	88

*These are only based on 1987 yields and input from Minto; consult other data sources for more information on long term yield performance. Basic assumption - all wheat grades #1 in its class.
**Net return based on Canadian Wheat Board prices.
***Net return based on the highest price offered from the CWB or non-board market.

As with most aspects of agriculture, the effectiveness and economic returns of applying extra management inputs are constantly changing. Farmers must be aware that successful crop production will only result when all factors are in tune with the limitations which are imposed upon us by economic realities, environmental constraints and the level of available technology.

PART 1

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EXECUTIVE SUMMARY OF 1987 RESULTS: K.G. BRIGGS

1-1 ICM research was conducted in 1987 in small plot trials with winter wheat and spring wheat at Edmonton and in large scale on-farm plots with spring wheat at Fuhr Farms, Spruce Grove, Alberta. For the third consecutive year, large scale winter wheat work at Spruce Grove was impossible due to the inability to seed during wet fall conditions. Due to the conclusion of this project, no winter wheat plots were seeded in the fall of 1987.

1-2 1987 was characterized by highly unusual weather at the Edmonton site. On May 19, Edmonton received 10.2 cm of snow and temperatures remained below freezing until May 22. Although the snow cover on the winter wheat plots was quite extensive, the crop was already too tall to be completely protected. Thus severe frost damage occurred to the upper part of the plant above the snow cover. Rainfall in June was lower than normal (52% of 30 year average) while in July, rainfall was higher than normal (137% of 30 year average). In addition, on July 31st, Edmonton experienced extremely high winds (up to 120 km/h) when a tornado struck the city. Many of the plots at the Edmonton site lodged severely as a result of this.

2-1 <u>WINTER WHEAT (SMALL PLOTS W240)</u>

Winter wheat yields ranged from 4677 to 5120 kg/ha (70 to 75 bu/acre) in 1987, an improvement over yields obtained in 1986. Even though all plots were seeded into barley stubble, responses to fertility treatments were minimal. The fertility of this stubble field appears to have been at a high base level.

2-2 No yield responses were obtained by manipulating row spacing and seeding rate in Trial 1. High seeding rates do not appear to be advantageous for winter wheat since it has the ability to tiller extensively to compensate for lower seedrates, or poor spring stands, as previously documented by others. An advantage from narrower row spacing for earlier maturity was found (up to 7 days earlier) at 5 inch spacings, compared to wider spacing.

2-3 In a trial to evaluate several plant growth regulators at two fertility levels, CERONE (300 gai/ha, GS 39) and a split application of CYCOCEL/CERONE, were found to give good control of lodging. A split application of CYCOCEL (460 gai/ha, GS 23/31) did not reduce lodging, but improved yield by 27% compared to the control. There were no fertility responses for yield in this trial, due to the apparently high fertility of the stubble field.

2-4 The efficacy of the fungicides TILT and DITHANE in controlling diseases common in winter wheat was evaluated in Trial 3. Disease ratings throughout the growing season indicated that TILT near or at recommended rates controlled powdery mildew (the major disease infestation). Towards the end of the growing season, however, no significant difference between treatments was found as treatments were unable to maintain disease control. None of the treatments resulted in a significant increase in yield compared to the control.

2-5 In the fourth winter wheat trial, CYCOCEL was applied at the recommended rate to Norstar grown at 6 fertility levels (early broadcast treatments of N at 0-150 kg/ha). The higher levels of nitrogen resulted in increased lodging, and CYCOCEL was found to be somewhat effective in reducing such lodging. However, the extra cost involved in applying higher levels of nitrogen was not compensated for by an increase in yield. The effectiveness of this trial was greatly reduced by the high initial fertility level of this field, which resulted in minimal yield responses, and minimised potential for interaction with PGR.

3-1 SPRING WHEAT (SMALL PLOTS W240)

All spring wheat trials in the W240 in 1987 were grown on barley stubble, except the "Cultivar x Management" trial, which was grown on both fallow and stubble. As in the winter wheat trials, the fertility level of the stubble field was higher than expected. Yields above 100 bu/acre were not obtained on either the fallow or stubble field in 1987. Fertility levels were higher in the stubble field than in the fallow field, a result which was unanticipated, but which was thoroughly checked for validity.

3-2 Seed rate and row spacing were manipulated in trial 1 to determine the optimum crop density for Neepawa and Oslo. This trial was unable to detect any seed rate by row spacing interactions, nor was yield affected by any of the treatments. However, it was found that as seed rate increased from 300 seeds/m^2 to 400 seeds/m^2, maturity in Neepawa was advanced by 4 1/2 days and by 1 day in Oslo. The Nordsten (Danish) seeder was the seeder that continued to deliver plant stand closest to those targeted, under excellent seedbed conditions.

3-3 Trials were conducted on both Neepawa and Oslo to evaluate various rate and methods of nitrogen application. Levels of nitrogen ranging from 30 to 180 kg N/ha were both banded and broadcast at seeding. One treatment also received split applications of nitrogen. No fertilizer response for yield was found for either Neepawa or Oslo, nor was there a difference in yield between banding and broadcast fertilizer applications. Average yields for these two trials were high (4339 kg/ha for Neepawa, 5063 kg/ha for Oslo). A high initial fertility level may explain the absence of response to fertility in these trials.

3-4 Trials were conducted on PT325 (Bluesky) and PT329 (Wildcat) at two fertility levels, to evaluate the efficacy of several plant growth regulators. These two varieties were found to behave quite differently, with Bluesky responding favorably in yield to treatments that suppressed yield in Wildcat. Although Bluesky lodged severely (average lodging rating 7.7) it's average yield in this small plot trial was very good at 5129 kg/ha (77 bu/acre). Wildcat yield averaged 4343 kg/ha (65 bu/acre), but lodging was only slight (average lodging rating 1.1). In Bluesky, a split application of CYCOCEL/CERONE resulted in a yield increase of 17% compared to the control. None of the treatments significantly reduced lodging. In Wildcat, however, the split application of CYCOCEL/CERONE reduced yield by 16% compared to the control. In addition, all treatments (except TERPAL C) significantly reduced lodging. Bluesky and Wildcat are both fairly tall varieties but usually have excellent straw strength despite their height. Despite the interesting interaction of PGR with these two varieties, lodging conditions and winds such as those experienced in 1987 are only expected once in every 500 years. Further research with CYCOCEL, on Bluesky and Wildcat is of considerable academic interest, but may not be of particular value to farmers.

3-5 A trial of 16 spring wheat cultivars at two management levels was conducted on both summer fallow and barley stubble. Contrary to expectations, the base fertility level of the stubble field was found to be higher than that of the fallow field. Although both trials were seeded on the same day, the trial on the fallow field emerged earlier and matured later than the trial on the stubble field. For both trials, cultivar effects were found to be more frequent than the effects of management level. As noted in previous years, several cultivars were found to be high yielding and earlier maturing than Neepawa (Oslo, Norquay, PT741, PT742, and Wildcat). Lodging was severe in both trials, with Bluesky and Glenlea lodging the most. Lodging tended to be more severe overall on the fallow field, but CYCOCEL was ineffective in reducing such lodging. Management level was found to be significant for yields and maturity on the stubble field but not on the fallow field, even though the soil test results indicated that fertilizer responses could be expected on the fallow field. Disease levels in both trials tended to be quite low.

3-6 Five of the cultivars in the above 'Cultivar x Management' trial received a third management treatment (the 'Optimum Varietal Management' or OVM treatment). In this treatment yield was targeted for each cultivar individually, based on estimated yield potential and available spring moisture (see materials and methods for detailed description). The results of the OVM treatment were found to be very similar to that of the Conventional treatment. The increase in seeding rate of the OVM treatment did result in earlier maturity in some cultivars, more so on the stubble than fallow field. Actual yields obtained were very close to the target. Use of the split fertilizer applications, fungicides or PGR's was not found to be necessary for any of the OVM treatments.

3-7 A combined three year analysis was conducted on the Cultivar x Management trial on fallow for the years 1985 to 1987. The main result obtained was a lack of cultivar x management level interaction for yield or maturity suggesting that individualised management treatments for these cultivars is not warranted. There was no significant effect of management on the yield or maturity of any of the 14 cultivars nor was there a significant interaction between cultivar and management treatment. Several cultivars were found to be consistently higher yielding and earlier maturing than Neepawa. Results also indicated that the use of plant growth regulators or fungicides in spring wheat is not worthwhile or economical, even at the high yield levels found in these trials.

3-8 Trials were conducted for Neepawa and Oslo to evaluate the efficacy of two fungicides in controlling disease in spring wheat. Disease levels were very low in both trials. Although disease ratings indicated significant differences between treatments in controlling disease, particularly powdery mildew, no significant yield differences were found between treatments. This result supports that of previous years in which no agronomically significant level of disease developed in the spring wheat under test.

4-1 <u>SPRING WHEAT FARM TRIALS</u>

Large-scale spring wheat trials were conducted for the third consecutive year at Fuhr Farms, Spruce Grove, Alberta. The cultivars Neepawa and Oslo were seeded at a narrower row spacing (4 1/2 inches) than previously used, with an Amazone drill. Weed control at the Spruce Grove site was excellent in 1987, including good control of wild oats. As for the Edmonton site, rainfall was less than normal for the month of June. This may explain the lower than expected yield of Oslo, which is known to be sensitive to pre-flowering drought stress.

4-2 For both Neepawa and Oslo, management (fertility) level was found to be more important in influencing the measured variables than was treatment (seeding rate + PGR + fungicide). In general, higher N levels resulted in the greatest delay in maturity but also the highest yield, with the highest yield recorded for Neepawa (82 bu/acre). Septoria levels in both Neepawa and Oslo were significantly influenced by fertility level, with the highest fertility level causing a significant reduction in disease. In addition, as fertility increased, a marked reduction in the incidence of take-all was found for Oslo.

4-3 The cost and returns analysis for Oslo and Neepawa, under the range of management conditions examined, indicated that the most profitable treatment combinations was for Neepawa produced under normal management for the region, achieving a yield of 65 bushels per acre. This treatment resulted in the lowest production cost per bushel ($1.57 per bushel) as well as the maximum gross margin per acre ($57.24). All treatments produced wheat that was only eligible for feed grade, priced at $2.45 per bushel. Although Neepawa with the maximum amount of inputs produced the maximum gross revenue per acre ($200.90), this advantage was offset by the higher production costs. Oslo yield appears to have been hurt by preflowering moisture stress (atypical for this site). The validated maximum yield for Neepawa of 82 bushels per acre may be a new farmscale yield record for this variety in this region.

SECTION 1: SMALL SCALE TRIALS (W240).

a) Winter Wheat

Location W240, Edmonton Research Station, Edmonton, Alberta.
NE-12-52-25-W4.

The soil test result (Norwest Labs) described the nutrient status (kg/ha) for this site as: 29 nitrate, 39 phosphate, 387 potassium, 35.1 sulphate, 9775 calcium, 117 sodium, 1618 magnesium, pH 6.2, 0.40 E.C. (salinity), 12% organic matter and medium texture. Recommendations were a) 88 Kg N/ha and 12 Kg P_2O_5/ha placed for excellent crop conditions (target yield 55 bu/acre) and b) 71 Kg N/ha and 12 Kg P_2O_5/ha placed for average crop conditions (target yield 44 bu/acre). Pre-seeding field operations consisted of light tillage using a spring tooth cultivator.

Experiment 1. WINTER WHEAT: RATES OF SEEDING X ROW SPACING.

Legal location: NE-12-52-25-W4

The objective of this trial was to determine optimum crop density by varying seeding rates and row spacing for Norstar winter wheat.

One variety of winter wheat, Norstar, was seeded into standing barley stubble on September 2, 1986 (September 4 for Swift Current drill). The trial consisted of 3 seed drills each with 4 replicates in a strip plot design. The drills used were: International disc drill (with 6 inch, or 15 cm spacings), Nordsten (Danish) disc drill (with 5 inch, or 12 cm spacings), and the Swift Current disc drill (with 9 inch, or 22 cm spacings).

Fertilizer regime for the trial was as follows: Fertilizer placed with the seed consisted of 20 KgN/ha; 50 Kg P_2O_5/ha; 30 Kg K_2O/ha; 10 Kg S/ha (in the form of 34-0-0, 11-51-0, 0-0-60 and 21-0-0-(24) respectively). 34-0-0, at the rate of 111 Kg N/ha, was hand broadcast on April 15, 1987. BUCTRIL M was applied on May 7, 1987 for general broadleaf weed control. A blanket application of CYCOCEL at 2.0 l/ha (+0.5% Citowett Plus) was applied at GS 31 on May 25, 1987. Two blanket applications of TILT at 0.5 l/ha were applied at GS 37 and 49-55, on June 4 and June 15 respectively. Diseases present were powdery mildew and Septoria leaf spot. All plots were harvested August 14, 1987.

The treatments were as follows (and were repeated for each of the 3 row spacings).

1. 60 kg seed/ha (170 seeds/m^2)
2. 90 kg seed/ha (260 seeds/m^2)
3. 120 kg seed/ha (350 seeds/m^2)
4. 150 kg seed/ha (435 seeds/m^2)
5. 180 kg seed/ha (525 seeds/m^2)

RESULTS AND CONCLUSIONS: WINTER WHEAT TRIAL 1.

1. Average yield of Norstar winter wheat in this trial was 5120 kg/ha (76 bu/acre).

2. There were no interactions between row spacing and seeding rate except for plants per m^2 (Table 1). The Nordsten drill (5 inch row spacing) resulted in plant densities closer to the target seeding rate than did the International (6 inch) or Swift Current (9 inch) drills (Table 1-3).

3. Alterations in seeding rate resulted in a significant difference for height and plants per m^2 only. An increase in the seeding rate resulted in a decrease in plant height (Table 1-2). Although seeding rate did affect plants per m^2, this was not reflected in a difference for heads per m^2 at harvest time. Coefficients of variation on plants per m^2 and yield components were very high.

4. Row spacing significantly affected kernels per m^2, 1000 K, maturity, height and plants per m^2 (Table 1-1). The narrowest row spacing resulted in the earliest maturity. This was clearly visible in the field, with those plots seeded with the Nordsten drill at the 5 inch (12 cm) row spacing heading out earlier than the other plots. The Nordsten drill also resulted in a higher plant density overall than the other two drills. Main effects of row spacing on 1000 K were major, but it is not possible to determine whether this is due to an effect of the row spacing or placement effects of the drills themselves.

5. The main conclusion from this experiment is that high seeding rates are not advantageous for winter wheat. Even at a very low seeding rate or if there is considerable winter kill, winter wheat has the capacity to tiller extensively to compensate. In addition, even though narrower row spacing can hasten maturity by up to 7 days, this is of less consequence in winter wheat than in spring wheat, where a difference of a day or two can be critical.

TABLE 1 WINTER WHEAT TRIAL 1. SEED RATE X ROW SPACING

	df	Yield	Kernels/m^2	1000 K	kg/HL	Lodging	Maturity	Height
rep	3	NS	NS	NS	NS	NS	NS	NS
row sp.	2	NS	*	*	NS	NS	**	*
seed rt.	4	NS	NS	NS	NS	NS	NS	**
row sp. x seed rt.	8	NS	NS	NS	NS	NS	NS	NS
mainplot C.V. %		9.7	8.9	3.3	0.8	20.4	0.9	2.6
subplot C.V. %		12.7	12.5	2.6	0.6	20.0	0.9	2.4

TABLE 1 (CONTINUED) WINTER WHEAT TRIAL 1. SEED RATE X ROW SPACING

	df	Plants/m^2	Heads/m^2	Kernels/head	Tillers/plant
rep	2	NS	NS	NS	NS
row sp.	2	**	NS	NS	NS
seed rt.	4	**	NS	NS	NS
row sp. x seed rt.	8	*	NS	NS	NS
mainplot C.V. %		32.1	24.4	31.0	42.4
subplot C.V. %		32.1	16.7	19.4	38.4

TABLE 1-1 WINTER WHEAT TRIAL 1. SIGNIFICANT (0.05) MAIN EFFECTS OF ROW SPACING FOR KERNELS/m^2, 1000K, MATURITY, HEIGHT, AND PLANTS/m^2.

	Kernels/m^2	1000 K (gm)	Maturity (days)	Height (cm)	Plants/m^2
1. 5 inch (12 cm) spacing	16091 *a*	32.53 *c*	336 *c*	98.6 *b*	294.2 *a*
2. 6 inch (15 cm) spacing	14599 *b*	33.51 *ab*	339 *bc*	101.4 *a*	171.2 *bc*
3. 9 inch (23 cm)	15388 *ab*	34.04 *a*	343 *a*	99.9 *ab*	139.2 *c*
S.E. (difference)	430	0.4	0.9	0.8	23.6

TABLE 1-2 WINTER WHEAT TRIAL 1. SIGNIFICANT (0.05) MAIN EFFECTS OF SEED RATE ON HEIGHT AND PLANTS/m^2.

	Height (cm)	Plants/m^2
1. 175 seeds/m^2	101.7 *a*	141.4 *e*
2. 260 seeds/m^2	101.0 *ab*	170.1 *d*
3. 350 seeds/m^2	100.3 *abc*	195.8 *cd*
4. 435 seeds/m^2	97.9 *d*	246.1 *ab*
5. 525 seeds/m^2	98.8 *cd*	254.2 *a*
S.E. (difference)	1.0	24.1

TABLE 1-3 SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF ROW SPACING AND SEEDING RATE FOR PLANTS/m^2. WINTER WHEAT TRAIL 1.

	Seeding Rate (seeds/m^2)				
Row Spacing	175	260	350	435	525
1. 5 inch (12 cm)	205.7	200.3	281.7	372.3	411.0
2. 6 inch (15 cm)	118.3	138.0	192.0	211.7	196.0
3. 9 inch (25 cm)	100.3	172.0	113.7	178.7	131.3
Interactive S.E. (difference)			41.7		

Experiment 2. <u>WINTER WHEAT: PLANT GROWTH REGULATOR X FERTILITY</u>.

Legal Location: NE-12-52-25-W4

The objective of this trial was to evaluate the effectiveness of various rates of several plant growth regulators on Norstar winter wheat and their interaction with fertility.

One variety of winter wheat, Norstar, was seeded into standing barley stubble on September 2, 1986 using an International disc drill seeder with 6 inch (15 cm) row spacings. The trial was designed as a split plot with 4 replicates. The seeding rate was 120 Kg/ha (350 seeds/m^2). Fertilizer placed with the seed consisted of 20 Kg N/ha; 50 Kg P_2O_5/ha; 30 Kg K_2O/ha; 10 Kg S/ha (in the form of 34-0-0, 11-51-0, 0-0-60 and 21-0-0-(24) respectively). BUCTRIL M was applied on May 7 for general broadleaf weed control. Two blanket applications of TILT at 0.5 l/ha were applied at GS 37 and 49-55, on June 4 and June 15, respectively. Diseases present were powdery mildew and Septoria leaf spot. All plots were harvested August 14, 1987.

Treatments were as follows:

Mainplot Treatments	Rate (kg A.I./ha)	Zadoks GS	Date Applied
1. Control	-	-	-
2. CYCOCEL*	0.92	31	May 25
3. CYCOCEL/CYCOCEL*	0.46/0.46	23/31	April 28/May 25
4. CERONE	0.08	39	June 5
5. CERONE	0.15	39	June 5
6. CERONE	0.30	39	June 5
7. TERPAL C	0.69	32-37	May 25
8. CYCOCEL*/CERONE	0.69/0.15	31/39	May 25/June 5

* + 0.5% Citowett Plus

<u>Subplot Treatments</u>

1. Target yield 50 bu/acre: 57 Kg N/ha applied on April 15.

2. Target yield 75 bu/acre: 111 Kg N/ha applied on April 15.

RESULTS AND CONCLUSIONS: WINTER WHEAT TRIAL 2.

1. Average yield of Norstar winter wheat in this trial was 5048 kg/ha (75 bu/acre).

2. There were no significant plant growth regulator by fertility interactions (Table 2).

3. Plant growth regulators had a significant effect on yield, kernels per m^2, lodging and height (Table 2). A split application of CYCOCEL, applied at GS 23 and 31, at a rate of 0.46 kg/ha, resulted in an increase in yield and kernels per m^2 compared to the control (Table 2-1). This treatment also resulted in the greatest reduction in a plant height, but did not reduce lodging compared to the control, which was severe. CERONE at 0.30 kg/ha, applied at GS 39, significantly reduced lodging compared to the control, but at the same time resulted in the lowest yield and kernels per m^2.

4. Fertility level had a significant effect on 1000 K and maturity (Table 2-2). Surprisingly, the higher fertility level resulted in slightly earlier maturity. Fertility did not affect yield, with a 75 bu/acre yield obtained for both fertility treatments. This suggests that the fertility of this field was somewhat higher than the soil test had indicated.

5. The main features of this trial were a) the high average yield level (5048 kg/ha) and b) a generally high level of lodging (average lodging rating 4.0). CYCOCEL was most effective in a split application (treatment 3), where it resulted in a significant yield increase of 27% compared to the control, even though it did not control lodging. In contrast, CERONE treatments did not significantly affect yield, although the highest rate (treatment 6) gave excellent lodging control. Lower rates did not control lodging. TERPAL C had no significant effect on yield or lodging compared to the control. The best control of lodging was provided by a split application of CYCOCEL/CERONE at high rates (treatment 8) but this treatment did not give any yield increase.

TABLE 2 WINTER WHEAT TRIAL 2. PLANT GROWTH REGULATORS X FERTILITY.

	df	Yield	Kernels/m^2	1000 K	kg/HL	Lodging	Maturity	Height
rep	3	**	**	NS	NS	*	NS	*
pgr	7	*	*	NS	NS	**	NS	**
fert.	1	NS	NS	**	NS	NS	*	NS
pgr x fert.	7	NS	NS	NS	NS	NS	NS	NS
mainplot C.V. %		14.4	14.1	3.4	0.8	52.8	1.5	4.5
subplot C.V. %		12.5	12.8	2.1	0.5	34.0	0.6	3.6

TABLE 2 (continued) WINTER WHEAT TRIAL 2. PLANT GROWTH REGULATORS X FERTILITY.

	df	Plants/m^2	Heads/m^2	Kernels/head	Tillers/plant
rep	2	NS	*	NS	NS
pgr	7	NS	NS	NS	NS
fert.	1	NS	NS	NS	NS
pgr x fert.	7	NS	NS	NS	NS
mainplot C.V. %		24.5	23.0	26.6	29.7
subplot C.V. %		16.0	10.6	15.4	26.8

TABLE 2-1 WINTER WHEAT TRIAL 2. SIGNIFICANT (0.05) MAIN EFFECTS OF PLANT GROWTH REGULATOR FOR YIELD, KERNELS PER M^2, LODGING AND HEIGHT.

	Yield (kg/ha)	Kernels/m^2	Lodging[1]	Height (cm)
1. Control	4542.0 *bc*	13120 *bc*	5.4 *ab*	107.6 *a*
2. CYCOCEL*, 920 gai, GS 31	5074.0 *abc*	14369 *abc*	4.0 *abcde*	99.1 *de*
3. CYCOCEL/CYCOCEL,* 460/460, GS23/31	5758.5 *a*	16157 *a*	5.2 *abc*	98.8 *e*
4. CERONE, 75 gai, GS 39	5139.5 *abc*	14545 *abc*	5.6 *a*	105.9 *ab*
5. CERONE, 150 gai, GS 39	5218.4 *ab*	15081 *ab*	4.1 *abcd*	104.0 *abc*
6. CERONE, 300 gai, GS 39	4407.3 *c*	12471 *c*	2.1 *def*	100.4 *cde*
7. TERPAL C, 690 gai, GS 32-37	5152.5 *abc*	14758 *abc*	3.6 *abcdef*	102.9 *abcd*
8. CYCOCEL*/CERONE, 690/150 gai, GS 31/39	5092.5 *abc*	14454 *abc*	1.7 *f*	98.5 *e*
S.E. (difference)	362.8	1015.4	1.0	2.3

*+ 0.5% Citowett Plus
1 Belgian scale (0.2 = no lodging, 9.0 = totally flat).

TABLE 2-2 WINTER WHEAT TRIAL 2. SIGNIFICANT (0.05) MAIN EFFECTS OF FERTILITY FOR 1000 K AND MATURITY.

	1000 K (g)	Maturity (days)
1. Target yield 50 bu/acre, 57 kg/ha N added	35.37 *a*	339.6 *a*
2. Target yield 75 bu/acre, 111 kg/ha N added	34.86 *b*	338.2 *b*
S.E. (difference)	0.2	0.5

Experiment 3: WINTER WHEAT: FUNGICIDE TRIAL.

Legal Location: NE-12-52-25-W4

The objective of this trial was to evaluate the efficacy of two fungicides (TILT and DITHANE) at varying rates and stages of application, in the control of disease common in winter wheat, under conditions of natural infestation.

Norstar winter wheat was seeded into standing barley stubble on September 2, 1986 using an International disc drill seeder with 6 inch (15 cm) row spacings. Seeding rate was 120 Kg/ha (350 seeds/m^2). The plots were arranged in a randomized block with 4 replicates. Starter fertilizer was placed with the seed as 20 Kg N/ha; 50 Kg P_2O_5/ha; 30 Kg K_2O/ha; 10 Kg S/ha (in the form of 34-0-0, 11-51-0, 0-0-60 and 21-0-0-(24) respectively). Based on a yield target of 75 bu/acre, 111 Kg N/ha (as 34-0-0) was hand broadcast on April 15, 1987. BUCTRIL M was applied on May 7 for broadleaf weed control. A blanket application of CYCOCEL at 2.0 l/ha (+ 0.5% Citowett Plus) was applied at GS 31 on May 25. Each plot was evaluated individually for disease development on a weekly basis. Although both the Horsfall-Barratt scale and a scale recommended by Dr. J.P. Tewari were used for the disease ratings, only the Horsfall-Barratt scale has been reported. Ratings are given for the whole plant and include all diseases present (mainly powdery mildew and Septoria). In addition, on two occasions the upper parts of the plant were rated individually (flagleaf, 2nd leaf below flagleaf, 3rd leaf below flagleaf). All plots were harvested August 19, 1987.

Treatments were as follows:

Mainplot Treatments	Rate (l/ha)	Zadoks GS	Date applied
1. Control	-	-	-
2. TILT	0.25	37	June 4
3. TILT	0.39	37	June 4
4. TILT	0.50	37	June 4
5. TILT/TILT	0.25/0.25	37/49-55	June 4/June 15
6. TILT/TILT	0.50/0.50	37/49-55	June 4/June 15
7. TILT	0.25	49-55	June 15
8. TILT	0.39	49-55	June 15
9. TILT	0.50	49-55	June 15
10. DITHANE/DITHANE	2.25/2.25 kg	49 + 10 days	June 15/June 23

RESULTS AND CONCLUSIONS: WINTER WHEAT TRIAL 3.

1. Average yield of Norstar winter wheat in this trial was 4677 kg/ha (70 bu/acre).

2. Powdery mildew was the predominant disease in this trial, but the Horsfall-Barratt scores represent total damage due to Septoria and mildew (Table 3-1). As disease development was monitored during the growing season, it appeared that the double application of TILT, at GS 37 and 49-55, at both the low and high rate, were the most effective. However, towards the end of the growing season, this was no longer the case. The final disease rating (GS 82-85) showed no significant difference between treatments.

3. In concurrence with the disease ratings, no significant difference in fungicide efficacy were found for yield, yield components, maturity or other variables (Table 3).

4. The diseases present in this trial were mainly powdery mildew and Septoria. The plots were also rated for root rot, which was found to be at an insignificant level. The incidence of "take-all" was also very slight, with less than 1% of white-heads observed (Some of these were due, in fact, to a mite feeding on the straw above the top node. In this case, the roots and leaves were healthy, but the heads had wilted).

5. In conclusion, TILT does appear to be effective in controlling powdery mildew in winter wheat, but at least two (and possibly three) applications are required to keep disease levels low until the end of the growing season. The lack of yield response, however, indicates that such treatment is not economical. DITHANE was ineffective in controlling the disease in this trial, which was mainly powdery mildew.

TABLE 3 WINTER WHEAT TRIAL 3. FUNGICIDES.

	df	Yield	Kernels/m^2	1000 K	kg/HL	Lodging	Maturity	Height
Rep	3	NS	NS	*	NS	NS	NS	*
fung.	9	NS	NS	NS	NS	NS	NS	NS
C.V. %		15.9	15.9	2.8	0.5	24.6	1.2	3.3

WINTER WHEAT TRIAL 3. FUNGICIDES.

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	NS	NS	**	NS
fung.	9	NS	NS	NS	NS
C.V. %		25.6	22.4	26.5	29.2

TABLE 3-1 WINTER WHEAT TRIAL 3: DISEASE RATING (HORSFALL-BARRATT GRADING SYSTEM)

Treatment	DISEASE RATING - HB GRADE (1 - 11)*					
	June 18 GS 52	June 25 GS 60	July 2 GS 64			
			whole pl	FL	2nd LF	3rd LF
1. Control	2.0 *a*	2.3 *a*	3.1 *a*	0.7 *a*	1.9 *a*	4.9 *a*
2. TILT, 0.25 l/ha, GS 37	0.5 *c*	0.8 *bc*	1.6 *cd*	0.2 *b*	0.5 *cd*	2.9 *bc*
3. TILT, 0.39 l/ha, GS 37	0.3 *c*	0.9 *bc*	1.1 *de*	0.2 *b*	0.2 *d*	1.1 *d*
4. TILT, 0.50 l/ha, GS 37	0.4 *c*	0.9 *bc*	1.0 *de*	0.2 *b*	0.2 *d*	0.6 *d*
5. TILT/TILT, 0.25/0.25 l/ha, GS 37/49-55	0.5 *c*	0.5 *c*	0.9 *de*	0.0 *b*	0.0 *d*	0.4 *d*
6. TILT/TILT, 0.50/0.50 l/ha, GS 37/49-55	0.3 *c*	0.5 *c*	0.8 *e*	0.0 *b*	0.0 *d*	0.5 *d*
7. TILT, 0.25 l/ha, GS 49-55	1.4 *ab*	1.7 *ab*	2.2 *bc*	0.0 *b*	1.0 *bc*	3.3 *abc*
8. TILT, 0.39 l/ha, GS 49-55	1.3 *ab*	1.3 *bc*	2.0 *c*	0.1 *b*	0.7 *cd*	3.3 *abc*
9. TILT, 0.50 l/ha, GS 49-55	1.2 *b*	1.3 *bc*	1.3 *de*	0.0 *b*	0.5 *cd*	1.7 *cd*
10. DITHANE M-45, 2.25 kg/2.25 kg, GS 49/+ 10 days.	1.4 *ab*	2.3 *a*	2.8 *ab*	0.3 *ab*	1.6 *ab*	4.4 *ab*
S.E. (difference)	0.3	0.4	0.3	0.2	0.3	0.7

*Means <u>within the same column</u>, which are followed by the same letter, are not significantly different at the 5% level (DMRT).

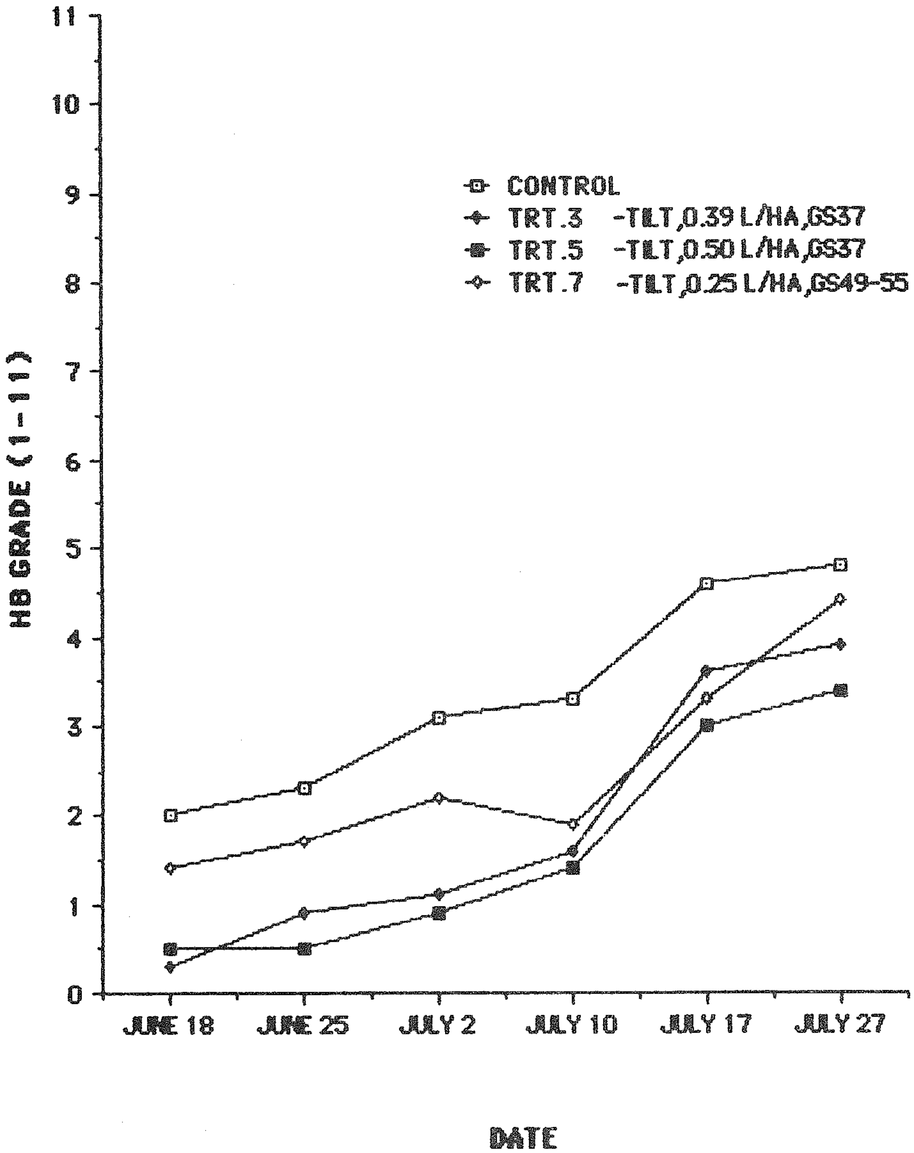
TABLE 3-1 (continued) WINTER WHEAT TRIAL 3: DISEASE RATING (HORSFALL-BARRATT GRADING SYSTEM)

Treatment	DISEASE RATING - HB GRADE (1 - 11)			
	July 10 GS 70	July 17 GS 76	July 27 GS 82-85	
			FL	2nd LF
1. Control	3.3 *a*	4.6 *a*	4.8	6.3
2. TILT, 0.25 l/ha, GS 37	2.0 *bc*	4.1 *ab*	3.9	5.9
3. TILT, 0.39 l/ha, GS 37	1.6 *c*	3.6 *bc*	3.9	5.8
4. TILT, 0.50 l/ha, GS 37	1.5 *c*	3.5 *bc*	3.8	5.6
5. TILT/TILT, 0.25/0.25 l/ha, GS 37/49-55	1.4 *c*	3.0 *c*	3.4	4.5
6. TILT/TILT, 0.50/0.50 l/ha, GS 37/49-55	1.5 *c*	3.1 *c*	3.4	4.8
7. TILT, 0.25 l/ha, GS 49-55	1.9 *bc*	3.3 *bc*	4.4	5.6
8. TILT, 0.39 l/ha, GS 49-55	2.1 *bc*	3.8 *abc*	4.6	6.3
9. TILT, 0.50 l/ha, GS 49-55	2.1 *bc*	3.7 *abc*	3.8	5.5
10. DITHANE M-45, 2.25 kg/2.25 kg, GS 49/+ 10 days.	2.5 *ab*	4.5 *a*	4.5	6.6
S.E. (difference)	0.4	0.4	NS	NS

*Means <u>within the same column</u>, which are followed by the same letter, are not significantly different at the 5% level (DMRT).

FIGURE 1

WINTER WHEAT TRIAL 3-DISEASE RATINGS



Experiment 4: WINTER WHEAT: FERTILITY X CYCOCEL

Legal Location: NE-12-52-25-W4

The objective of this trial was to determine the benefits of various levels of nitrogen fertilizer applications and their interaction with CYCOCEL.

Norstar winter wheat was seeded into standing barley stubble on September 2, 1986 using an International disc drill seeder with 6 inch (15 cm) row spacings. Seeding rate was 120 Kg/ha (350 seeds/m^2). The experiment was designed as a split plot with 4 replicates. Starter fertilizer placed with the seed consisted of 20 Kg N/ha; 50 Kg P_2O_5/ha; 30 Kg K_2O/ha; 10 Kg S/ha (in the form of 34-0-0, 11-51-0, 0-0-60 and 21-0-0-(24) respectively). BUCTRIL M was applied on May 7 for broadleaf weed control. Two blanket applications of TILT at 0.5 l/ha were applied at GS 37 and GS 49-55 on June 4 and June 15 respectively. All plots were harvested on August 14, 1987.

Treatments were as follows:

Mainplot treatments: all fertilizer treatments were single application, spring broadcast on April 15, 1987 (using 34-0-0).

1. Control
2. 30 Kg N/ha
3. 60 Kg N/ha
4. 90 Kg N/ha
5. 120 Kg N/ha
6. 150 Kg N/ha

Subplot treatments.

1. Control
2. CYCOCEL at 2.0 l/ha (+ 0.5% Citowett Plus) at GS 31 on May 25, 1987.

RESULTS AND CONCLUSIONS. WINTER WHEAT TRIAL 4

1. Average yield of Norstar winter wheat in this trial was 4699 kg/ha (70 bu/acre).

2. Fertility significantly affected lodging, with increasing fertility resulting in increased lodging compared to the control (Table 4-1).

3. CYCOCEL significantly reduced both lodging and height (Table 4-2).

4. There was a significant fertility by CYCOCEL interaction for 1000 K and height (Table 4-3). No interpretation of these results is offered.

5. In conclusion, although CYCOCEL is somewhat effective in reducing the lodging resulting from increased fertility, the extra cost involved in applying higher levels of nitrogen is not compensated for by an increase in yield. However, results may have been more encouraging if the fertility level of this field had been lower initially.

TABLE 4 WINTER WHEAT TRIAL 4. FERTILITY X CYCOCEL.

	df	Yield	Kernels/m^2	1000 K	kg/HL	Lodging	Maturity	Height
rep	3	NS	**	**	**	NS	**	NS
fert	5	NS	NS	NS	NS	**	NS	NS
CCC	1	NS	NS	NS	NS	**	NS	**
fert x CCC	5	NS	NS	*	NS	NS	NS	*
mainplot C.V. %		11.7	12.9	4.1	0.4	41.2	0.6	3.8
subplot C.V. %		10.9	11.2	1.8	0.4	28.2	1.0	3.4

TABLE 4 (continued) WINTER WHEAT TRIAL 4. FERTILITY X CCC.

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	NS	**	NS	**
fert	5	NS	NS	NS	NS
CCC	1	NS	NS	NS	NS
fert x CCC	5	NS	NS	NS	NS
mainplot C.V. %		23.6	12.7	26.1	19.2
subplot C.V. %		10.8	15.9	19.3	21.2

TABLE 4-1 WINTER WHEAT TRIAL 4. SIGNIFICANT (0.05) MAIN EFFECTS OF FERTILITY FOR LODGING.

	Lodging
1. Control	1.7 *d*
2. 30 kg N/ha	3.4 *c*
3. 60 kg N/ha	4.6 *bc*
4. 90 kg N/ha	4.4 *bc*
5. 120 kg N/ha	6.7 *a*
6. 150 kg N/ha	6.2 *ab*
S.E. (difference)	0.9

TABLE 4-2 WINTER WHEAT TRIAL 4. SIGNIFICANT (0.05) MAIN EFFECTS OF CYCOCEL FOR LODGING AND HEIGHT.

	Lodging	Height (cm)
1. Control	5.5 *a*	106.3 *a*
2. CCC, 2.0 l/ha, GS 31	3.5 *b*	97.3 *b*
S.E. (difference)	0.4	1.0

TABLE 4-3 WINTER WHEAT TRIAL 4. SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF FERTILITY AND CYCOCEL FOR 1000 K AND HEIGHT.

	1000 K (g)		Height (cm)	
Fertility	Control	CCC	Control	CCC
1. Control	37.02	36.13	107.8	91.0
2. 30 kg N/ha	36.07	36.35	106.8	94.8
3. 60 kg N/ha	35.38	36.05	104.8	96.0
4. 90 kg N/ha	35.35	33.93	104.5	101.8
5. 120 kg N/ha	33.70	34.07	106.8	99.5
6. 150 kg N/ha	33.72	33.82	107.0	101.0
Interaction S.E. (difference)	0.5		2.5	

b) SMALL SCALE SPRING WHEAT TRIALS (W240).

Location: W240, Edmonton Research Station, Edmonton, Alberta. NE-12-52-25-W4.

The spring wheat trials consisted of 6 experiments, all of which were seeded into barley stubble, except trial 4, which was repeated on fallow as well as on stubble.

The soil test result (Norwest labs) described the soil nutrient status (kg/ha) for the stubble field as: 108 nitrate, 45 phosphate, 507 potassium, 36 sulphate, pH 6.7, 0.52 E.C. (salinity), 12% organic matter and medium texture. Recommendations were a) no required N, and 25 Kg P_2O_5/ha placed, for excellent crop conditions (target yield of 74 bu/acre) and b) no required N and 25 Kg P_2O_5/ha placed for average crop conditions (target yield 60 bu/acre).

The soil test result (Norwest labs) described the soil nutrient status (kg/ha) for the fallow field as: 66 nitrate, 45 phosphate, 439 potassium, 35 sulphate, pH 6.0, 0.18 E.C. (salinity), 11% organic matter and medium texture. Recommendations were a) 41 Kg N/ha and 21 Kg P_2O_5/ha placed for excellent crop conditions (target yield 74 bu/acre) and b) 33 Kg N/ha and 21 Kg P_2O_5/ha placed for average crop conditions (target yield 60 bu/acre).

Experiment 1: SPRING WHEAT: RATE OF SEEDING X ROW SPACING.

Legal Location: NE-12-52-25-W4

The objective of this trial was to determine optimum crop density by varying seeding rates and row spacings for Neepawa and Oslo wheat.

Two varieties of spring wheat, Neepawa and Oslo, were seeded into separate trials having a split plot design and 4 replicates. Both varieties were seeded on May 14, 1987. The drills used were: 1) International disc drill (6 inch or 15 cm spacing) and 2) Nordsten (Danish) disc drill (5 inch or 12 cm spacing). Prior to seeding, 90 Kg P_2O_5/ha was banded with the International drill, and 30 Kg K_2O and 10 Kg S/ha were hand broadcast and harrowed. HOEGRASS II was applied on June 4 for general weed control. All plots received a blanket application of TILT at 0.5 l/ha at GS 49-55, on July 1. All seed was VITAVAX treated. Plots were harvested on September 14, 1987.

Treatments were as follows:

Mainplot treatments: Row Spacing

1. International drill 6" (15 cm) row spacing.
2. Nordsten drill, 5" (12 cm) row spacing.

Subplot treatments: Seed Rate

1. 200 seeds/m^2
2. 300 seeds/m^2
3. 400 seeds/m^2
4. 500 seeds/m^2

RESULTS AND CONCLUSIONS: TRIAL 1 NEEPAWA

1. Average yield of Neepawa in this trial was 3784 kg/ha (56 bu/acre).

2. There was no significant effect of row spacing on any variables except plants per m^2 (Table 5). As in winter wheat trial 1, the Nordsten (5 inch) drill resulted in a plant stand closest to the target plant density (Table 5-1).

3. Seeding rate had a significant effect on plants per m^2, heads per m^2, tillers per plant, 1000 K, test weight, maturity and height (Table 5). Increasing the seeding rate resulted in earlier maturity, a decrease in height and tillers per plant. 1000 K and test weight also decreased as seeding rate increased (Table 5-2). Possibly these effects can be explained by an increase in moisture stress and a decrease in available nitrogen as plant density increased. Although heads per m^2 were greatest at the highest seeding rate, there was no significant effect on yield from any of the seeding rate treatments.

4. There was a significant row spacing by seeding rate interaction with respect to lodging, tillers per plant and kernels per head (Table 5-3). With the International drill (6 inch row spacing), higher seeding rate significantly reduced lodging.

5. This trial was unable to detect any exploitable interaction between seeding rate and row spacing, since yield was not affected by any of the treatments. However, increasing the seeding rate from 300 to 400 seeds per m^2 reduced time to maturity by 4 1/2 days.

TABLE 5 SPRING WHEAT TRIAL 1. SEED RATE X ROW SPACING (NEEPAWA).

	df	Yield	Kernels/m²	1000 K	kg/HL	Lodging	Maturity	Height	WUE[1]
rep	3	NS	*	NS	NS	NS	*	*	NS
row sp.	1	NS	NS	NS	NS	NS	NS	NS	NS
seed rt.	3	NS	NS	**	*	NS	**	*	NS
row x seed sp rt.	3	NS	NS	NS	NS	*	NS	NS	NS
mainplot C.V. %		5.8	4.3	2.2	0.6	87.0	1.5	1.3	5.7
subplot C.V. %		8.1	8.4	2.5	0.4	41.4	1.7	2.1	8.1

TABLE 5 (continued) SPRING WHEAT TRIAL 1. SEED RATE X ROW SPACING (NEEPAWA).

	df	Plants/m²	Heads/m²	Tillers/plant	Kernels/head
rep	2	NS	NS	NS	NS
row sp.	1	*	NS	NS	NS
seed rt.	3	**	*	**	NS
row x seed sp. rt.	3	NS	NS	*	**
mainplot C.V. %		8.5	14.9	29.5	10.7
subplot C.V. %		13.6	10.4	27.1	12.7

[1]WUE = Water use efficiency = yield/water used - 10 cm

TABLE 5-1 TRIAL 1 NEEPAWA. SIGNIFICANT (0.05) MAIN EFFECTS OF ROW SPACING FOR PLANTS PER M^2.

	Plants/m^2
1. International (6")	289.0 *b*
2. Nordsten (5")	345.6 *a*
S.E. (difference)	11.0

(N.B. Experiment wide target Plants/m^2 was 350)

TABLE 5-2 TRIAL 1 NEEPAWA. SIGNIFICANT (0.05) MAIN EFFECTS OF SEED RATE FOR 1000 K, HECTOLITRE WEIGHT, MATURITY, HEIGHT, PLANTS PER M^2, HEADS PER M^2, TILLERS PER PLANT.

Seed rate	1000 K (g)	Kg/HL	Maturity (days)	Height (cm)	Plant/m^2	Heads/m^2	Tillers/plant
1. 200 seeds/m^2	32.34 *a*	73.9 *a*	119.8 *a*	95.4 *a*	189.5 *d*	477.3 *c*	2.9 *a*
2. 300 seeds/m^2	31.47 *b*	73.7 *ab*	118.5 *a*	93.0 *b*	263.7 *c*	505.0 *bc*	2.0 *bc*
3. 400 seeds/m^2	31.15 *cd*	73.6 *ab*	114.0 *bc*	92.4 *b*	375.5 *b*	568.7 *ab*	1.5 *cd*
4. 500 seeds/m^2	30.82 *d*	73.4 *b*	113.3 *c*	92.1 *b*	440.5 *a*	609.0 *a*	1.4 *d*
S.E. (difference)	0.4	0.1	1.0	1.0	24.9	32.5	0.3

TABLE 5-3 TRIAL 1 NEEPAWA. SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF ROW SPACING AND SEED RATE FOR LODGING, TILLERS PER PLANT AND KERNELS PER HEAD.

Seed Rate	Lodging		Tillers/plant		Kernels/head	
	6"	5"	6"	5"	6"	5"
1. 200 seeds/m^2	3.2	3.6	3.9	1.8	18.3	28.6
2. 300 seeds/m^2	2.4	3.6	2.1	1.9	26.1	23.5
3. 400 seeds/m^2	0.8	4.5	1.6	1.4	23.2	21.5
4. 500 seeds/m^2	1.2	4.1	1.5	1.3	20.0	19.3
S.E. (difference)	0.9		0.4		2.3	

RESULTS AND CONCLUSIONS. TRIAL 1 OSLO.

1. Average yield of Oslo in this trial was 3951 kg/ha (59 bu/acre).

2. There was a significant effect of row spacing on yield, kernels per m^2, height, heads per m^2 and tillers per plant (Table 6). Reduction in yield, yield components and height (Table 6-1) at the narrower row spacing was possibly due to pre-heading moisture stress, which is known to be a problem with Oslo.

3. Seeding rate had a significant effect on maturity, plants per m^2, heads per m^2, tillers per plant and kernels per head (Table 6-2). As in the case of Neepawa, there was no significant effect on yield.

4. There were no significant row spacing by seeding rate interactive effects on any of the variables (Table 6).

5. With the exception of the yield response to row spacing, Oslo behaved similarly to Neepawa in the row spacing by seeding rate trial. However, when Oslo seeding rate was increased from 300 to 400 seeds per m^2, time to maturity was advanced by only 1 day. For the two adjacent experiments, Oslo averaged 113.1 days to maturity compared to 116.4 days for Neepawa.

TABLE 6 SPRING WHEAT TRIAL 1. SEED RATE X ROW SPACING (OSLO).

	df	Yield	Kernels/m^2	1000 K	kg/HL	Lodging	Maturity	Height	WUE
rep	3	*	*	NS	NS	NS	NS	NS	NS
row sp.	1	*	*	NS	NS	NS	NS	*	NS
seed rt.	3	NS	NS	NS	NS	NS	**	NS	NS
row x seed sp. rt.	3	NS	NS	NS	NS	NS	NS	NS	NS
mainplot C.V. %		3.5	3.5	3.3	0.6	0	2.7	1.4	8.2
subplot C.V. %		9.8	10.7	3.5	0.5	0	1.7	2.3	14.9

TABLE 6 (continued) SPRING WHEAT TRIAL 1. SEED RATE X ROW SPACING (OSLO).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	NS	NS	*	NS
row sp.	1	NS	*	**	NS
seed rt.	3	**	**	**	**
row x seed sp. rt.	3	NS	NS	NS	NS
mainplot C.V. %		27.5	5.0	6.1	11.9
subplot C.V. %		11.7	11.6	17.2	9.8

TABLE 6-1 TRIAL 1 OSLO. SIGNIFICANT (0.05) MAIN EFFECTS OF ROW SPACING FOR YIELD, KERNELS PER M^2, HEIGHT, HEADS PER M^2 AND TILLERS PER PLANT.

	Yield kg/ha	Kernels/m^2	Height (cm)	Heads/m^2	Tillers/plant
1. International (6")	4069.3 *a*	11382.6 *a*	72.9 *a*	463.5 *a*	1.9 *a*
2. Nordsten (5")	3831.8 *b*	10832.8 *b*	70.8 *b*	412.6 *b*	1.4 *b*
S.E. (difference)	49.7	135.7	0.4	8.9	0.04

TABLE 6-2 TRIAL 1 OSLO. SIGNIFICANT (0.05) MAIN EFFECTS OF SEED RATE FOR MATURITY, PLANTS PER M^2, HEADS PER M^2, TILLERS PER PLANT AND KERNELS PER HEAD.

	Maturity (days)	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
1. 200 seeds/m^2	115.8 *a*	182.3 *d*	370.7 *d*	2.1 *a*	30.6 *a*
2. 300 seeds/m^2	113.3 *bc*	274.2 *c*	397.5 *cd*	1.6 *bc*	27.0 *bc*
3. 400 seeds/m^2	112.3 *cd*	344.0 *ab*	457.8 *bc*	1.5 *c*	24.7 *c*
4. 500 seeds/m^2	110.8 *d*	379.8 *a*	526.2 *a*	1.4 *c*	21.0 *d*
S.E. (difference)	1.1	20.0	29.4	0.2	1.5

Experiment 2: <u>SPRING WHEAT: NITROGEN FERTILITY</u>

Legal Location: NE-12-52-25-W4

The objective of this trial was to evaluate various rates and methods of nitrogen application for Neepawa and Oslo wheat.

Two varieties of spring wheat, Neepawa and Oslo, were seeded into separate trials on May 13 in a randomized block with 4 replicates. The drill used was a Swift Current seeder/bander with 9 inch (23 cm) row spacing. All seed was VITAVAX treated. Prior to seeding, 45 kg P_2O_5/ha and 30 Kg K_2O and 10 Kg S/ha were hand broadcast and harrowed. All treatments received 35 Kg P_2O_5/ha placed with the seed. HOEGRASS II was applied on June 4 for general weed control. A blanket application of TILT at a rate of 0.5 l/ha at GS 49-55 was applied on July 1. All Oslo plots were harvested September 2 and all Neepawa plots September 10, 1987.

Treatments were as follows:

1. No added N.
2. 30 Kg N/ha, banded at seeding.
3. 60 Kg N/ha, banded at seeding.
4. 90 Kg N/ha, banded at seeding.
5. 120 Kg N/ha, banded at seeding.
6. 150 Kg N/ha, banded at seeding.
7. 180 Kg N/ha, banded at seeding.
8. 30 Kg N/ha, hand broadcast at GS 00.
9. 60 Kg N/ha, hand broadcast at GS 00.
10. 90 Kg N/ha, hand broadcast at GS 00.
11. 120 Kg N/ha, hand broadcast at GS 00.
12. 150 Kg N/ha, hand broadcast at GS 00.
13. 180 Kg N/ha, hand broadcast at GS 00.
14. 60 Kg N/ha banded at seeding, 40/40 Kg N/ha hand broadcast at GS 31/49.

RESULTS AND CONCLUSIONS. TRIAL 2 NEEPAWA

1. Average yield of Neepawa in this trial was 4339 kg/ha (65 bu/acre).

2. Fertility levels had a significant effect on 1000 K, test weight, lodging and heads per m^2 (Table 7). Higher levels of nitrogen reduced 1000 K and test weight, and increased lodging and heads per m^2 (Table 7-1). There were no fertilizer responses for yield.

3. Consistent with there being no fertilizer response for yield in this trial, no difference between banding and broadcasting was found either. The lowest lodging scores were found in banded fertilizer applications and in the control.

4. Based on the spring soil test, yield responses to nitrogen were expected in this trial but were not obtained. In retrospect, the base fertility status of this field was obviously higher than was indicated, leading to lack of yield response.

TABLE 7 SPRING WHEAT TRIAL 2. NITROGEN FERTILITY (NEEPAWA).

	df	Yield	Kernels/m^2	1000 K	kg/HL	Lodging	Maturity	Height	WUE
rep	3	**	**	*	**	*	NS	*	*
fert.	13	NS	NS	*	*	*	NS	NS	NS
C.V. %		5.0	6.5	3.5	0.7	31.9	0	1.9	5.0

TABLE 7 (continued) SPRING WHEAT TRIAL 2. NITROGEN FERTILITY (NEEPAWA).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	NS	**	**	NS
fert.	13	NS	**	NS	NS
C.V. %		22.8	8.1	32.6	10.7

TABLE 7-1 TRIAL 2 NEEPAWA. SIGNIFICANT (0.05) MAIN EFFECTS OF FERTILITY FOR HECTOLITRE WEIGHT, 1000 K, LODGING AND HEADS PER M^2.

		Kg/Hl	1000 K	Lodging	Heads/m^2
1.	No added N	73.2 *bc*	32.8 *a*	4.7 *bcd*	493.3 *d*
2.	30 kgN/ha, banded	73.7 *abc*	31.4 *abcd*	5.8 *abcd*	604.3 *abc*
3.	60 kgN/ha, banded	73.2 *bc*	32.0 *abc*	4.7 *bcd*	597.0 *abc*
4.	90 kgN/ha, banded	74.2 *a*	31.9 *abcd*	3.9 *d*	539.7 *cd*
5.	120 kgN/ha, banded	73.5 *abc*	31.3 *abcd*	4.5 *bcd*	590.3 *bc*
6.	150 kgN/ha, banded	74.0 *ab*	30.8 *cd*	5.3 *bcd*	670.7 *a*
7.	180 kgN/ha, banded	73.8 *abc*	30.5 *cd*	6.9 *abc*	625.7 *ab*
8.	30 kgN/ha, broadcast	74.3 *a*	32.7 *ab*	5.1 *bcd*	541.3 *cd*
9.	60 kgN/ha, broadcast	73.5 *abc*	30.1 *d*	6.1 *abcd*	601.0 *abc*
10.	90 kgN/ha, broadcast	73.1 *c*	32.7 *abcd*	7.0 *ab*	572.0 *bc*
11.	120 kgN/ha, broadcast	73.1 *c*	31.2 *abcd*	8.0 *a*	581.7 *bc*
12.	150 kgN/ha, broadcast	73.8 *abc*	31.0 *bcd*	6.6 *abc*	588.0 *bc*
13.	180 kgN/ha, broadcast	73.7 *abc*	30.4 *cd*	6.5 *abc*	549.3 *bcd*
14.	60 kgN/ha, banded at GS 00; 40/40 kgN/ha broadcast GS 31/49	73.8 *abc*	30.6 *cd*	4.5 *cd*	562.3 *bcd*
	S.E. (difference)	0.4	0.8	1.1	32.6

RESULTS AND CONCLUSIONS. TRIAL 2 OSLO.

1. Average yield of Oslo in this trial was 5063 kg/ha (76 bu/acre).

2. No significant effects of nitrogen fertility were found for Oslo (Table 8). Explanation for lack of response is the same as described for the Neepawa trial.

TABLE 8 SPRING WHEAT TRIAL 2. NITROGEN FERTILITY (OSLO).

	df	Yield	Kernels/m^2	1000 K	kg/Hl	Lodging	Maturity	Height	WUE
rep	3	**	**	NS	NS	NS	NS	*	**
fert.	13	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %		7.1	8.1	3.3	0.5	0	0	2.4	7.1

TABLE 8 (continued) SPRING WHEAT TRIAL 2. NITROGEN FERTILITY (OSLO).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	**	**	**	NS
fert.	13	NS	NS	NS	NS
C.V. %		16.5	10.1	22.1	14.4

Experiment 3: SPRING WHEAT: PLANT GROWTH REGULATOR X FERTILITY

Legal Location: NE-12-52-25-W4

The objective of this trial was to evaluate plant growth regulators and their interaction with fertility levels for yield enhancement, for two newly registered tall cultivars of utility wheat.

Two varieties of wheat, Bluesky and Wildcat, were seeded into separate trials with the Nordsten disc drill at 5 inch (12 cm) row spacings. Experimental design was a split-plot with 4 replicates. All seed was VITAVAX treated. Prior to seeding, 90 Kg P_2O_5/ha was banded with the International drill, and 30 Kg K_2O and 10 Kg S was hand broadcast and harrowed. HOEGRASS II was applied on June 4 for general weed control. A blanket application of TILT was applied at GS 49-55 on July 1 at a rate of 0.5 l/ha. Bluesky was harvested on September 4 and Wildcat on September 10, 1987.

Treatments were as follows:

Mainplot treatments: Plant Growth Regulator

		Rate (kg A.I./ha)	GS	Date applied
1.	Control	-	-	-
2.	CERONE	0.08	39	June 24
3.	CERONE	0.15	39	June 24
4.	TERPAL C	0.30	32-37	June 23
5.	CYCOCEL/CERONE	0.69/0.15	31/39	June 18/June 24

Subplot treatments: Fertility

1. 60 Kg N/ha at GS 00: applied May 15.
2. 60/60/40 Kg N/ha at GS 00/31/49: applied May 15/June 18/July 2.

RESULTS AND CONCLUSIONS. TRIAL 3 BLUESKY

1. Average yield of Bluesky in this trial was 5129 kg/ha (77 bu/acre).

2. Plant growth regulator treatments were significant for yield, height and water use efficiency (Table 9). Treatment 9, a split application of CYCOCEL and CERONE, significantly increased yield compared to the control (Table 9-1). This yield increase did not occur with the CERONE (treatment 2) application only. This yield effect cannot be explained by an increase in tillering or by an effect on yield components. It should also be noted that all plots lodged severely (average lodging rating 7.7) and these yields increases cannot be explained by significant reduction in lodging.

3. Fertility treatments were significant for 1000 K and maturity (Table 9-2). Split applications of nitrogen fertilizer delayed maturity as in previous years.

4. There were no significant plant growth regulator by fertility interactions.

TABLE 9 SPRING WHEAT TRIAL 3. PGR X FERTILITY (PT325 - BLUESKY).

	df	Yield	Kernels/m^2	1000 K	kg/Hl	Lodging	Maturity	Height	WUE
rep	3	NS	NS	NS	NS	NS	NS	NS	NS
PGR	4	*	NS	NS	NS	NS	NS	**	*
fert.	1	NS	NS	*	NS	NS	*	NS	NS
PGR x fert	4	NS	NS	NS	NS	NS	NS	NS	NS
mainplot C.V. %		9.3	9.3	8.1	1.1	30.8	4.1	5.3	9.3
subplot C.V. %		9.2	8.7	4.0	0.5	14.9	2.2	2.8	9.2

TABLE 9 (continued) SPRING WHEAT TRIAL 3. PGR X FERTILITY (PT 325 - BLUESKY).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	NS	NS	NS	NS
PGR	4	NS	NS	NS	NS
fert.	1	NS	NS	NS	NS
PGR x fert.	4	NS	NS	NS	NS
mainplot C.V. %		23.3	6.8	36.0	9.8
subplot C.V. %		8.9	6.1	16.9	10.5

TABLE 9-1 TRIAL 3 (PT325 - BLUESKY). SIGNIFICANT (0.05) MAIN EFFECTS OF PGR FOR YIELD, HEIGHT AND WUE.

	Yield (kg/ha)	Height (cm)	WUE
1. Control	4894.3 *c*	92.8 *ab*	134.7 *c*
2. CERONE, 150 gai/ha, GS 39	5068.4 *bc*	90.1 *bc*	139.5 *bc*
3. CERONE, 300 gai/ha, GS 39	4929.4 *c*	85.4 *cd*	135.7 *c*
4. TERPAL C, 690 gai/ha, GS 32 - 37	5033.3 *c*	96.9 *a*	138.5 *c*
5. CYCOCEL/CERONE, 690/150 gai/ha, GS 31/39	5719.9 *a*	83.6 *d*	157.4 *a*
S.E. (difference)	239.0	2.4	6.6

TABLE 9-2 TRIAL 3 (PT325 - BLUESKY). SIGNIFICANT (0.05) MAIN EFFECTS OF FERTILITY FOR 1000 K AND MATURITY.

	1000 K (g)	Maturity (days)
1. 60 Kg N/ha GS 00	38.2 *b*	115.2 *b*
2. 60/60/40 Kg N/ha GS 00/31/49	39.4 *a*	117.3 *a*
S.E. (difference)	0.5	0.8

RESULTS AND CONCLUSIONS. TRIAL 3 WILDCAT.

1. Average yield of Wildcat in this trial was 4343 kg/ha (65 bu/acre).

2. There was a significant effect of plant growth regulator for yield, lodging, height and water use efficiency (Table 10). Lodging was very slight (average lodging rating 1.1) and all treatments, except treatment 4, significantly reduced lodging (Table 10-1). In contrast to Bluesky, CERONE at 300 gai/ha (treatment 3) and the split CYCOCEL/CERONE treatment significantly reduced yield compared to the control. This yield reduction cannot be explained by a decrease in tillers per plant or other yield components.

3. There was a significant effect of fertility for maturity and test weight (table 10-2). Split applications delayed maturity as in previous years.

4. The plant growth regulator by fertility trials with Bluesky and Wildcat show major interactions of cultivar with PGR, with Bluesky responding favorably in yield to treatments which suppress yield in Wildcat.

TABLE 10 SPRING WHEAT TRIAL 3. PGR X FERTILITY (PT329 - WILDCAT).

	df	Yield	Kernels/m^2	1000 K	kg/Hl	Lodging	Maturity	Height	WUE
rep	3	**	**	NS	NS	NS	NS	**	**
PGR	4	*	NS	NS	NS	**	NS	**	*
fert.	1	NS	NS	NS	*	NS	*	NS	NS
PGR x fert.	4	NS	NS	NS	NS	NS	NS	NS	NS
mainplot C.V. %		8.9	9.6	3.6	0.5	75.6	0.7	3.5	8.9
subplot C.V. %		6.1	6.2	3.1	0.4	105.5	0.6	3.1	6.1

TABLE 10 (continued) SPRING WHEAT TRIAL 3. PGR X FERTILITY (PT329 - WILDCAT).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep	2	**	NS	**	NS
PGR	4	NS	NS	NS	NS
fert.	1	NS	NS	NS	NS
PGR x fert.	4	NS	NS	NS	NS
mainplot C.V. %		11.8	9.3	15.3	14.3
subplot C.V. %		9.0	10.2	12.5	12.4

TABLE 10-1 TRIAL 3 (PT329 - WILDCAT). SIGNIFICANT (0.05) MAIN EFFECTS OF PGR FOR YIELD, LODGING, HEIGHT AND WUE.

	Yield (kg/ha)	Lodging	Height (cm)	WUE
1. Control	4609.3 *a*	2.5 *a*	84.9 *a*	126.9 *a*
2. CERONE, 150 gai/ha GS 39	4598.5 *ab*	0.5 *b*	77.4 *bc*	126.6 *ab*
3. CERONE, 300 gai/ha GS 39	4141.5 *c*	0.2 *b*	75.1 *c*	114.0 *cd*
4. TERPAL C, 690 gai/ha GS 32 - 37	4390.6 *abc*	2.3 *a*	83.5 *a*	120.9 *abc*
5. CYCOCEL/CERONE 690/150 gai/ha GS 31/39	3976.3 *c*	0.2 *b*	70.3 *d*	109.4 *d*
S.E. (difference)	193.5	0.4	1.4	5.3

TABLE 10-2 TRIAL 3 (PT329 - WILDCAT). SIGNIFICANT (0.05) MAIN EFFECTS OF FERTILITY FOR HECTOLITRE WEIGHT AND MATURITY.

	Kg/Hl	Maturity (days)
1. 60 kg N/ha, GS 00	73.6 *a*	110.7 *b*
2. 60/60/40 kg N/ha GS 00/32/49	73.4 *b*	111.2 *a*
S.E. (difference)	0.1	0.2

Experiment 4A: Spring Wheat: Cultivar X Management (stubble)

Legal Location: NE-12-52-25-W4

The objective in this last year of a three year trial was to evaluate 16 cultivars, licensed and otherwise, and their possible interaction with different management levels. Two management levels were used, as in previous years, but a third management level was also added for HY320, Oslo, Neepawa, PT325 (Bluesky), PT329 (Wildcat). This trial was conducted on barley stubble, but was also repeated on fallow on an adjacent field. Data are reported separately for the 2 management levels (16 cultivars) and 3 management levels (5 cultivars). Results from the fallow trial (trial 4b) are reported separately.

This stubble trial was seeded with a Swift Current double disc drill at 9 inch (22 cm) row spacings on May 13, 1987. The trial was designed as a split-plot with 4 replicates. Prior to seeding 90 Kg P_2O_5/ha was banded with the International drill and 30 Kg K_2O/ha and 10 Kg S/ha were hand broadcast and harrowed. HOEGRASS II was applied on June 4 for general weed control. Some early maturing cultivars were harvested on September 2, while all remaining cultivars were harvested on September 10.

Mainplot treatments: Cultivar

1. HY320
2. Oslo
3. Norquay
4. PT726
5. PT741
6. PT742
7. PT329 (Wildcat)
8. Glenlea
9. Neepawa
10. Katepwa
11. Columbus
12. Park
13. BW569 (Conway)
14. PT325 (Bluesky)
15. QT8132
16. BW92 (Roblin)

Subplot treatments: Management

1. Conventional treatment: seeding rate 300 seeds/m^2 (VITAVAX treated); no additional N fertilizer; no plant growth regulators or fungicides used.

2. Integrated Crop Management (ICM) treatment: seeding rate 500 seeds/m^2 (VITAVAX treated); target yield 100 bu/acre (76 Kg N/acre added); one application of CYCOCEL at 1.5 l/ha at GS 31 on June 18; one application of TILT at 0.5 l/ha at GS 49-55 on July 1. The ICM treatment is a fixed protocol treatment applied to all varieties.

3. Optimum varietal management (OVM) treatment: seeding rate 500 seeds/m^2 (VITAVAX treated); target yield based on individual estimate of yield potential (see table below); TILT application not required. The OVM treatment was only applied on the cultivars HY320, Oslo, Neepawa, Bluesky and Wildcat.

The following outlines the procedure by which yield targets for the OVM treatments in Trial 4A (Stubble) was arrived at. The base level information used was the commercially obtained spring sample soil test report, which included estimates of (a) the yield potential for the existing fertility level, and (b) estimates of the added nutrients required to be added to obtain specified yields of CWRS wheat. This information is the same as farmers receive.

These reports indicated that without further nitrogen addition the stubble field should yield 75 bu/acre of wheat (CWRS, presumably), given normal moisture availability. Based on prior experience in Edmonton, we did not accept the idea that 75 bu/acre of Neepawa (CWRS) was achievable, and we therefore set the target yield of Neepawa without N addition at a lower level of 65 bu/acre. Target yields for the other four cultivars being tested by OVM were then estimated relative to Neepawa, based on prior data of relative yields in Edmonton. Because of the known nitrogen responsiveness of HY320, as well as the good spring moisture conditions, and because the final yield target for the HY320 OVM treatment exceeded the 75 bu/acre base yield level estimated from the soil test, 15 kg/ha of addition broadcast N was added to the HY320 plots only. Target yields were as follows:

Trial 4A (Stubble).

Cultivar	Yield capability (bu/acre) Soil test basis without added nitrogen	U of A Target Yield (bu/acre) for OVM	Additional N (kg/ha) added to achieve U of A OVM target yield
Bluesky	-	70	-
Wildcat	-	70	-
HY320	-	80	15
Oslo	-	70	-
Neepawa	75	65	-

The higher seed rate of 500 seeds/m^2 was applied uniformly to all 5 varieties for their OVM treatments, as they were all believed to be responsive to this input. It was planned to provide other inputs i.e., split fertilizer, growth regulators, fungicides, according to the individual estimated needs of the varieties as the season progressed, so that all OVM treatments would not necessarily be the same.

Conditions were such that none of these extra inputs were actually applied to any of the varieties.

Two methods of analysis for Trial 4A (Stubble) were used:

1. Analysis of 16 cultivars and 2 management levels.
2. Analysis of 2 cultivars and 3 management levels.

RESULTS AND CONCLUSIONS: TRIAL 4A (STUBBLE) 16 CULTIVARS AND 2 MANAGEMENT LEVELS.

1. Cultivar effects were highly significant for all variables except plants per m^2 (Table 11). In this trial, 11 varieties were found to be significantly higher yielding than Neepawa, and 4 of these (Oslo, Norquay, Wildcat and QT8132) were found to be significantly earlier maturing (Table 11-1). Major varietal differences in lodging were found, with Glenlea and Bluesky being notably poor. It should be noted, however, that this trial was grown at a very high nutrient level and received extreme winds associated with the July tornado, which touched down less than 2 miles away. The extremely good straw strength of Oslo and Norquay under these conditions is notable. Maximum wind speeds of up to 120 km/h were recorded on the farm.

2. The highest yields were found for HY320 (5231 kg/ha) and PT742 (4957 kg/ha). The lowest yields were found for the CWRS cultivars Neepawa, Katepwa, Park, BW569 (Conway) and BW92 (Roblin) (Table 11-1).

3. Management level was found to be significant for all variables except lodging and harvest index (Table 11). The lack of significant effect on lodging indicates that CYCOCEL was ineffective in reducing lodging for any variety, even though lodging scores up to 8 were found in this trial. The ICM management treatment did significantly increase yield (by 10%) but delayed maturity (by an average of 1.5 days) (Table 11-2). This increase in yield seemed mainly due to an increase in plant density and kernels per m^2, rather than from an increase in significant tillering, kernels per m^2 or 1000 K (all of which decreased). It is difficult to conclude whether the TILT application influenced yield since disease levels (mainly powdery mildew) were low in this trial.

4. Significant cultivar by management interactions were found in this stubble test for yield, 1000 K, water use efficiency, height, test weight and heads per m^2 (Table 11-3). Significant yield increases under the ICM management level were not found for Glenlea or Bluesky, but these two varieties also lodged the most under the higher fertility regime. The remainder of the cultivar x management interactions consists of differential response in the extent of the positive response to the ICM inputs (Figure 2).

5. The main features of the results from Trial 4A (16 cultivars, 2 management levels) on stubble are as follows. Firstly, interaction of variety with management level was found for yield, and was mainly attributable to lack of yield response by Glenlea and Bluesky. These were also the two varieties which lodged severely in this trial. Secondly, the CYCOCEL used in the protocol ICM treatment was ineffective in reducing lodging for any of the varieties. Thirdly, as in the previous two years on fallow, a number of the varieties were significantly higher yielding than Neepawa. Four of these were significantly earlier in maturity than Neepawa (Oslo, Norquay, Wildcat and QT8132, the last by 11 days). The lowest yielding cultivars in the trial were CWRS type as in previous years on fallow. Fourthly, despite this trial being on barley stubble the basic fertility level of this trial was very high, leading to very high wheat yields even without added nutrients.

TABLE 11 SPRING WHEAT TRIAL 4A (STUBBLE). CULTIVAR X MANAGEMENT (1987). 16 CULTIVARS. 2 MANAGEMENT LEVELS.

	df	Maturity	Yield	Kernels/m^2	1000 K	Kg/Hl	Lodging
rep	3	NS	*	*	NS	NS	NS
cult.	15	**	**	**	**	**	**
mgt.	1	**	**	**	**	**	NS
cult. x mgt.	15	NS	**	NS	**	**	NS
mainplot C.V. %		2.6	9.2	9.0	3.2	0.9	0.4
subplot C.V. %		1.4	6.6	7.7	3.0	0.7	0.3

TABLE 11 (continued) SPRING WHEAT TRIAL 4A (STUBBLE). CULTIVAR X MANAGEMENT (1987). 16 CULTIVARS. 2 MANAGEMENT LEVELS.

	df	TOTDM	HI	Height	WUE
rep.	3	*	NS	NS	*
cult.	15	**	**	**	**
mgt.	1	**	NS	**	**
cult. x mgt.	15	NS	NS	**	**
mainplot C.V.		0.7	0	2.6	9.2
subplot C.V. %		0.6	0	2.5	6.6

SPRING WHEAT TRIAL 4A (STUBBLE). CULTIVAR X MANAGEMENT (1987). 16 CULTIVARS. 2 MANAGEMENT LEVELS. ANALYSIS ON 3 REPLICATES.

	df	Plants/m^2	Heads/m^2	Kernels/head	Tillers/plant
rep	2	NS	NS	NS	NS
cult.	15	NS	**	**	**
mgt.	1	**	**	**	*
cult. x mgt.	15	NS	*	NS	NS
mainplot C.V. %		15.8	12.1	12.7	16.4
subplot C.V. %		20.0	9.8	12.6	18.3

PART A: TABLE 11-1 TRIAL 4A, STUBBLE (16 CULTIVARS AND 2 MANAGEMENT LEVELS, 1987) SIGNIFICANT (0.05) MAIN EFFECTS OF CULTIVAR FOR MATURITY, YIELD, KERNELS PER M^2, 1000 K HECTOLITRE WEIGHT, LODGING, HEADS PER M^2, KERNELS PER HEAD AND TILLERS PER PLANT.

		Maturity (days)	Yield (kg/ha)	Kernels/m^2	1000 K (g)	Kg/Hl
1.	HY320	119.6 *ab*	5230.8 *a*	14103.5 *a*	37.1 *ef*	74.8 *cd*
2.	Oslo	112.4 *efg*	4251.3 *cde*	11889.1 *cd*	35.8 *hi*	74.4 *def*
3.	Norquay	112.0 *fg*	4423.3 *cd*	11999.5 *c*	36.9 *fgh*	74.9 *bcd*
4.	PT726	114.8 *cdef*	4340.6 *cd*	11317.5 *cdef*	38.4 *d*	75.5 *ab*
5.	PT741	113.6 *def*	4522.9 *c*	10631.1 *efg*	42.6 *a*	75.6 *a*
6.	PT742	114.1 *cdef*	4956.5 *a*	12335.0 *bc*	40.2 *c*	75.8 *a*
7.	PT329 (Wildcat)	109.5 *g*	4538.9 *bc*	12290.3 *c*	36.9 *fg*	74.3 *def*
8.	Glenlea	121.8 *a*	4316.6 *cd*	10422.3 *fg*	41.5 *ab*	75.2 *abc*
9.	Neepawa	116.3 *cd*	3665.0 *g*	11511.4 *cde*	31.9 *k*	73.8 *f*
10.	Katepwa	115.3 *cde*	3808.4 *fg*	11639.6 *cde*	32.7 *jk*	74.0 *ef*
11.	Columbus	121.0 *a*	4175.9 *cdef*	11783.0 *cd*	35.6 *i*	75.6 *a*
12.	Park	114.1 *cdef*	3825.3 *fg*	12051.9 *c*	31.8 *k*	75.2 *abc*
13.	BW569 (Conway)	117.1 *bc*	3564.8 *g*	10993.0 *defg*	32.6 *k*	74.0 *ef*
14.	PT325 (Bluesky)	113.8 *def*	4322.6 *cd*	10599.0 *efg*	40.8 *bc*	74.1 *ef*
15.	QT8132	105.6 *h*	4123.6 *def*	9557.5 *g*	43.1 *a*	75.6 *a*
16.	BW92 (Roblin)	115.4 *cde*	3898.8 *efg*	10888.8 *defg*	35.8 *ghi*	74.5 *de*
	S.E. (difference)	1.5	194.5	519.9	0.6	0.3

		Lodging	Heads/m^2	Kernels/head	Tillers/plant
1.	HY320	2.3 *ef*	364.0 *f*	38.0 *a*	1.07 *de*
2.	Oslo	0.2 *g*	408.5 *f*	28.8 *def*	1.06 *de*
3.	Norquay	0.2 *g*	413.8 *ef*	28.2 *def*	1.20 *bcd*
4.	PT726	1.6 *f*	410.8 *f*	29.2 *cde*	1.13 *cde*
5.	PT741	4.2 *c*	397.3 *f*	25.7 *efg*	1.28 *abcd*
6.	PT742	3.8 *d*	420.7 *ef*	29.2 *de*	1.33 *abc*
7.	PT329 (Wildcat)	3.6 *de*	377.5 *f*	33.3 *bc*	1.14 *bcde*
8.	Glenlea	7.9 *a*	364.8 *f*	29.2 *de*	1.15 *bcde*
9.	Neepawa	3.6 *de*	486.5 *abc*	23.1 *gh*	1.43 *a*
10.	Katepwa	3.8 *d*	505.5 *ab*	23.2 *gh*	1.32 *abc*
11.	Columbus	4.2 *cd*	471.8 *abcde*	24.8 *fgh*	1.36 *ab*
12.	Park	5.6 *b*	482.2 *abcd*	25.5 *efg*	1.31 *abc*
13.	BW569 (Conway)	3.6 *de*	511.7 *a*	21.5 *h*	1.42 *a*
14.	PT325 (Bluesky)	8.1 *a*	367.2 *f*	30.1 *cd*	0.94 *e*
15.	QT8132	0.2 *g*	371.3 *f*	25.4 *efgh*	1.08 *de*
16.	BW92 (Roblin)	2.3 *ef*	399.5 *f*	27.5 *def*	1.24 *abcd*
	S.E. (difference)	0.7	29.5	2.0	0.1

PART B: TABLE 11-1 TRIAL 4A (STUBBLE). 16 CULTIVARS AND 2 MANAGEMENT LEVELS, 1987. SIGNIFICANT (0.05) MAIN EFFECT OF CULTIVAR FOR TOTAL DRY MATTER, HARVEST INDEX, HEIGHT AND WATER USE EFFICIENCY.

		TOTDM (g)	HI	Height (cm)	WUE
1.	HY320	2268.8 *a*	0.53 *ab*	75.0 *h*	179.4 *a*
2.	Oslo	1973.8 *defgh*	0.49 *def*	70.6 *j*	145.8 *def*
3.	Norquay	1941.3 *efgh*	0.52 *abc*	72.6 *ij*	151.7 *de*
4.	PT726	2001.3 *cdef*	0.50 *bcde*	75.3 *h*	148.9 *de*
5.	PT741	1988.8 *cdefg*	0.52 *abc*	81.1 *f*	155.1 *d*
6.	PT742	2156.3 *ab*	0.53 *ab*	76.5 *gh*	170.0 *ab*
7.	PT329 (Wildcat)	2047.5 *bcde*	0.51 *bcd*	86.1 *e*	155.6 *cd*
8.	Glenlea	2121.3 *bc*	0.47 *fg*	101.9 *a*	148.0 *de*
9.	Neepawa	1922.5 *efgh*	0.44 *h*	93.9 *c*	125.7 *h*
10.	Katepwa	1922.5 *efgh*	0.45 *gh*	96.0 *bc*	130.6 *gh*
11.	Columbus	2112.5 *bcd*	0.45 *gh*	101.1 *a*	143.2 *defg*
12.	Park	1837.5 *hi*	0.48 *ef*	89.5 *d*	131.2 *gh*
13.	BW569 (Conway)	1871.3 *fghi*	0.44 *h*	95.4 *bc*	122.2 *gh*
14.	PT325 (Bluesky)	1987.5 *cdefg*	0.50 *cde*	96.5 *bc*	148.2 *de*
15.	QT8132	1732.5 *i*	0.54 *a*	63.6 *k*	141.4 *efg*
16.	BW92 (Roblin)	1851.3 *ghi*	0.48 *ef*	85.9 *e*	133.7 *fgh*
	S.E. (difference)	73.3	0.01	1.1	6.7

TABLE 11-2 TRIAL 4A (STUBBLE). 16 CULTIVARS AND 2 MANAGEMENTS LEVELS. SIGNIFICANT (0.05) MAIN EFFECTS OF MANAGEMENT FOR MATURITY, YEILD, KERNELS PER M^2, 1000 K, HECTOLITRE WEIGHT, PLANTS PER M^2, HEADS PER M^2, KERNELS PER HEAD, TILLERS PER PLANT, TOTAL DRY MATTER, HEIGHT AND WUE.

	Maturity (days)	Yield (kg/ha)	Kernels/m^2	1000 K (g)	Kg/HL	Plants/m^2
1. Conventional	114.0 *b*	4033.4 *b*	10825.4 *b*	37.4 *b*	75.0 *a*	303.4 *b*
2. ICM	115.5 *a*	4462.2 *a*	12176.1 *a*	36.8 *a*	74.7 *b*	411.6 *a*
S.E. (difference)	0.3	49.9	156.5	0.2	0.1	14.6

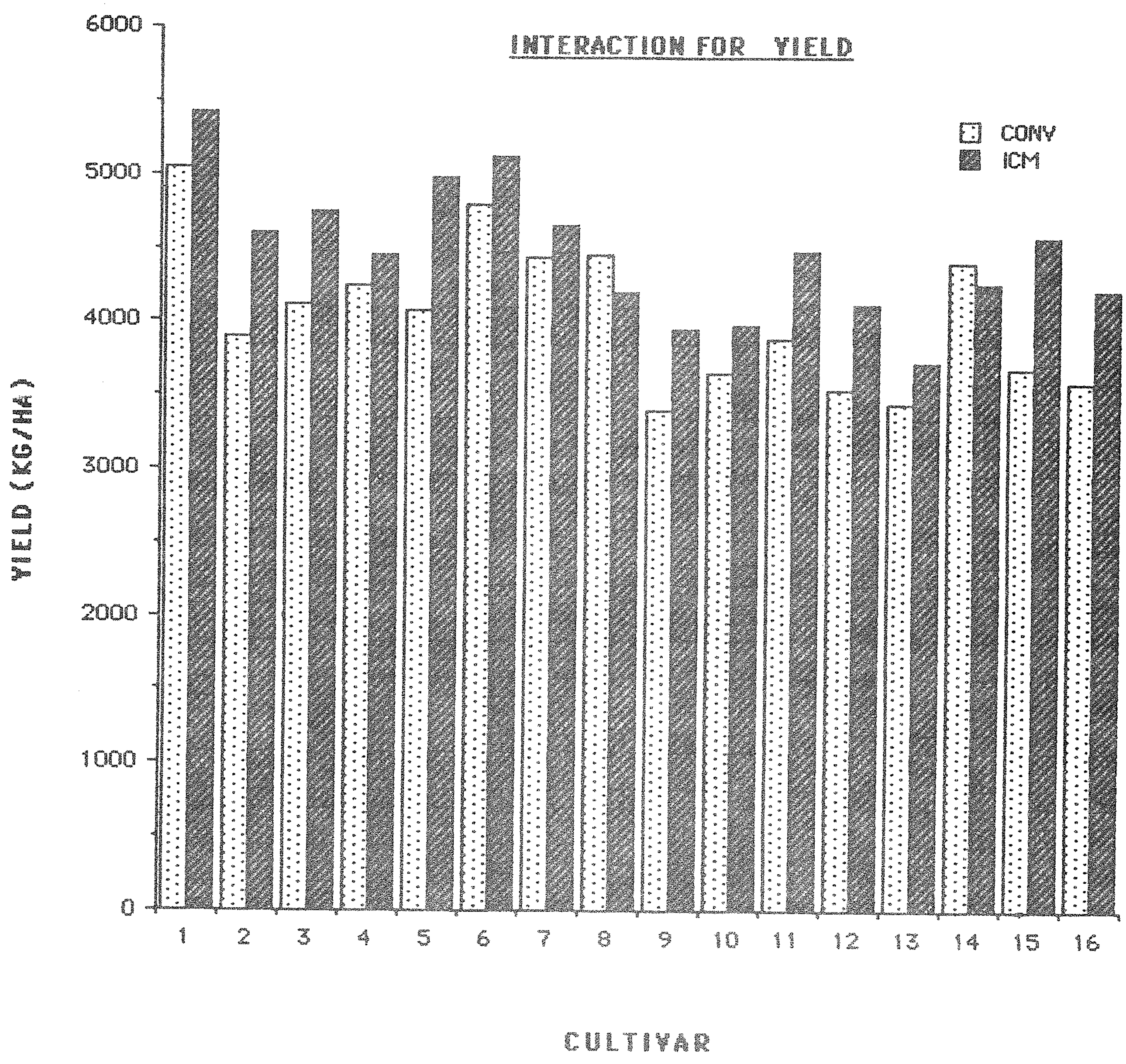
	Heads/m^2	Kernels/head	Tillers/plant	TOTDM (g)	Height (cm)	WUE
1. Conventional	377.5 *b*	28.9 *a*	1.3 *a*	1880. *b*	87.4 *a*	138.3 *b*
2. ICM	466.7 *a*	26.4 *b*	1.2 *b*	2087. *a*	82.8 *b*	153.0 *a*
S.E. (difference)	8.4	0.7	0.04	21.9	0.4	1.7

TABLE 11-3 TRIAL 4A (STUBBLE). 16 CULTIVARS AND 2 MANAGEMENT LEVELS. SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF CULTIVAR AND MANAGEMENT FOR YIELD, 1000 K, HECTOLITRE WEIGHT, HEIGHT, WUE AND HEADS PER M^2.

	Yield (kg/ha)		1000 K (g)		WUE	
	Conv	ICM	Conv	ICM	Conv	ICM
1. HY320	5044	5418	37.7	36.6	173.0	185.8
2. Oslo	3899	4603	35.7	35.8	133.7	157.9
3. Norquay	4111	4736	37.0	36.9	141.0	162.4
4. PT726	4237	4445	38.3	38.6	145.3	152.4
5. PT741	4066	4980	43.2	42.1	139.5	170.8
6. PT742	4787	5126	40.6	39.9	164.3	175.8
7. PT329 (Wildcat)	4429	4649	36.4	37.5	151.9	159.4
8. Glenlea	4447	4186	43.4	39.6	152.5	143.6
9. Neepawa	3393	3938	31.8	32.0	116.4	135.0
10. Katepwa	3648	3969	33.0	32.5	125.1	136.2
11. Columbus	3881	4471	36.7	34.4	133.1	153.3
12. Park	3540	4111	32.1	31.6	121.4	141.0
13. BW569 (Conway)	3400	3729	33.0	32.2	116.6	127.9
14. PT325 (Bluesky)	4394	4252	41.7	39.9	150.7	145.8
15. QT8132	3673	4575	42.5	43.7	126.0	156.9
16. BW92 (Roblin)	3588	4209	35.6	36.0	123.1	144.3
Interaction S.E. (difference)	199.5		0.8		6.8	

	Height (cm)		Kg/Hl		Heads/m^2	
	Conv	ICM	Conv	ICM	Conv	ICM
1. HY320	76.8	73.3	75.1	74.5	345	383
2. Oslo	72.3	69.0	74.9	73.9	341	476
3. Norquay	71.8	73.5	75.0	74.8	392	436
4. PT726	77.5	73.0	75.7	75.3	348	474
5. PT741	84.0	78.3	76.3	75.0	353	442
6. PT742	80.3	72.8	76.5	75.1	391	450
7. PT329 (Wildcat)	89.3	83.0	74.2	74.5	314	441
8. Glenlea	103.8	100.0	76.1	74.4	319	410
9. Neepawa	96.5	91.3	73.8	73.9	468	505
10. Katepwa	97.8	94.3	74.2	73.7	476	535
11. Columbus	103.0	99.3	75.6	75.7	425	519
12. Park	94.3	84.8	75.2	75.2	394	571
13. BW569 (Conway)	96.5	94.3	73.9	74.0	428	596
14. PT325 (Bluesky)	99.8	93.2	74.1	74.0	292	442
15. QT8132	67.5	59.8	75.4	75.7	375	367
16. BW92 (Roblin)	87.0	84.8	74.3	74.7	379	420
Interaction S.E. (difference)	1.5		0.4		33.7	

FIGURE 2: TRIAL 4A (FROM TABLE 11-3) CULTIVAR X MANAGEMENT



RESULTS AND CONCLUSION. TRIAL 4A (STUBBLE). 5 CULTIVARS, 3 MANAGEMENT LEVELS.

1. Cultivar effects were found to be significant for all variables except plants per m^2 and tillers per plant (Table 12). All other varieties were found to be higher yielding than Neepawa, although the highest yielding (HY320) was also the last to mature (Table 12-1). All other varieties were also higher than Neepawa for 1000 K, harvest index and kernels per head. All Bluesky plots lodged severely compared to Neepawa, while Oslo did not lodge at all.

2. Management level was found to be significant for all variables except tillers per plant (Table 12). The ICM management levels resulted in the highest yield, but also in the latest maturity. OVM did not significantly increase the yield over Conventional, but the higher seedrate did lead to 2 days saving in maturity, but with some increase in lodging (Table 12-2).

3. There were no significant cultivar by management interactions (3 levels) for the five varieties in this analysis (HY320, Oslo, Wildcat, Neepawa and Bluesky).

4. The major features of this trial on stubble was the absence of interaction of the three management methods with the five cultivars. The seasonal circumstances resulted in the OVM treatment being identical with the Conventional treatment except for seedrate (with the exception of HY320, for which some extra N had been added). The two day saving in maturity for OVM compared to Conventional may therefore be attributed to the increased seedrate, but no yield gain was obtained. This increased seedrate in OVM also increased lodging.

5. It is of interest to compare the actual yields obtained from the various treatments to those predicted by the soil test, those set as targets for the Conventional, and those obtained by OVM (Table 12-3). Compared to target yields, the Conventional yields were within 5 bushels (lower) for Bluesky, Wildcat and HY320. The best yield obtained for Neepawa was much less than target, and 25 bushels less than that predicted by the soil test. Oslo's inability to yield near target may be explained by the occurrence of preflowering drought, to which Oslo is known to be very susceptible.

TABLE 12 SPRING WHEAT TRIAL 4A (STUBBLE). CULTIVAR X MANAGEMENT (1987). 5 CULTIVARS. 3 MANAGEMENT LEVELS.

	df	Maturity	Yield	Kernels/m^2	1000 K	Kg/Hl	Lodging
rep	3	NS	**	**	NS	NS	NS
cult.	4	**	**	**	**	**	**
mgt.	2	**	**	**	*	**	*
cult. x mgt.	8	NS	NS	NS	NS	NS	NS
mainplot C.V. %		2.7	7.6	7.6	3.3	0.7	42.5
subplot C.V. %		1.9	6.7	7.5	3.1	0.8	30.0

TABLE 12 (continued) SPRING WHEAT TRIAL 4A (STUBBLE). CULTIVAR X MANAGEMENT (1987). 5 CULTIVARS. 3 MANAGEMENT LEVELS.

	df	TOTDM	HI	Height	WUE
rep.	3	*	NS	NS	**
cult.	4	**	**	**	**
mgt.	2	*	**	**	**
cult. x mgt.	8	NS	NS	NS	NS
mainplot C.V. %		8.5	0	2.7	7.6
subplot C.V. %		7.4	0	2.8	6.7

TABLE 12 (continued) SPRING WHEAT TRIAL 4A (STUBBLE). CULTIVAR X MANAGEMENT (1987). 5 CULTIVARS. 3 MANAGEMENT LEVELS.

	df	Plants/m^2	Heads/m^2	Kernels/head	Tillers/plant
rep	2	NS	NS	NS	NS
cult.	4	NS	**	**	NS
mgt.	2	**	**	**	NS
cult. x mgt.	8	NS	NS	NS	NS
mainplot C.V. %		17.3	9.8	12.8	0.2
subplot C.V. %		19.9	13.8	15.1	0.2

TABLE 12-1 TRIAL 4A (STUBBLE). 5 CULTIVARS AND 3 MANAGEMENT LEVELS, 1987. SIGNIFICANT (0.05) MAIN EFFECTS OF CULTIVAR FOR MATURITY, YIELD, KERNELS PER M^2, 1000 K, HECTOLITRE WEIGHT, LODGING, HEADS PER M^2, KERNELS PER HEAD, TOTAL DRY MATTER, HARVEST INDEX, HEIGHT AND WATER USE EFFICIENCY.

		Maturity (days)	Yield (kg/ha)	Kernels/m^2	1000 K (g)	Kg/Hl	Lodging
1.	HY320	119.8 *a*	5146.2 *a*	13904.5 *a*	37.1 *bc*	74.9 *a*	2.8 *d*
2.	Oslo	111.9 *d*	4095.5 *d*	11437.6 *cd*	35.8 *d*	74.8 *ab*	0.2 *e*
3.	Wildcat	107.8 *e*	4448.5 *bc*	12172.4 *bc*	36.5 *cd*	74.3 *bc*	4.3 *bc*
4.	Neepawa	115.0 *bc*	3605.0 *e*	11387.3 *d*	31.7 *e*	73.9 *c*	3.6 *cd*
5.	Bluesky	113.8 *cd*	4216.9 *cd*	10534.0 *e*	40.0 *a*	74.3 *bc*	8.4 *a*
S.E. (difference)		1.2	133.3	367.2	0.5	0.2	0.7

		Heads/m^2	Kernels/head	TOTDM (g)	HI	Height (cm)	WUE
1.	HY320	400.9 *cd*	34.5 *a*	2239.2 *a*	0.52 *a*	75.4 *d*	176.4 *a*
2.	Oslo	424.9 *bc*	26.6 *cd*	1931.7 *c*	0.48 *b*	70.8 *e*	140.5 *d*
3.	Wildcat	374.8 *d*	32.7 *a*	2050.0 *bc*	0.49 *ab*	86.8 *c*	152.6 *bc*
4.	Neepawa	479.0 *a*	23.3 *d*	1930.8 *c*	0.43 *c*	95.0 *b*	123.6 *e*
5.	Bluesky	389.9 *cd*	27.7 *bc*	1980.0 *c*	0.49 *b*	97.3 *a*	144.6 *cd*
S.E. (difference)		19.2	1.7	70.6	0.01	0.9	4.6

TABLE 12-2 TRIAL 4A (STUBBLE). 5 CULTIVARS AND 3 MANAGEMENT LEVELS, SIGNIFICANT (0.05) MAIN EFFECTS OF MANAGEMENT FOR MATURITY, YIELD, KERNELS PER M^2, 1000 K, HECTOLITRE WEIGHT, LODGING, PLANTS PER M^2, HEADS PER M^2, KERNELS PER HEAD, TOTAL DRY MATTER, HARVEST INDEX, HEIGHT AND WATER USE EFFICIENCY.

		Maturity (days)	Yield (kg/ha)	Kernels/m^2	1000 K (g)	Kg/Hl	Lodging
1.	CONV	113.8 *b*	4231.5 *bc*	11549.4 *bc*	36.6 *a*	74.4 *bc*	3.4 *b*
2.	ICM	115.3 *a*	4572.0 *a*	12621.5 *a*	36.4 *ab*	74.2 *c*	3.8 *ab*
3.	OVM	111.9 *c*	4103.9 *c*	11490.7 *c*	35.7 *b*	74.8 *a*	4.4 *a*
S.E. (difference)		0.7	90.8	282.3	0.4	0.2	0.4

		Plants/m^2	Heads/m^2	Kernels/head	TOTDM (g)	HI	Height (cm)	WUE
1.	CONV	304.3 *b*	352.0 *b*	33.1 *a*	1967.5 *b*	0.49 *a*	86.9 *a*	145.1 *bc*
2.	ICM	425.0 *a*	449.5 *a*	28.3 *bc*	2112.5 *a*	0.49 *a*	82.0 *b*	156.8 *a*
3.	OVM	453.1 *a*	440.2 *ab*	25.6 *c*	1999.0 *b*	0.47 *b*	86.4 *a*	140.7 *c*
S.E. (difference)		28.6	20.9	1.6	47.3	0.01	0.8	3.1

TABLE 12-3 TRIAL 4A SPRING WHEAT, 1987. CULTIVAR X MANAGEMENT (STUBBLE). PREDICTED TARGET YIELDS (BU/ACRE) AND THOSE ACTUALLY OBTAINED FOR 5 CULTIVARS.

Cultivar	Yield Capability, Soil Test basis, with no added nitrogen	Conventional treatment Target Yield (bu/acre)	Yields obtained (bu/acre)[1]			
			CONV	OVM	ICM	Average
Bluesky	-	70	66	60	63	62.9 *cd*
Wildcat	-	70	66	64	69	66.4 *bc*
HY320	-	80	75	74	81	76.8 *a*
Oslo	-	70	58	56	69	61.1 *d*
Neepawa	75	65	51	52	59	53.8 *e*

1 No significant interaction of Cultivar x Management yields.

Experiment 4B: SPRING WHEAT: CULTIVAR X MANAGEMENT (FALLOW)

Legal Location: NE-12-52-25-W4

The objective of this trial was to evaluate 16 cultivars, licensed and otherwise, and their interaction with 2 management levels under fallow conditions, as in the previous two years. 3 management levels were used for HY320, Oslo, Neepawa, Bluesky, Wildcat.

This trial was seeded with a Swift Current double disc drill at 9 inch (22 cm) row spacings on May 13, 1987. The trial was designed as a split-plot with 4 replicates. Prior to seeding 90 Kg P_2O_5/ha was banded with the International drill, and 30 Kg K_2O/ha and 10 Kg S/ha were hand broadcast and harrowed. HOEGRASS II was applied on June 4 for general weed control. All plots were harvested on September 11, 1987.

Mainplot treatments: Cultivar

1. HY320
2. Oslo
3. Norquay
4. PT726
5. PT741
6. PT742
7. PT329 (Wildcat)
8. Glenlea
9. Neepawa
10. Katepwa
11. Columbus
12. Park
13. BW569 (Conway)
14. PT325 (Bluesky)
15. QT8132
16. BW92 (Roblin)

Subplot treatments: Management

1. Conventional treatment: seeding rate 300 seeds/m^2 (VITAVAX treated); 35 Kg N/ha added (to bring up soil N to level on stubble field); no plant growth regulators or fungicides used.

2. Integrated Crop Management (ICM) treatment: seeding rate 500 seeds/m^2 (VITAVAX treated); target yield 100 bu/acre (111 Kg N/ha added); one application of CYCOCEL at 1.5 l/ha at GS 31 on June 18; one application of TILT at 0.5 l/ha at GS 49-55 on July 1.

3. Optimum Varietal Management (OVM) treatment: seeding rate 500 seeds/m^2 (VITAVAX treated); target yield based on individual yield potential (see table below); TILT application not required. OVM applied only on cultivars HY320, Oslo, Neepawa, Bluesky and Wildcat only. The same rationale was used for setting the "Conventional" yield target and the inputs for the OVM treatment as described for Trial 4A (Stubble).

Surprisingly, the nutrient level status on this fallow field was much lower than on the stubble test used for Trial 4A. The maximum predicted yield for this test without added nutrients was given as 50 bu/acre of wheat (CWRS). (These soil test results were thoroughly checked and reconfirmed with the commercial source of the data). It was then decided to try and achieve the same target yields in Trials 4A and 4B, resulting in the following treatment regimes.

TRIAL 4B (FALLOW)

Cultivar	Yield capability (before) Soil test basis without added nitrogen	U of A Target Yield (bu/acre) for OVM	Additional N (kg/ha) added to achieve U of A OVM target yield
Bluesky	-	70	61
Wildcat	-	70	61
HY320	-	80	91
Oslo	-	70	61
Neepawa	50	65	46

As in Trial 4A, seasonal conditions were such that individual variety requirements for other inputs (e.g. split fertilizer, fungicide, PGR) for the OVM were not required.

Trial 4B (Fallow) was analysed in two different ways:

1. Analysis of 16 cultivars and 2 management levels.

2. Analysis of 5 cultivars and 3 management levels.

In addition, an analysis of all the cultivars grown at two management levels on fallow over 3 years in the W240 was also conducted, and is separately reported.

RESULTS AND CONCLUSIONS. TRIAL 4B (FALLOW). 16 CULTIVARS, 2 MANAGEMENT LEVELS.

1. Contrary to expectations, the overall fertility of the fallow field was found to be lower than that of the stubble field (108 kg N/ha present on stubble, 66 kg N/ha present on fallow). To compensate for this difference, the nitrogen fertility level for the conventional treatment was brought up to equal that on the stubble field (Trial 4A). Although Trial 4A and 4B were seeded on the same day, the fallow trial emerged earlier and matured later overall compared to the stubble trial. No doubt this was due to a difference in timing and availability of moisture between the two fields. However this did not result in any yield advantage on the fallow field. The average experiment wide yield was 4045 kg/ha for the fallow trial (4B) and 4248 kg/ha for the stubble trial (4A).

2. Cultivar effects were significant for all variables except plants per m^2 and tillers per plant (Tables 13, 13-1), and are mainly similar to those found in the previous two years and in the 1987 Trial 4A (Stubble). As in previous years in this trial, a number of cultivars were significantly earlier than Neepawa in maturity, and were also significantly higher yielding (Oslo, Norquay, PT741, PT742). QT8132 was 16 days earlier in maturity than Neepawa in this trial, but yielded extremely poorly (although it yielded well in the stubble trial 4A). As confirmed by a very low kernels/head count for QT8132, this variety exhibited a higher degree of spikelet sterility in this trial. QT8132, Oslo and Norquay can be noted for their lack of lodging, under 'near tornado' conditions which caused other cultivars to score 5 or worse (Neepawa, Conway, Bluesky). Harvest indices in this trial approached 0.50 for some of the better semidwarfs, but were not as high as in the stubble trial, where several exceeded 0.50 (Table 13-1).

3. Management effects did not significantly affect yield or maturity and there were fewer significant effects of management level in this fallow trial than in the stubble trial. On fallow, management level was significant for kernels per m^2, test weight, plants per m^2, tillers per plant, total dry matter and height (Table 13-2).

4. There was a significant cultivar by management interaction for maturity, lodging and height (Table 13-3). The interaction effect for maturity can be characterised by grouping the cultivars into (a) those for which management did not significantly alter days to maturity (HY320, Oslo, Wildcat, Glenlea, Columbus, Conway, Bluesky, QT8132), (b) those that responded to ICM inputs by maturing earlier (Neepawa,, Park), (c) those that responded to ICM with slight increases in maturity (Norquay, PT741, PT742, Katepwa and Roblin), and (d) PT726, which exhibited a major delay in maturity with the ICM treatment. The results for Neepawa in this trial are considered unusual, compared to previous results). Examination of the interactions of cultivar with management for lodging also leads to cultivar groupings: (a) Cultivars with little or no lodging under either management system (Oslo, Norquay, QT8132), (b) Cultivars with straw strength reduced by the ICM treatment (Roblin, Wildcat), (c) Cultivars whose lodging resistance was improved by the ICM treatment (an unexpected result) (HY320, PT741, PT742, Neepawa, Katepwa, Park) and (d) other unique cultivar responses.

5. The main features from this 16 cultivar x management system trial are as follows:
(a) Lack of significant effect of main management level on yield or maturity,

as in previous years, despite a soil test value that indicated some fertilizer responses could be expected.

(b) The cultivars involved expressed differences similar to previous years, with the best cultivars again being significantly earlier maturing and higher yielding than Neepawa.

(c) Extremely strong straw was found in several of these cultivars, and quite poor straw strength in others, with the high winds from the 1987 tornado resulting in excellent differential for lodging. However, lodging damage occurred too late in the season for PGR's to be effective. Degree of lodging that occurred depended on cultivar and management.

(d) In general terms, the results from Trial 4B (Fallow) were somewhat surprising compared to results from the nearby Trial 4A (Stubble). Moisture conditions seemed better at all times in the fallow field, and Trial 4B (Fallow) emerged faster, and matured later. The Trial 4B soil test results indicated lower fertility than in the barley stubble in Trial 4A, which was not expected, and these test results were fully checked, and then accepted. Fertilizer added to reach target yields similar to those in Trial 4A (Stubble) did result in similar yields attained on an experiment wide basis.

TABLE 13 SPRING WHEAT TRIAL 4B (FALLOW). CULTIVAR X MANAGEMENT (1987). 16 CULTIVARS. 2 MANAGEMENT LEVELS.

	df	Maturity	Yield	Kernels/m^2	1000 K	Kg/Hl	Lodging
rep	3	NS	**	**	*	NS	NS
cult.	15	**	**	**	**	**	**
mgt.	1	NS	NS	*	NS	*	NS
cult. x mgt.	15	**	NS	NS	NS	NS	**
mainplot C.V. %		1.4	8.9	11.1	4.3	0.8	94.5
subplot C.V. %		1.0	7.6	9.5	4.5	0.8	28.6

TABLE 13 (continued) SPRING WHEAT TRIAL 4B (FALLOW). CULTIVAR X MANAGEMENT (1987). 16 CULTIVARS. 2 MANAGEMENT LEVELS.

	df	TOTDM	HI	Height	WUE
rep.	3	**	NS	**	**
cult.	15	**	**	**	**
mgt.	1	**	NS	**	NS
cult. x mgt.	15	NS	NS	**	NS
mainplot C.V. %		7.2	0	2.9	8.9
subplot C.V. %		5.5	0	2.2	7.6

TABLE 13 (continued) SPRING WHEAT TRIAL 4B (FALLOW). CULTIVAR X MANAGEMENT (1987). 16 CULTIVARS. 2 MANAGEMENT LEVELS.

	df	Plants/m^2	Heads/m^2	Kernels/head	Tillers/plant
rep	2	NS	NS	NS	NS
cult.	15	NS	**	**	NS
mgt.	1	**	NS	NS	*
cult. x mgt.	15	NS	NS	NS	NS
mainplot C.V. %		17.5	13.1	16.1	113.5
subplot C.V. %		25.0	12.6	14.5	112.8

TABLE 13-1. TRIAL 4B (FALLOW). 16 CULTIVARS AND 2 MANAGEMENT LEVELS. SIGNIFICANT (0.05) MAIN EFFECTS OF CULTIVAR FOR MATURITY, YIELD, KERNELS PER M^2, 1000 K, HECTOLITRE WEIGHT, LODGING, HEADS PER M^2, KERNELS PER HEAD.

		Maturity (days)	Yield (kg/ha)	Kernels/m^2	1000 K (g)	Kg/Hl
1.	HY320	121.0 *a*	5220.6 *a*	15386 *a*	34.3 *e*	73.7 *de*
2.	Oslo	114.0 *f*	4295.3 *de*	12258 *cd*	34.2 *e*	73.0 *fg*
3.	Norquay	113.9 *f*	4250.3 *de*	12193 *cdef*	34.9 *de*	72.8 *gh*
4.	PT726	117.4 *cd*	4114.6 *efg*	11285 *defg*	36.6 *c*	74.5 *ab*
5.	PT741	114.3 *ef*	4586.0 *cd*	11249 *efg*	40.9 *a*	74.0 *bcde*
6.	PT742	114.1 *f*	4658.6 *bc*	12692 *bc*	36.7 *c*	74.6 *a*
7.	PT329 (Wildcat)	112.8 *fg*	4098.4 *efg*	11803 *cdef*	34.7 *e*	72.3 *i*
8.	Glenlea	119.0 *b*	3835.5 *fgh*	10336 *g*	37.1 *bc*	73.6 *de*
9.	Neepawa	117.4 *d*	3828.0 *fgh*	12508 *cde*	30.7 *h*	73.9 *cde*
10.	Katepwa	116.8 *d*	3701.5 *h*	12022 *cdef*	30.8 *gh*	73.5 *ef*
11.	Columbus	119.5 *ab*	3735.3 *h*	11634 *cdefg*	32.2 *fg*	74.4 *abc*
12.	Park	113.3 *f*	3646.5 *h*	12215 *cdef*	29.9 *h*	74.1 *abcd*
13.	BW569 (Conway)	119.3 *b*	3667.5 *h*	12075 *cdef*	30.5 *h*	73.7 *de*
14.	PT325 (Bluesky)	111.5 *g*	4185.4 *ef*	11457 *cdefg*	36.7 *c*	72.3 *hi*
15.	QT8132	101.0 *h*	3065.0 *i*	7309 *h*	42.1 *a*	74.2 *abcd*
16.	BW92 (Roblin)	116.8 *d*	3828.0 *gh*	11163 *fg*	34.3 *e*	73.7 *de*
	S.E. (difference)	0.8	179.7	653.9	0.8	0.3

		Lodging	Heads/m^2	Kernels/head
1.	HY320	1.5 *c*	451 *cde*	31.6 *a*
2.	Oslo	0.2 *c*	486 *bcd*	25.3 *bcd*
3.	Norquay	0.2 *c*	463 *cde*	26.3 *bcd*
4.	PT726	1.1 *c*	453 *cde*	25.7 *bcd*
5.	PT741	4.6 *ab*	490 *bcd*	23.1 *cdef*
6.	PT742	3.0 *bc*	469 *cd*	27.7 *abc*
7.	PT329 (Wildcat)	3.0 *bc*	391 *e*	29.6 *ab*
8.	Glenlea	4.6 *ab*	426 *de*	25.1 *bcde*
9.	Neepawa	5.0 *ab*	611 *a*	20.7 *ef*
10.	Katepwa	4.5 *ab*	552 *ab*	22.3 *def*
11.	Columbus	6.3 *a*	516 *bc*	22.6 *def*
12.	Park	2.7 *bc*	614 *a*	19.6 *f*
13.	BW569 (Conway)	5.3 *ab*	602 *a*	20.2 *f*
14.	PT325 (Bluesky)	6.8 *a*	392 *e*	28.9 *ab*
15.	QT8132	0.2 *c*	399 *e*	18.5 *f*
16.	BW92 (Roblin)	0.6 *c*	517 *bc*	22.4 *def*
	S.E. (difference)	1.5	37.0	2.3

TABLE 13-1 (continued) TRIAL 4B (FALLOW). 16 CULTIVARS AND 2 MANAGEMENT LEVELS. SIGNIFICANT (0.05) MAIN EFFECT OF CULTIVAR FOR TOTAL DRY MATTER, HARVEST INDEX, HEIGHT AND WATER USE EFFICIENCY.

		TOTDM (g)	HI	Height (cm)	WUE
1.	HY320	2540.0 *a*	0.47 *a*	78.5 *jk*	162.2 *a*
2.	OSLO	2212.5 *cdefgh*	0.44 *cd*	73.3 *l*	133.4 *de*
3.	Norquay	2135.0 *fgh*	0.46 *ab*	75.8 *kl*	132.0 *e*
4.	PT726	2160.0 *efgh*	0.43 *d*	77.3 *k*	127.8 *ef*
5.	PT741	2295.0 *bcdef*	0.46 *ab*	83.0 *i*	142.4 *cd*
6.	PT742	2321.3 *bcd*	0.46 *ab*	76.9 *k*	144.7 *bc*
7.	PT329 (Wildcat)	2171.3 *defgh*	0.43 *d*	90.0 *gh*	127.3 *ef*
8.	Glenlea	2290.0 *bcdefg*	0.38 *gh*	102.8 *bc*	119.1 *fg*
9.	Neepawa	2347.5 *bc*	0.37 *hi*	97.6 *e*	118.9 *fg*
10.	Katepwa	2246.3 *cdefgh*	0.38 *gh*	99.4 *de*	115.0 *g*
11.	Columbus	2331.3 *bcd*	0.36 *ij*	105.9 *a*	116.0 *g*
12.	Park	2130.4 *gh*	0.39 *fg*	93.1 *f*	113.3 *g*
13.	BW569 (Carway)	2396.3 *ab*	0.35 *j*	100.4 *cd*	113.9 *g*
14.	PT325 (Bluesky)	2311.3 *bcde*	0.41 *e*	101.6 *c*	130.0 *ef*
15.	QT8132	1550.0 *i*	0.45 *b*	64.3 *m*	95.2 *h*
16.	BW92 (Roblin)	2125.0 *h*	0.41 *e*	87.9 *h*	118.9 *fg*
	S.E. (difference)	79.6	0.01	1.2	5.6

TABLE 13-2 TRIAL 4B (FALLOW) 1987. 16 CULIVARS AND 2 MANAGEMENT LEVELS. SIGNIFICANT (0.05) MAIN EFFECTS OF MANAGEMENT FOR KERNELS PER M^2, HECTOLITRE WEIGHT, PLANTS PER M^2, TILLERS PER PLANT, TOTAL DRY MATTER, AND HEIGHT.

		Kernels/m^2	Kg/Hl	Plants/m^2	Tillers/plant	TOTDM (g)	Height (cm)
1.	CONV	11542.8 *b*	73.8 *a*	290.7 *b*	2.2 *a*	2191.3 *b*	89.8 *a*
2.	ICM	11942.9 *a*	73.5 *b*	381.1 *a*	1.3 *b*	2254.1 *a*	86.2 *b*
S.E.(difference)		197.3	0.1	17.1	0.4	21.7	0.3

TABLE 13-3 TRIAL 4B (FALLOW) 1987. 16 CULTIVARS AND 2 MANAGEMENT LEVELS. SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF CULTIVAR AND MANAGEMENT FOR MATURITY, LODGING, AND HEIGHT.

	Maturity (days)		Lodging		Height (cm)	
	Conv	ICM	Conv	ICM	Conv	ICM
1. HY320	121.0	121.0	1.9	1.1	79.8	77.3
2. Oslo	114.0	114.0	0.2	0.2	74.8	71.8
3. Norquay	113.5	114.3	0.2	0.2	75.5	76.0
4. PT726	115.8	119.0	1.2	1.1	79.8	74.8
5. PT741	113.8	114.8	4.9	4.4	86.3	79.8
6. PT742	113.8	114.5	4.5	1.5	79.8	74.0
7. PT329 (Wildcat)	112.8	112.8	2.2	3.8	92.3	87.8
8. Glenlea	119.0	119.0	4.6	4.6	104.5	101.0
9. Neepawa	118.0	116.8	5.4	4.6	100.3	95.0
10. Katepwa	116.3	117.3	5.0	4.0	99.5	99.3
11. Columbus	119.5	119.5	5.9	6.8	106.0	105.8
12. Park	115.0	111.5	3.9	1.6	95.8	90.5
13. BW569 (Conway)	119.0	119.5	4.8	5.9	102.0	98.8
14. PT325 (Bluesky)	111.5	111.5	6.8	6.8	103.8	99.5
15. QT8132	101.0	101.0	0.2	0.2	67.5	61.0
16. BW92 (Roblin)	116.3	117.3	0.2	1.1	88.8	87.0
Interaction S.E. (difference)	0.8		0.6		1.4	

RESULTS AND CONCLUSIONS. TRIAL 4B (FALLOW). 5 CULTIVARS, 3 MANAGEMENT LEVELS. (These results are from a subset of the cultivar trial described in the previous section, but with the added OVM treatment of each).

1. Cultivar effects were significant for all variables except plants per m^2 and tillers per plant (Table 14). The trends were similar on fallow as they were on the stubble field. The four other cultivars were significantly higher yield and earlier maturing then Neepawa, although the highest yielding (HY320) was also the latest maturing (Table 14-1). Although lodging on fallow was not as severe as on stubble (possibly due to the lower overall fertility of this field), Bluesky was again found to lodge the most while Oslo did not lodge at all. All cultivars significantly exceeded Neepawa in water use efficiency, harvest index, kernels per head and 1000 K.

2. There were fewer significant effects of management level on fallow (Trial 4B) than on stubble (Trial 4A). On fallow, management level was significant for test weight, height, plants per m^2 and tillers per plant (Table 14). Yield and maturity were again unaffected by the main effect of management level (Table 14-2).

3. There was a significant cultivar by management interaction for maturity and for test weight (Table 14-3). The interaction for maturity seems attributable to a specific reduction in days to maturity for the cultivar Wildcat under OVM and some reduction for Neepawa when either ICM or OVM treatment was applied. Other cultivars were not responsive to management for days to maturity. The cultivar x management interaction for test weight were very cultivar specific, but it is notable that only in the case of HY320 did ICM give a better result than Conventional.

4. The major purpose of this subset analysis was to determine whether target yields could be set on fallow for individual cultivars, to be achieved by applying unique OVM treatments to each cultivar and to see how such yield targeting would compare with Conventional management and a protocol ICM management level. The various target yields and yields achieved are described in Table 14-4. It should be noted that OVM differed from the Conventional treatment mainly by an increased seeding rate, and by application of individualized nitrogen treatments. PGR's and fungicides were not needed for any of the OVM treatments. The main feature of the results from this particular trial was a lack of significant interaction of cultivar with management method, with predominant effects (especially for yield) being mainly due to cultivar differences. The OVM treatments for individual cultivars were not effective in optimising yield, compared to the Conventional treatment. As the lowest cost treatment, the Conventional treatment may have been the optimum. The cultivars in this trial fell short of target yields under Conventional management by 5 - 9 bu/acre, and by 1 - 16 bu/acre under OVM. It is not possible to say whether these shortfalls in yield were due to limiting moisture conditions, fertility limitations or other factors. However, it should be noted that the high fertility levels in the ICM treatment did not result in improved yields, and that HY320 (a cultivar very responsive to high fertility) did achieve an 83 bu/acre yield in the ICM treatment, a 10 bushel increase over its yield in the Conventional treatment.

TABLE 14 SPRING WHEAT TRIAL 4B (FALLOW). CULTIVAR X MANAGEMENT (1987). 5 CULTIVARS. 3 MANAGEMENT LEVELS.

	df	Maturity	Yield	Kernels/m^2	1000 K	Kg/Hl	Lodging
rep	3	NS	*	*	NS	NS	NS
cult.	4	**	**	**	**	**	**
mgt.	2	NS	NS	NS	NS	**	NS
cult. x mgt.	8	*	NS	NS	NS	*	NS
mainplot C.V. %		2.1	10.4	12.7	7.1	1.0	113.8
subplot C.V. %		0.9	7.9	11.5	6.6	0.6	30.4

TABLE 14 (continued) SPRING WHEAT TRIAL 4B (FALLOW). CULTIVAR X MANAGEMENT (1987). 5 CULTIVARS. 3 MANAGEMENT LEVELS.

	df	TOTDM	HI	Height	WUE
rep.	3	*	NS	NS	*
cult.	4	*	**	**	**
mgt.	2	NS	NS	**	NS
cult. x mgt.	8	NS	NS	NS	NS
mainplot C.V. %		8.9	0	2.9	10.4
subplot C.V. %		6.6	0	2.2	7.9

TABLE 14 (continued) SPRING WHEAT TRIAL 4B (FALLOW). CULTIVAR X MANAGEMENT (1987). 5 CULTIVARS. 3 MANAGEMENT LEVELS.

	df	Plants/m^2	Heads/m^2	Kernels/head	Tillers/plant
rep	2	NS	NS	NS	NS
cult.	4	NS	*	*	NS
mgt.	2	**	NS	NS	**
cult. x mgt.	8	NS	NS	NS	NS
mainplot C.V. %		18.8	23.6	25.6	21.6
subplot C.V. %		19.4	13.5	14.3	19.0

TABLE 14-1 TRIAL 4B (FALLOW) 1987. 5 CULTIVARS AND 3 MANAGEMENT LEVELS. SIGNIFICANT (0.05) MAIN EFFECTS OF CULTIVAR FOR MATURITY, YIELD, KERNELS PER M^2, 1000 K, HECTOLITRE WEIGHT, LODGING, HEADS PER M^2, KERNELS PER HEAD, TOTAL DRY MATTER, HARVEST INDEX, HEIGHT AND WATER USE EFFICIENCY.

		Maturity (days)	Yield (kg/ha)	Kernels/m^2	1000 K (g)	Kg/HL	Lodging
1.	HY320	121.0 *a*	5230 *a*	15363 *a*	34.4 *ab*	73.7 *a*	1.9 *bc*
2.	Oslo	114.1 *c*	4292 *bc*	12606 *bc*	34.1 *b*	72.9 *bc*	0.2 *c*
3.	Wildcat	111.7 *de*	4120 *c*	11923 *c*	34.6 *ab*	72.3 *c*	3.0 *bc*
4.	Neepawa	117.3 *b*	3656 *d*	11697 *c*	31.5 *c*	73.7 *a*	5.6 *ab*
5.	Bluesky	111.5 *e*	4093 *c*	11269 *c*	36.4 *a*	72.3 *c*	6.7 *a*
S.E. (difference)		1.0	183	651.5	1.0	0.3	1.6

		Heads/m^2	Kernals/head	TOTDM (g)	HI	Height (cm)	WUE
1.	HY320	451.8 *b*	32.5 *a*	2523 *a*	0.47 *a*	78.2 *d*	162.5 *a*
2.	Oslo	490.3 *ab*	24.8 *bc*	2249 *c*	0.44 *b*	74.6 *e*	133.3 *bc*
3.	Wildcat	405.3 *b*	29.0 *ab*	2174 *c*	0.43 *c*	90.7 *c*	127.9 *c*
4.	Neepawa	483.4 *a*	20.6 *c*	2308 *bc*	0.36 *e*	98.6 *b*	113.5 *d*
5.	Bluesky	394.8 *b*	29.0 *ab*	2272 *c*	0.41 *d*	101.3 *a*	127.1 *c*
S.E. (difference)		51.7	3.3	83.6	0.01	1.1	5.7

TABLE 14-2 TRIAL 4B (FALLOW) 1987. 5 CULTIVARS AND 3 MANAGEMENT LEVELS. SIGNIFICANT (0.05) MAIN EFFECTS OF MANAGEMENT FOR HECTOLITRE WEIGHT, PLANTS PER M^2, TILLERS PER PLANT AND HEIGHT.

		Kg/Hl	Plants/m^2	Tillers/plant	Height (cm)
1.	CONV	73.2 *a*	273.1 *b*	1.7 *a*	90.2 *a*
2.	ICM	72.8 *b*	387.3 *a*	1.2 *b*	86.3 *b*
3.	OVM	72.8 *b*	383.5 *a*	1.2 *b*	89.6 *a*
S.E. (difference)		0.1	24.7	0.1	0.6

TABLE 14-3. TRIAL 4B (FALLOW) 1987. 5 CULTIVARS AND 2 MANAGEMENT LEVELS. SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF CULTIVAR AND MANAGEMENT FOR MATURITY AND HECTOLITRE WEIGHT.

		Maturity (days)			Kg/Hl		
		CONV	ICM	OVM	CONV	ICM	OVM
1.	HY320	121.0	121.0	121.0	73.4	74.1	73.6
2.	Oslo	114.0	114.0	114.3	73.1	72.8	72.7
3.	Wildcat	112.8	112.8	109.5	72.6	72.0	72.3
4.	Neepawa	118.0	116.8	117.3	74.2	73.6	73.2
5.	Bluesky	111.5	111.5	111.5	72.9	71.8	72.2
	S.E. (difference)		0.8			0.3	

TABLE 14-4 EXPERIMENT 4B SPRING WHEAT 1987. CULTIVAR X MANAGEMENT (FALLOW). PREDICTED TARGET YIELD/BU/ACRE AND THOSE ACTUALLY OBTAINED, FOR 5 CULTIVARS.

Cultivar	Yield capability (before) Soil test basis without added nitrate	U of A Target Yield (bu/acre) for OVM	Yields obtained (bu/acre)[1] CONV	ICM	OVM	AVERAGE
Bluesky	-	70	65	60	58	61 *c*
Wildcat	-	70	61	61	62	61 *c*
HY320	-	80	73	83	78	78 *a*
Oslo	-	70	62	66	64	64 *bc*
Neepawa	50	65	57	57	49	54 *d*

1 No significant interaction for Cultivar x Management for Yield.

EXPERIMENT 4. SPRING WHEAT: CULTIVAR X MANAGEMENT. 3 YEAR STUDY (1985 - 1987) (SMALL PLOT TRIAL, W240).

The objective in this last year of a three year trial was to complete the evaluation of 14 spring wheat cultivars and their interaction with different management levels over 3 years at one location.

The 4 replicate trial was seeded with a Swift Current double disc drill at 9 inch (23 cm) row spacing in mid-May. In 1985, the trial was a randomized block design. In 1986 and 1987, it was a split-plot design to facilitate the comparison of management levels within each cultivar. The trial was seeded into fallow land, with blanket applications of fertilizer (see Table 14-5A) to provide non-limiting amounts of P, K and S. Weeds were controlled with a single application of either BUCTRIL M (bromoxynil + MCPA) or HOEGRASS II (diclofop methyl + bromoxynil). The majority of plots were harvested by the end of August, although in 1987 harvest was delayed until September 11 due to a severe rainstorm (70 mm) on September 3.

The 14 cultivars used were: 1) HY320; 2) Oslo; 3) Norquay; 4) PT726; 5) PT741; 6) PT742; 7) PT329 (Wildcat); 8) Glenlea; 9) Neepawa; 10) Katepwa; 11) Columbus; 12) Park; 13) BW 569 (Conway); 14) PT325 (Bluesky).

Management treatments were as follows:

1) Conventional treatment: target seeding rate 300 plants/m^2; nitrogen fertilizer added according to Norwest lab recommendation for average yield (see Table 14-5A); no plant growth regulators or fungicides used.

2) Integrated crop management (ICM) treatment: target seeding rate 500 plants/m^2; seed VITAVAX treated; nitrogen application 119 kg/ha in 1985 (rate selected to provide non-limiting amounts of N), nitrogen application in 1986 and 1987 based on target yield (see Table 14-5A); one application of CYCOCEL, rate 1.5 l/ha, at GS 31; one application of TILT, rate 0.5 l/ha, at GS 49-55.

RESULTS AND CONCLUSIONS. 3 YEARS DATA (1985 - 1987) WITH 14 CULTIVARS AND 2 MANAGEMENT LEVELS, EDMONTON.

The main features of this 3 year trial on fallow are as follows:

1. There was a lack of significant effect of the management level on the yield and maturity of the 14 cultivars, and lack of a significant interaction between cultivar and management method (Table 14-5B). These effects were also nonsignificant in each of the individual years. These results confirm that, under these experimental conditions on fallow, no individualized management was warranted for these cultivars.

2. For the third year in a row and for the three year average, a number of the cultivars in test had significantly higher yield than (or yield equal to) Neepawa, and were as early as or earlier than Neepawa (Table 14-5D). The highest yielding of these was PT741 (21% higher yield than Neepawa, 1.1 days earlier) and the earliest of them was Wildcat (4.2 days earlier). The other cultivars in this group were Oslo, Norquay, PT741, PT742 and Bluesky. The yield and maturity relationship of all cultivars in this test compared to Neepawa are indicated in Figure 3.

3. These trials were grown on fallow for which the soil tests indicated a low N level in 1985, a moderate level in 1987 and a very high level in 1986 (Table 14-5A). The absence of response to the ICM treatment may be explained on the basis that the total N available in each year (Soil test plus added) for the Conventional treatment placed these cultivars in nonlimiting conditions for fertility. Also, addition of other inputs at this fertility level did not contribute to further yields, as indicated by the lack of yield response for the ICM treatment.

4. This trial has been useful in determining maximum yields that may be obtained from an array of adapted cultivars under extremely favorable management conditions on fallow. Further studies of this type should be conducted under stubble conditions more typical of nutrient levels for farms in the region. It is doubtful whether treatments involving fungicides or growth regulators would be worthwhile in such tests. Some of the best cultivars in this trial are not yet widely grown by farmers, and some are unregistered.

5. In the 5 cultivar x 3 management trial costs and returns analysis on stubble and on fallow (Table 14-5E) total variable costs per acre on fallow for different varieties ranged from \$101.41 to \$107.87 at the Conventional management level, from \$158.93 to \$169.70 for the formula "ICM" level, and from \$113.79 to \$133.79 for the OVM level. Production costs per bushel were, without exception, lowest for all varieties at the Conventional management level. The OVM approach was ineffective at lowering production cost per unit of production in this particular trial. Since all grain harvested graded feed, varietal comparisons of returns were all calculated using a common feed price of \$2.45 per bushel. In this comparison the higher yields of the non-CWRS varieties therefore showed up with higher gross margins, especially for HY320. Although this is not a statistically determinable comparison, since the two trials were run separately, there was some indication that gross returns for Bluesky, Wildcat and HY320 may have been slightly higher on the stubble test than on the fallow test, but this was not the case for Oslo and Neepawa.

TABLE 14-5A SPRING WHEAT. 3 YEAR SUMMARY. CULTIVAR X MANAGEMENT (FALLOW). SOIL TEST RESULTS AND FERTILITY TREATMENTS.

	1985	1986	1987
P (soil test) kg/ha	21	15	45
P (added) kg/ha	60	90*	90*
P (total) kg/ha	81	105	135
K (soil test) kg/ha	391	328	439
K (added) kg/ha	0	30	30
K (total)	391	358	469
S (soil test) kg/ha	35.2	37.5	34.7
S (added) kg/ha	14.0	10.0	10.0
S (total)	49.2	47.5	44.7

* banded

	1985		1986		1987	
	Conv.	ICM	Conv.	ICM	Conv.	ICM
N (soil test) kg/ha	20	20	224	224	66	66
N (added) kg/ha	59	119	0	78	35	111
N (total) kg/ha	79	139	224	302	101	177
Target Yield (bu/acre)	NA	NA	74	100	74	100
May - Aug rainfall (mm)	232.6		293.7		412.3	
Water used (mm)	651.5		381.6		422.0	

TABLE 14-5B SPRING WHEAT 3 YEAR SUMMARY (1985, 1986, 1987). CULTIVAR X MANAGEMENT 14 CULTIVARS. 2 MANAGEMENT LEVELS.

	df	Yield	Maturity
Year	2	**	**
Cultivar	13	**	**
Management level	1	NS	NS
Cult. x man.	13	NS	NS
C.V. %		17.4	3.4

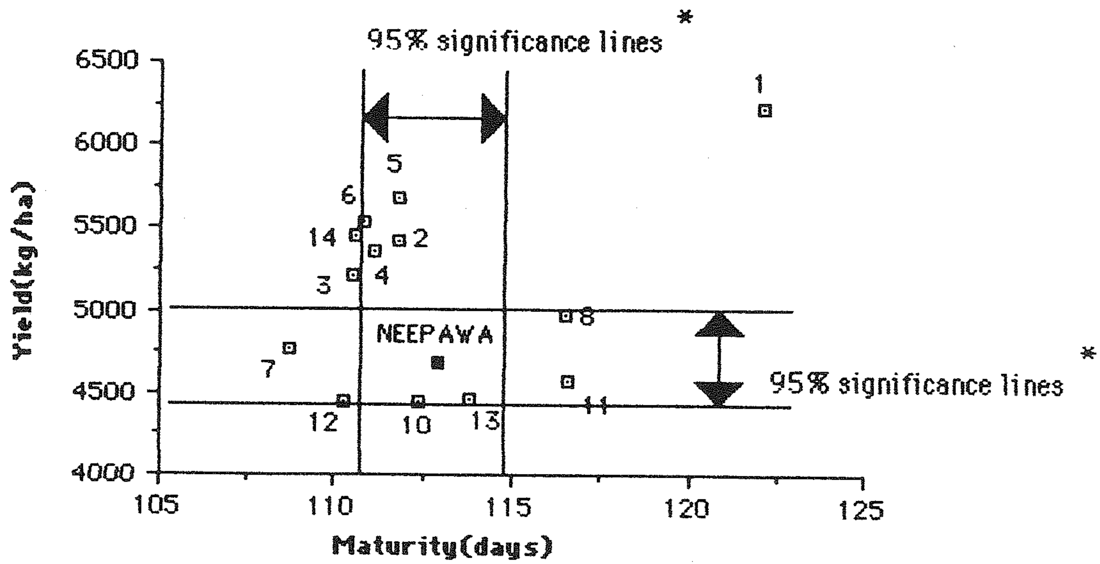
TABLE 14-5C 3 YEAR CULTIVAR X MANAGEMENT TRIAL. SIGNIFICANT (0.01) MAIN EFFECTS OF YEAR FOR YIELD AND MATURITY.

Year	Yield (kg/ha)	Maturity (days)
1985	5797 *c*	109 *a*
1986	5352 *b*	113 *b*
1987	4137 *a*	116 *c*
S.E. (difference)	118.5	0.5

TABLE 14-5D 3 YEAR CULTIVAR X MANAGEMENT TRIAL. SIGNIFICANT (0.01) MAIN EFFECTS OF CULTIVAR FOR YIELD AND MATURITY.

Cultivar	Yield (kg/ha)	Maturity (days)
1. HY320	6234 *h*	121.1 *f*
2. Oslo	5421 *efg*	111.8 *bcd*
3. Norquay	5223 *de*	110.5 *ab*
4. PT726	5362 *ef*	111.1 *bc*
5. PT741	5689 *g*	111.8 *bcd*
6. PT742	5544 *fg*	110.8 *abc*
7. PT329 (Wildcat)	4776 *bc*	108.7 *a*
8. Glenlea	4983 *cd*	116.5 *e*
9. Neepawa	4697 *abc*	112.9 *cd*
10. Katepwa	4455 *a*	112.4 *bcd*
11. Columbus	4581 *ab*	116.6 *e*
12. Park	4453 *a*	110.3 *ab*
13. BW 569	4462 *a*	113.8 *d*
14. PT325 (Bluesky)	5454 *efg*	110.6 *ab*
S.E. (difference)	144.0	1.0

FIGURE 3: Three year yield and maturity plot of 14 cultilvars on fallow, averaged over two management levels (from Table 14-5D).



*Significance level lines are relative to Neepawa.

1. HY320 2. Oslo 3. Norquay 4. PT726 5. PT741 6. PT742

7. PT329(Wildcat) 8. Glenlea 9. Neepawa 10. Katepwa 11. Columbus

12. Park 13. BW569(Conway) 14. PT325(Bluesky)

TABLE 14-5E **1987 COSTS AND RETURNS, CULTIVAR X MANAGEMENT, 5 CULTIVARS AND 3 MANAGEMENT LEVELS, STUBBLE AND FALLOW.**

		BLUESKY	WILDCAT	HY320	OSLO	NEEPAWA
Soil test		0.35	0.35	0.35	0.35	0.35
HOEGRASS II		18.83	18.83	18.83	18.83	18.83
K_2O (0-0-60)		4.25	4.25	4.25	4.25	4.25
P_2O_5 (banded)		27.15	27.15	27.15	27.15	27.15
Banding cost		3.50	3.50	3.50	3.50	3.50
S (21-0-0-(24))		3.38	3.38	3.38	3.38	3.38
TOTAL COMMON COSTS		57.46	57.46	57.46	57.46	57.46
Machine op.	CONV	20.00	20.00	20.00	20.00	20.00
	ICM	30.00	30.00	30.00	30.00	30.00
	OVM	20.00	20.00	20.00	20.00	20.00
CYCOCEL	CONV	-	-	-	-	-
	ICM	10.13	10.13	10.13	10.13	10.13
	OVM	-	-	-	-	-
TILT	CONV	-	-	-	-	-
	ICM	6.40	6.40	6.40	6.40	6.40
	OVM	-	-	-	-	-
46-0-0 (Stubble)	CONV	-	-	-	-	-
	ICM	21.70	21.70	21.70	21.70	21.70
	OVM	-	-	4.30	-	-
46-0-0 (Fallow)	CONV	9.98	9.98	9.98	9.98	9.98
	ICM	31.68	31.68	31.68	31.68	31.68
	OVM	17.54	17.54	26.15	17.54	13.07
Seed $8.18/bu + $1 VITAVAX	CONV	20.43	18.05	18.09	17.17	13.97
	ICM	34.03	30.12	30.16	28.63	23.26
	OVM	34.03	30.12	30.16	28.63	23.26
Total sp.. costs (Stubble)	CONV	40.43	38.05	38.09	37.17	33.97
	ICM	102.26	98.35	98.39	96.86	91.49
	OVM	54.03	50.12	70.99	48.63	43.26
TOTAL VAR. COSTS (Stubble)	CONV	97.89	95.51	95.55	94.63	91.43
	ICM	159.72	155.81	155.85	154.32	148.95
	OVM	111.49	107.58	128.45	106.09	100.72

TABLE 14-5E (continued)

		BLUESKY	WILDCAT	HY320	OSLO	NEEPAWA
Total sp. costs (Fallow)	CONV	50.41	48.03	48.07	47.15	43.95
	ICM	112.24	108.33	108.37	106.84	101.47
	OYM	71.57	67.66	76.31	66.17	56.33
TOTAL VAR. COSTS (Fallow)	CONV	107.87	105.49	105.53	104.61	101.41
	ICM	169.70	165.79	165.83	164.30	158.93
	OYM	129.03	125.12	133.77	123.63	113.79
Yield (bu/ac) (Stubble)	CONV	66	66	75	58	51
	ICM	63	69	81	69	59
	OYM	60	64	74	56	52
Yield (bu/ac) (Fallow)	CONV	65	61	73	62	57
	ICM	60	61	83	66	57
	OYM	58	62	78	64	49
Cost/bu (Stubble)	CONV	1.48	1.45	1.27	1.63	1.79
	ICM	2.53	2.55	1.92	2.24	2.52
	OYM	1.86	1.68	1.74	1.89	1.94
Cost/bu (Fallow)	CONV	1.66	1.73	1.45	1.69	1.78
	ICM	2.82	2.71	2.00	2.03	2.79
	OYM	2.22	2.02	1.72	1.93	2.32

GROSS RETURN, BASED ON FEED GRADE ($2.45/BU)

		BLUESKY	WILDCAT	HY320	OSLO	NEEPAWA
Gross revenue (Stubble)	CONV	161.70	161.70	183.75	142.10	124.95
	ICM	154.35	169.05	198.45	169.05	144.55
	OYM	147.00	156.80	181.30	137.20	127.40
Gross margin (Stubble)	CONV	63.81	66.19	88.20	47.47	33.52
	ICM	-5.37	13.24	42.60	14.73	-4.40
	OYM	35.51	49.22	52.85	31.11	26.68
Gross revenue (Fallow)	CONV	159.25	149.45	178.85	151.90	139.65
	ICM	147.00	149.45	203.35	161.70	139.65
	OYM	142.10	151.90	191.10	156.80	120.05
Gross margin (Fallow)	CONV	51.38	43.96	73.32	47.29	38.24
	ICM	-22.70	-16.34	37.52	-2.60	-19.28
	OYM	13.07	26.78	58.13	33.17	6.26

EXPERIMENT 5: SPRING WHEAT: FUNGICIDE TRIAL

Legal Location: NE-12-52-25-W4

The objective of this trial was to evaluate the efficacy of two fungicides (TILT and DITHANE) in the control of diseases common in spring wheat.

Two varieties of spring wheat, Neepawa and Oslo, were seeded into separate trials using the Nordsten (Danish) disc drill on May 14, 1987. All seed was VITAVAX treated. Experimental design was a randomized block with 4 replicates. Prior to seeding, 90 Kg P_2O_5/ha was banded with the International drill, and 30 Kg K_2O and 10 Kg S/ha were hand broadcast and harrowed. HOEGRASS II was applied for general weed control on June 4. All plots were harvested on September 10, 1987. Each plot was evaluated individually for disease development on a weekly basis. Although both the Horsfall-Barratt scale and a scale recommended by Dr. J.P. Tewari were used for the disease ratings, only the Horsfall-Barratt scale has been reported. Ratings are given for the whole plant and include all diseases present (mainly powdery mildew and some Septoria). The final disease rating includes an individual rating of the flagleaf and the 2nd leaf below the flag leaf.

Treatments were as follows:

		Rate (l/ha)	GS	Date applied
1.	Control	-	-	-
2.	TILT	0.50	31	June 18
3.	TILT	0.50	49-55	July 1
4.	DITHANE	0.50 kg	49-55 + 10 days	July 1
5.	TILT (scout basis)*	0.50	When necessary	Not sprayed

* Not sprayed due to lack of disease.

RESULTS AND CONCLUSIONS. TRIAL 5 NEEPAWA.

1. There were no significant effects of the fungicide treatments on yield or any of the other agronomic variables measured (Table 15).

2. Development of disease was monitored regularly during the growing season. The unsprayed control exhibited very little disease development until mid July (GS 69) and reached a peak of only 3.3 on the Horsfall-Barrett scale by mid August (Table 15-1; Figure 4). Disease levels were insufficient to affect yield, presumably because of the lateness of development of higher disease levels. No significant differences between fungicide treatments were observed until the final disease rating (GS 83 - August 12). At this time, treatment 3 (TILT, 0.50 l/ha, GS 49-55) and treatment 4 (Dithane) were both significantly effective in reducing disease on the flagleaf and the 2nd leaf below the flagleaf (Table 15-1). Both powdery mildew and Septoria were present. This disease reduction did not result in any yield increase compared to the control, for Neepawa.

3. The main features from this trial were (a) lack of major development of disease on Neepawa at a level that would influence yield and (b) the effectiveness of TILT (at GS49-55) and DITHANE (at GS49-55 plus 10 days) in significantly reducing disease development at later stages, at the low disease level.

TABLE 15 SPRING WHEAT TRIAL 5. FUNGICIDES. (NEEPAWA).

	df	Yield	Kernels/m^2	1000 K	kg/Hl	Lodging	Maturity	Height	WUE
rep.	3	NS	NS	NS	NS	*	**	**	NS
fung.	4	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %		5.3	5.7	2.6	0.7	30.9	0.7	2.7	5.3

TABLE 15 (continued) SPRING WHEAT TRIAL 5. FUNGICIDES. (NEEPAWA).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep.	2	NS	**	*	**
fung.	4	NS	NS	NS	NS
C.V. %		16.6	7.4	19.7	6.6

TABLE 15-1 DISEASE RATINGS (HORSFALL - BARRATT SCALE). TRIAL 5 (NEEPAWA).

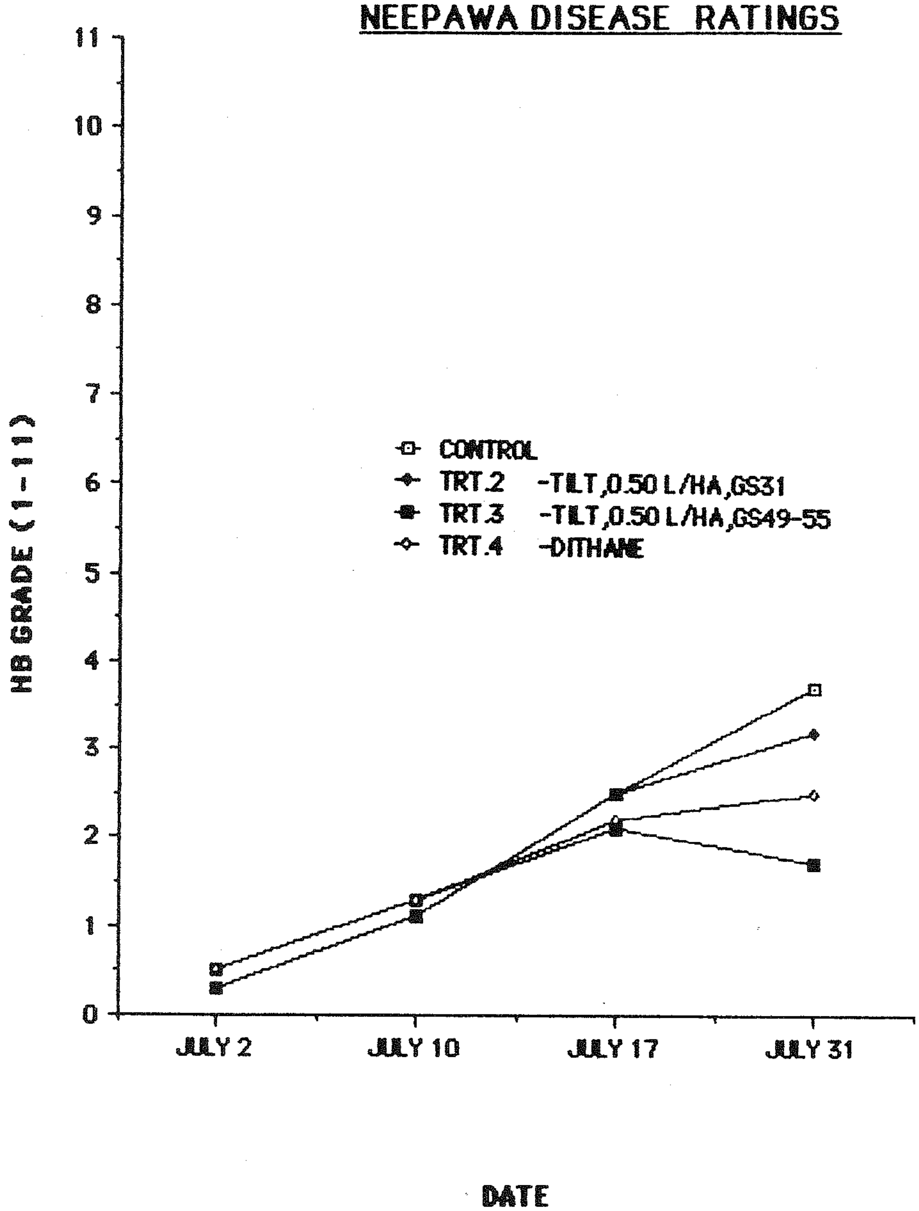
Treatments	Disease rating - HB Grade (1-11)[1]					
	July 2 GS 46	July 10 GS 69	July 17 GS 70	July 31 GS 82	GS 83 - August 12[3] FL	2nd LF
1. Control	0.3	1.1	2.5	3.7*a*	3.3*a*	5.6*a*
2. TILT, 0.50 l/ha, GS 31	0.3	1.1	2.5	3.2*ab*	3.1*a*	4.7*a*
3. TILT, 0.50 l/ha, GS 49-55	0.5	1.3	2.1	1.7*c*	1.1*b*	2.1*b*
4. DITHANE, 0.50 kg/ha, GS 49-55 + 10 days	0.5	1.3	2.2	2.5*b*	1.2*b*	2.7*b*
5. TILT (scout), 0.5 l/ha[2], (when necessary)	0.5	1.2	2.5	3.3*a*	2.7*a*	5.3*a*
S.E.	NS	NS	NS	0.2	0.2	0.3

1. Means within the same column, which are followed by the same letter, are not significantly different at the 5% level (DMRT).

2. Not sprayed due to lack of sufficient levels of disease.

3. Entire plant not rated because of extensive natural wilting and senescence of older leaves, which made it difficult to rate wilting specifically caused by disease.

FIGURE 4
SPRING WHEAT TRIAL 5
NEEPAWA DISEASE RATINGS



RESULTS AND CONCLUSIONS. TRIAL 5 OSLO.

1. As for Neepawa, there were no significant effects of fungicide treatment on yield or any of the other agronomic variables measured (Table 16).

2. Development of disease was monitored regularly during the growing season and the progression of disease on the unsprayed control is shown in Table 16-1. The highest levels of disease did not develop until late July and after, and are not considered high. Significant differences between fungicide treatments did begin to appear at GS 70 (July 17). The final disease rating (GS 83 - August 12) on both the flagleaf and the 2nd leaf below the flagleaf showed that treatment 3 (TILT, 0.5 l/ha, GS49-55) and treatment 4 (DITHANE, 0.5 kg/ha, GS49-55 + 10 days) significantly reduced disease. Diseases present were mainly powdery mildew and some Septoria. As with Neepawa, there was no corresponding increase in yield when the disease level was reduced, presumably because of the lateness of disease development and the low levels found.

TABLE 16 SPRING WHEAT TRIAL 5. FUNGICIDES. (OSLO).

	df	Yield	Kernels/m^2	1000 K	kg/Hl	Lodging	Maturity	Height	WUE
rep.	3	NS	NS	NS	NS	NS	NS	NS	NS
fung.	4	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %		8.8	9.3	2.7	0.7	0	0.2	9.8	8.8

TABLE 16 (continued) SPRING WHEAT TRIAL 5. FUNGICIDES. (OSLO).

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head
rep.	2	**	NS	**	NS
fung.	4	NS	NS	NS	NS
C.V. %		6.5	7.0	10.8	11.2

TABLE 16-1 TRIAL 5 FUNGICIDES (OSLO). DISEASE RATINGS (HORSFALL - BARRATT SCALE).

Treatments	Disease rating - HB Grade (1-11)[1]					
	July 2	July 10	July 17	July 31	GS 83 - August 12[3]	
	GS 46	GS 69	GS 70	GS 82	FL	2nd LF
1. Control	0.3	1.3	2.5*ab*	3.9*a*	2.4*a*	3.4*a*
2. TILT, 0.50 l/ha, GS 31	0.2	1.1	2.1*bc*	2.9*b*	1.7*a*	2.6*a*
3. TILT, 0.50 l/ha, GS 49-55	0.1	1.0	1.8*c*	2.2*c*	0.7*b*	1.1*b*
4 DITHANE, 0.50 kg/ha, GS 49-55 + 10 days	0.2	1.2	2.1*bc*	2.7*bc*	0.6*b*	1.4*b*
5. TILT (scout), 0.5 l/ha[2], (when necessary)	0.4	1.5	2.7*a*	3.1*b*	2.2*a*	3.6*a*
S.E.	NS	NS	0.1	0.1	0.2	0.3

1. Means within the same column, which are followed by the same letter, are not significantly different at the 5% level (DMRT).

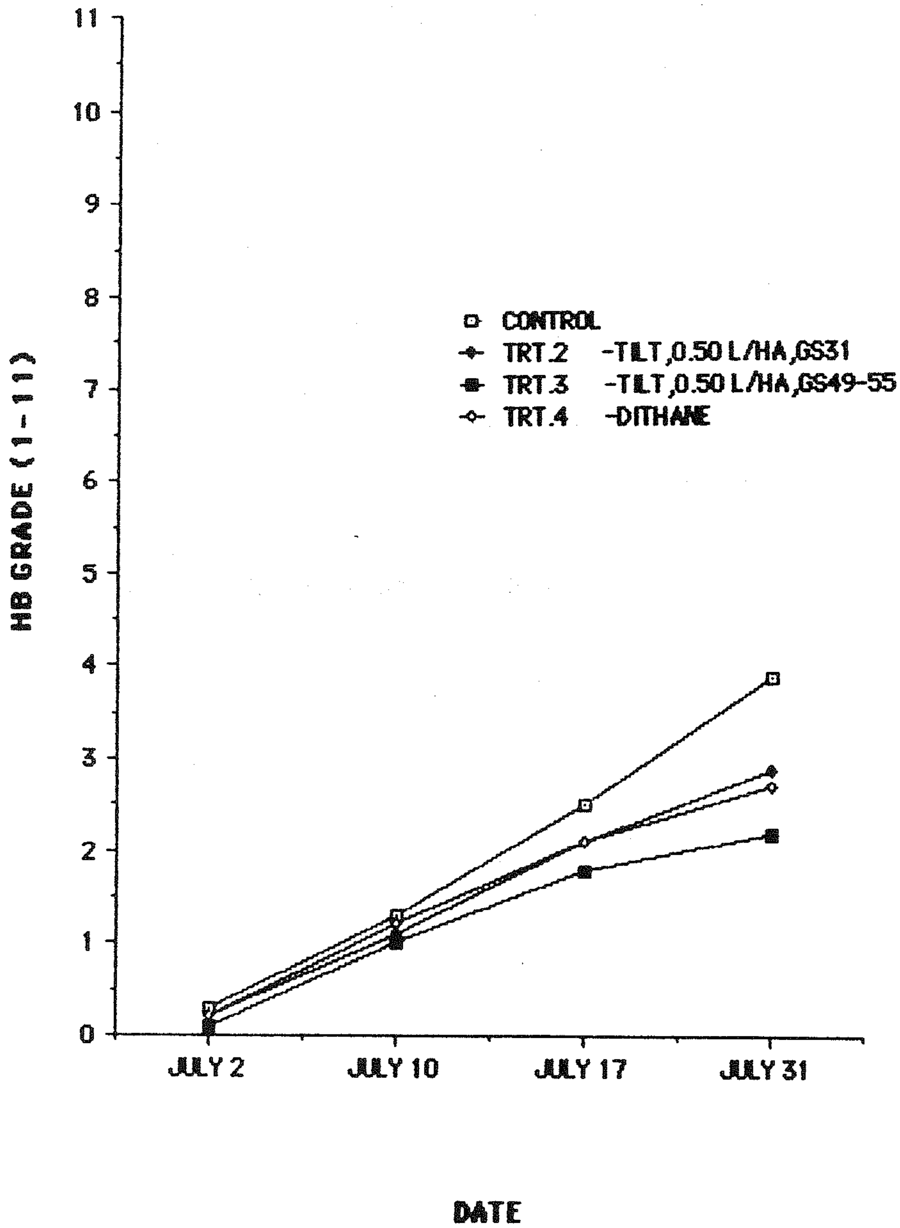
2. Not sprayed due to lack of sufficient levels of disease.

3. The entire plant was not rated because extensive natural wilting and senescence of older leaves made it difficult to rate the amount of damage specifically caused by disease.

FIGURE 5

SPRING WHEAT TRIAL 5

OSLO DISEASE RATINGS



Section 2: Farm Scale Trial - Spring Wheat, Spruce Grove, Alberta, 1987

Co-operator: Mr. Bruce Fuhr, Fuhr Farms, Spruce Grove.

Legal Location: NE-5-53-27-W4

The soil test result (Norwest labs) described the soil nutrient status (kg/ha) as follows: 17 nitrate, 64 phosphate, 279 potassium, 26.7 sulphate, pH 6.9, 0.82 E.C. (salinity), 8% organic matter, and medium texture. Recommendations were a) 79 Kg N/ha for excellent crop conditions (target yield 67 bu/acre) and b) 63 Kg N/ha for average crop conditions (target yield 54 bu/acre).

Two varieties of wheat, Neepawa and Oslo, (both VITAVAX treated) were seeded on May 11 and 12 with an Amazone single disc seed drill at 4 1/2 inch (11.4 cm) row spacings, tramlined. Each plot was 0.99 acres (3999 m^2) in size with a strip plot design and 2 replicates. In the fall of 1986, the field had been banded with 60 lbs N/acre (67 Kg N/ha) and 80 lbs P_2O_5/acre (90 Kg P_2O_5/ha).

Field preparation for seeding included cultivation followed by an application of AVADEX (triallate) granular at 1.4 Kg A.I./ha for control of wild oats. Nitrogen as anhydrous ammonia (82-0-0) was banded at 2 fertility levels (see below) at right angles prior to seeding, on May 3. BANVEL (dicamba) and MCPA-K at 0.3 l/ha and 1.1 l/ha (respectively) were applied as a tankmix on June 10 and 11 for broadleaf weed control. Weeds observed were mainly Canada thistle, perennial sow thistle, volunteer canola and stinkweed.

Treatments were as follows:

Mainplot treatments: Variety, seeding rate, PGR, fungicide

1. Oslo 300 seeds/m^2
2. Oslo 500 seeds/m^2
3. Oslo 500 seeds/m^2, TILT
4. Neepawa 300 seeds/m^2
5. Neepawa 500 seeds/m^2
6. Neepawa 500 seeds/m^2, CYCOCEL
7. Neepawa 500 seeds/m^2, CYCOCEL, TILT

CYCOCEL (+0.5% Citowett Plus) was applied on June 23 (GS 32) at 1.5 l/ha.
TILT was applied on July 1 (GS 48) at 0.5 l/ha.

Subplot treatments: Fertility management level.

The "Conventional" treatment level was targeted at the centre of Alberta Agriculture fertilizer recommendations for the region, intended to represent 'average' fertilizer practice in the area. The "High Conventional" treatment level was chosen to target the uppermost levels for fertilizer recommendations in the area, to represent "High yield" farmers. The ICM fertility level was set at a very high nitrogen level equivalent to that used in the ICM treatments for 1985 and 1986 at Spruce Grove, intended to maximise yield.

1. Conventional: Total nitrogen required 78 lbs N/acre (88 Kg N/ha). Total soil N was 88 lbs/acre (99 Kg N/ha), therefore no extra N was added.

2. High conventional: Total nitrogen required was 108 lbs N/acre (121 Kg N/ha). Total soil N was 88 lbs/acre (99 Kg N/ha) therefore 20 lbs N/acre (22 Kg N/ha) was added as anhydrous ammonia (82-0-0).

3. ICM: Total nitrogen required 208 lbs N/acre (234 Kg N/ha). Total soil N was 88 lbs/acre (99 Kg N/ha). Therefore 120 lbs N/acre (135 Kg N/ha) was added as anhydrous ammonia, to emulate fertility levels of the ICM treatment in the previous two years.

All plots were rated for disease in early August by Dr. L.J. Piening (Agriculture Canada, Lacombe). Square meter samples (2 per plot) were harvested on September 7 for yield component determination. Head counts were done on these samples, and the heads were later threshed. The yield data were used to determine tillers per plant, kernels per m^2 and kernels per head. All Neepawa plots were harvested on September 10 and 11, and all Oslo plots on September 18. The one week delay was due to fall rains. The crop was straight combined, with the grain from each plot weighed individually in the field using a large-scale weigh bin. A sample of grain was taken at this time and used to determine 1000 K and moisture content. All yield data of the combined plots were then corrected to 14.5% moisture.

RESULTS AND CONCLUSIONS. LARGE SCALE SPRING WHEAT. FUHR FARMS, SPRUCE GROVE, ALBERTA.

1. There was no significant effect of treatments on yield or maturity, but there was a significant effect of treatments on kernels per m^2, 1000 K, lodging, height, plants per m^2, heads per m^2 and tillers per plant (Table 17). Although TILT did have a significant effect in reducing disease levels (Table 17-4) it did not result in a corresponding increase in yield. CYCOCEL was effective in reducing lodging in Neepawa. However, there was no lodging in Oslo. For both Neepawa and Oslo, an increase in seeding rate resulted in a decrease in tillers per plant and an increase in heads per m^2 (Table 17-1).

2. Management (fertility) level was much more important in influencing the variables than were treatments. Fertility effects were significant for yield, kernels per m^2, test weight, lodging, maturity, height, heads per m^2, tillers per plant and water use efficiency (Table 17). The ICM management level (120 lbs N/acre added) resulted in the largest increase in yield (813 kg/ha or 12 bu/acre) compared to the Conventional management level (no added N) (Table 17-2). Kernels per m^2, heads per m^2, tillers per plant and water use efficiency were also highest for the ICM management level. On the negative side, the ICM management level delayed maturity by 7 days (compared to the Conventional management level) and resulted in some lodging in Neepawa, although this lodging was not severe. The incidence of Septoria in Neepawa and Oslo was greatest at the lowest fertility level (Conventional) (Table 17-4).

3. The ICM level management (Fertility) treatment increased maturity, compared to Conventional and High Conventional fertility levels (Table 17-2). However the Treatment x Fertility management interactions were also significant for these two variables (Table 17-3). In the case of maturity, delay caused by higher N levels is anticipated but was only found as N level was increased from either the Conventional or High Conventional level to the ICM level (5.4 to 6.8 day delay). The interaction is attributable mainly to differential maturity response of Oslo at 500 seeds/m^2, with and without TILT applied at the High Conventional fertility level. No obvious explanation is offered for this, except that a related pattern of interaction was also found for yield with these same two treatments. (Unstable yield performance of Oslo compared to Neepawa has also been noted in several of the small plot trials in Edmonton).

   Other components of this Treatment x Management interaction for yield (Table 17-3) include (a) a significant yield drop for Oslo with 500 seeds m^2 at the highest fertility level, compared to the Conventional level, (b) a very large response of Neepawa at 300 seeds/m^2, as fertility was raised from Conventional to ICM level, and (c) the highest yield of all being recorded for Neepawa with the maximum amount of input (Treatment 7, ICM fertility level), at which level lodging was still not significant.

   The yield table for the Treatment x Management interaction also allows one to see that at the Conventional fertility rate, increased seeding rate significantly increased yield for Oslo (Treatment 3) compared to the low seedrate (Treatment 1), but significantly reduced yield for Neepawa (Treatments 5) or did not increase yield (Treatment 7). Some erratic reversals of these patterns occurred at the two higher fertility levels.

4. Septoria levels in both Oslo and Neepawa were significantly influenced by fertility level, with the highest fertility level causing a significant reduction in disease (Table 17-4). In the case of Neepawa treatment 7 (which included high seedrate, CYCOCEL and TILT) significantly reduced Septoria infection. No significant treatment effects on Septoria were found in Oslo due to seedrate or TILT application.

   For take-all, neither management nor fertility level significantly affected disease level in Neepawa. In the case of Oslo however, a marked reduction in take-all level was found (significant at <0.05) as fertility level was increased (Table 17-5).

5. <u>Spruce Grove Costs and Returns (Table 17-6):</u>
   Total variable input costs per acre for each of the 21 different treatment combinations in the 1987 Spruce Grove Farmscale Trial ranged from $102.01 to $167.86. The lowest cost treatment was for Neepawa under conventional levels of management which are typical for the region, and this treatment also resulted in the lowest production cost per bushel of the 21 treatments (at $1.57 per bushel). All treatments for Neepawa and Oslo only achieved feed grade, and therefore gross margins are compared for feed prices in all cases at $2.45/bushel. Neepawa under conventional production practices was the most profitable per acre ($57.24 gross margin). Even though Neepawa at the highest input levels had the highest actual yield and gross revenue, the higher production costs offset this increased gross revenue. Use of TILT did not increase revenue, and appears to have seriously suppressed revenue in the case of Oslo. As indicated earlier, preheading moisture stress may have prejudiced the yield potential of Oslo in this trial.

TABLE 17 FARM SCALE TRIAL. SPRING WHEAT, SPRUCE GROVE, ALBERTA, 1987.

	df	Yield	Kernels/m^2	1000 K	kg/Hl	Lodging	Maturity	Height
rep	1	NS	NS	NS	NS	NS	NS	NS
Treatment (trt.)	6	NS	**	**	NS	**	NS	**
Management (man.)	2	**	**	NS	**	**	**	*
Trt. x Man.	12	*	NS	NS	NS	**	*	NS
mainplot C.V. %		7.4	8.9	3.3	1.6	43.0	1.9	6.1
subplot C.V. %		6.4	12.4	3.3	0.9	43.0	1.8	5.0

TABLE 17 (continued) FARM SCALE TRIAL. SPRING WHEAT, SPRUCE GROVE, ALBERTA, 1987.

	df	Plants/m^2	Heads/m^2	Tillers/plant	Kernels/head	WUE
rep.	1	NS	**	NS	*	NS
Treatment (trt.)	6	**	**	**	NS	NS
Management (man.)	2	NS	**	**	NS	**
trt. x man.	12	NS	NS	NS	NS	*
mainplot C.V. %		15.5	8.4	13.0	8.2	7.4
subplot C.V. %		9.1	8.7	13.0	8.8	6.5

TABLE 17-1 LARGE SCALE SPRING WHEAT (SPRUCE GROVE). SIGNIFICANT (0.05) MAIN EFFECTS OF TREATMENT FOR KERNELS PER M^2, 1000 K, LODGING, HEIGHT, PLANTS PER M^2, HEADS PER M^2, AND TILLERS PER PLANT.

	Kernels/m^2	1000 K (g)	Lodging	Height (cm)
1. Oslo, 300 seeds/m^2	9562 *d*	38.3 *a*	0.2 *d*	76.8 *ef*
2. Oslo, 500 seeds/m^2	9143 *d*	37.8 *a*	0.2 *d*	75.5 *f*
3. Oslo, 500 seeds/m^2, TILT	9969 *cd*	37.2 *a*	0.2 *d*	78.5 *def*
4. Neepawa, 300 seeds/m^2	12675 *a*	33.1 *bc*	0.7 *c*	98.2 *ab*
5. Neepawa, 500 seeds/m^2	11386 *ab*	31.8 *c*	1.6 *a*	99.3 *a*
6. Neepawa, 500 seeds/m^2, CYCOCEL	11923 *a*	31.5 *c*	0.7 *bc*	84.8 *cd*
7. Neepawa, 500 seeds/m^2, CYCOCEL, TILT	12023 *a*	32.9 *c*	0.4 *c*	82.5 *de*
S.E. (difference)	561.4	0.7	0.1	3.0

	Plants/m^2	Heads/m^2	Tillers/plant
1. Oslo, 300 seeds/m^2	287 *bc*	546 *d*	1.9 *bc*
2. Oslo, 500 seeds/m^2	403 *a*	541 *d*	1.4 *e*
3. Oslo, 500 seeds/m^2, TILT	414 *a*	599 *cd*	1.5 *de*
4. Neepawa, 300 seeds/m^2	233 *c*	661 *bcd*	2.9 *a*
5. Neepawa, 500 seeds/m^2	390 *a*	666 *abc*	1.8 *cd*
6. Neepawa, 500 seeds/m^2, CYCOCEL	389 *a*	739 *a*	1.9 *bc*
7. Neepawa, 500 seeds/m^2, CYCOCEL, TILT	371 *a*	702 *ab*	1.9 *bc*
S.E. (difference)	31.8	30.9	0.1

TABLE 17-2 LARGE SCALE SPRING WHEAT (SPRUCE GROVE). SIGNIFICANT (0.05) MAIN EFFECTS OF MANAGEMENT FOR YIELD, KERNELS PER M^2, HECTOLITRE WEIGHT, LODGING, MATURITY, HEIGHT, HEADS PER M^2, TILLERS PER PLANT AND WUE.

		Yield (kg/ha)	Kernels/m^2	Kg/Hl	Lodging	Maturity (days)
1.	Conventional (no added N)	4111 *b*	10023 *b*	74.8 *a*	0.2 *b*	112.2 *b*
2.	High Conventional (20 lbs N/acre)	4159 *b*	10369 *b*	74.8 *a*	0.2 *b*	113.6 *b*
3.	ICM (120 lbs N/acre)	4925 *a*	12471 *a*	73.3 *b*	1.3 *a*	119.0 *a*
	S.E. (difference)	105.6	511.5	0.2	0.1	0.8

		Height (cm)	Heads/m^2	Tillers/plant	WUE
1.	Conventional (no added N)	83.1 *b*	590 *b*	1.7 *b*	171.4 *b*
2.	High Conventional (20 lbs N/acre)	84.0 *b*	603 *b*	1.8 *b*	173.4 *b*
3.	ICM (120 lbs N/acre)	88.2 *a*	716 *a*	2.1 *a*	205.1 *a*
	S.E. (difference)	1.6	20.9	0.1	4.5

TABLE 17-3 LARGE SCALE SPRING WHEAT (SPRUCE GROVE) 1987. SIGNIFICANT (0.05) INTERACTIVE EFFECTS OF TREATMENT AND MANAGEMENT (FERTILITY LEVELS: CONV., H. CONV. AND ICM) FOR YIELD, LODGING, MATURITY AND WATER USE EFFICIENCY.

	Yield (kg/ha)			Av. Yield (kg/ha)	Lodging		
	Conv.	H. Conv	ICM		Conv.	H. Conv.	ICM
1. Oslo, 300 seeds/m^2	3768	4038	4891	4232 *a*	0.2	0.2	0.2
2. Oslo, 500 seeds/m^2	4010	4362	3828	4067 *a*	0.2	0.2	0.2
3. Oslo, 500 seeds/m^2 TILT	4347	3900	5073	4440 *a*	0.2	0.2	0.2
4. Neepawa, 300 seeds/m^2	4340	3996	5145	4494 *a*	0.2	0.2	1.6
5. Neepawa, 500 seeds/m^2	3915	4044	4817	4259 *a*	0.5	0.2	4.0
6. Neepawa, 500 seeds/m^2 CYCOCEL	4066	4285	5215	4522 *a*	0.2	0.2	1.8
7. Neepawa, 500 seeds/m^2 CYCOCEL, TILT	4333	4487	5503	4774 *a*	0.2	0.2	0.9
Mean (1-7)[1]	4111 x	4159 x	4925 y	4398			
S.E. (applies to body of table only)		279.4				0.2	

1 Means and DMRT letters apply to row comparison only

	Maturity (days)			WUE		
	Conv.	H. Conv	ICM	Conv	H. Conv	ICM
1. Oslo, 300 seeds/m^2	113.0	114.0	120.0	160.4	171.9	208.2
2. Oslo, 500 seeds/m^2	113.0	116.5	113.0	170.8	185.7	163.0
3. Oslo, 500 seeds/m^2 TILT	116.5	113.0	120.0	185.1	166.0	216.0
4. Neepawa, 300 seeds/m^2	113.0	115.0	120.0	178.2	164.0	211.2
5. Neepawa, 500 seeds/m^2	113.0	114.0	120.0	160.7	166.1	197.8
6. Neepawa, 500 seeds/m^2 CYCOCEL	110.0	113.0	120.0	166.9	175.9	214.1
7. Neepawa, 500 seeds/m^2 CYCOCEL, TILT	107.0	110.0	120.0	177.9	184.2	225.9
S.E.		2.1			11.8	

TABLE 17-4 LARGE SCALE SPRING WHEAT. SPRUCE GROVE, 1987. SEPTORIA RATINGS[1] (COURTESY OF DR. L.J. PIENING, LACOMBE RESEARCH STATION, AGRICULTURE CANADA, RECORDED AUGUST 5).

Fertility (Added)	Septoria rating (% leaf area diseased) Neepawa	Oslo
1. No added N	5.6 *a*	4.5 *a*
2. 20 lbs N/acre	3.6 *b*	3.4 *ab*
3. 120 lbs N/acre	1.6 *c*	2.4 *c*

Treatment	Septoria rating (% of leaf area diseased)
4. Neepawa, 300 seeds/m^2	3.8 *a*
5. Neepawa, 500 seeds/m^2	3.9 *a*
6. Neepawa, 500 seeds/m^2 CYCOCEL	5.1 *a*
7. Neepawa, 500 seeds/m^2 CYCOCEL, TILT	1.7 *b*

TABLE 17-5 LARGE SCALE SPRING WHEAT. SPRUCE GROVE 1987. TAKE-ALL RATINGS (COURTESY OF DR. L.J. PIENING, LACOMBE RESEARCH STATION, AGRICULTURE CANADA; RECORDED AUGUST 5).

	Take-all rating (No. infected plants/20m^2)	Take-all rating (% of seeds planted)
Fertility	Oslo	Oslo
1. No added N	35.5 *a*	0.41 *a*
2. 20 lbs N/acre	16.8 *b*	0.21 *b*
3. 120 lbs N/acre	2.2 *c*	0.02 *c*

TABLE 17-6 **1987 SPRUCE GROVE SPRING WHEAT COSTS AND RETURNS**

(EXPRESSED IN $/ACRE)

		OSLO 300	OSLO 500	OSLO 500 + TILT	NEEP 300	NEEP 500	NEEP 500 + CCC	NEEP 500 +CCC TILT
Soil test		0.35	0.35	0.35	0.35	0.35	0.35	0.35
AVADEX		13.06	13.06	13.06	13.06	13.06	13.06	13.06
BANVEL		2.42	2.42	2.42	2.42	2.42	2.42	2.42
MCPA-K		1.74	1.74	1.74	1.74	1.74	1.74	1.74
N(fall banded)		15.00	15.00	15.00	15.00	15.00	15.00	15.00
P_2O_5		32.00	32.00	32.00	32.00	32.00	32.00	32.00
Banding cost		3.50	3.50	3.50	3.50	3.50	3.50	3.50
TOTAL COMMON COSTS		68.07	68.07	68.07	68.07	68.07	68.07	68.07
Machine op.	C	20.00	20.00	25.00	20.00	20.00	25.00	30.00
	HC	20.00	20.00	25.00	20.00	20.00	25.00	30.00
	ICM	20.00	20.00	25.00	20.00	20.00	25.00	30.00
CYCOCEL	C	-	-	-	-	-	10.13	10.13
	HC	-	-	-	-	-	10.13	10.13
	ICM	-	-	-	-	-	10.13	10.13
TILT	C	-	-	6.40	-	-	-	6.40
	HC	-	-	6.40	-	-	-	6.40
	ICM	-	-	6.40	-	-	-	6.40
82-0-0	C	-	-	-	-	-	-	-
	HC	5.00	5.00	5.00	5.00	5.00	5.00	5.00
	ICM	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Seed	C	18.09	30.16	30.16	13.94	23.26	23.26	23.26
$8.18/bu+	HC	18.09	30.16	30.16	13.94	23.26	23.26	23.26
$1 VIT.	ICM	18.09	30.16	30.16	13.94	23.26	23.26	23.26
Total sp. costs	C	38.09	50.16	61.56	33.94	43.26	58.39	69.79
	HC	43.09	55.16	66.56	38.94	48.26	63.39	74.79
	ICM	68.09	80.16	91.56	63.94	73.26	88.39	99.79
TOT.VAR. COSTS	C	106.16	118.23	129.63	**102.01**	111.33	126.46	137.86
	HC	111.16	123.23	134.63	107.01	116.33	131.46	142.86
	ICM	136.16	148.23	159.63	132.01	141.33	156.46	167.86
Costs(to Neep300)	C	4.15	16.22	27.62	**0.00**	9.32	24.45	35.85
	HC	9.15	21.22	32.62	5.00	14.32	29.45	40.85
	ICM	34.15	46.22	57.62	30.00	39.32	54.45	65.85

TABLE 17-6 (continued)

		OSLO 300	OSLO 500	OSLO 500 + TILT	NEEP 300	NEEP 500	NEEP 500 + CCC	NEEP 500 +CCC,TILT
Yield (bu/acre)	C	56	60	65	65	58	61	65
	HC	60	65	58	60	60	64	67
	ICM	73	57	76	77	72	78	82
Cost/bu	C	1.90	1.97	1.99	**1.57**	1.92	2.07	2.12
	HC	1.85	1.90	2.32	1.78	1.94	2.05	2.13
	ICM	1.87	2.60	2.10	1.71	1.96	2.01	2.05
Cost/bu (to Neep 300)	C	0.33	0.40	0.42	**0.00**	0.35	0.50	0.55
	HC	0.28	0.33	0.75	0.21	0.37	0.48	0.56
	ICM	0.30	1.03	0.53	0.14	0.76	0.44	0.48

Price per bushel (1987 basis - graded at Alberta Wheat Pool, Ellerslie) (a) Neepawa $2.45/bu-FEED (b) Oslo $2.45/bu-FEED

GROSS RETURNS, BASED ON FEED GRADE ($2.45/BU)

		OSLO 300	OSLO 500	OSLO 500 + TILT	NEEP 300	NEEP 500	NEEP 500 + CCC	NEEP 500 +CCC,TILT
Gross revenue	C	137.20	147.00	159.25	**159.25**	142.10	149.45	159.25
	HC	147.00	159.25	142.10	147.00	147.00	156.80	164.15
	ICM	178.85	139.65	186.20	188.65	176.40	191.10	200.90
Gross margin	C	31.04	28.77	29.62	**57.24**	30.77	22.99	21.39
	HC	35.84	36.02	7.47	39.99	30.67	25.34	21.29
	ICM	42.69	-8.58	26.57	56.64	35.07	34.64	33.04
Gross margin(to Neep300)	C	-26.20	-28.47	-27.62	**0.00**	-26.47	-34.25	-35.85
	HC	-21.40	-21.22	-49.77	-17.25	-26.57	-31.90	-35.95
	ICM	-14.55	-65.82	-31.67	-0.60	-22.17	-22.60	-24.00

ASSUME: NEEPAWA #3CWRS AT $3.00/BU
OSLO #2CPS AT $2.48/BU

GROSS RETURNS, NEEPAWA @ $3.00/bu, OSLO @ $2.48/bu

		OSLO 300	OSLO 500	OSLO 500 + TILT	NEEP 300	NEEP 500	NEEP 500 + CCC	NEEP 500 +CCC,TILT
Gross revenue	C	138.88	148.80	161.20	**195.00**	174.00	183.00	195.00
	HC	148.80	161.20	143.84	180.00	180.00	192.00	201.00
	ICM	181.04	141.36	188.48	231.00	216.00	234.00	246.00
Gross margin	C	32.72	30.57	31.57	**95.99**	62.67	96.54	57.14
	HC	37.64	37.97	9.21	72.99	63.67	60.54	58.14
	ICM	44.88	-6.87	28.85	98.99	74.67	77.54	78.14
Gross margin(to Neep300)	C	-63.27	-65.42	-64.42	**0.00**	-33.32	0.55	-38.85
	HC	-58.35	-58.02	-86.78	-23.00	-32.62	-35.45	-37.85
	ICM	-51.11	-102.86	-67.14	3.00	-21.32	-18.45	-17.85

SECTION 3: WEATHER SUMMARY

a) Spruce Grove (Large Scale Trials)

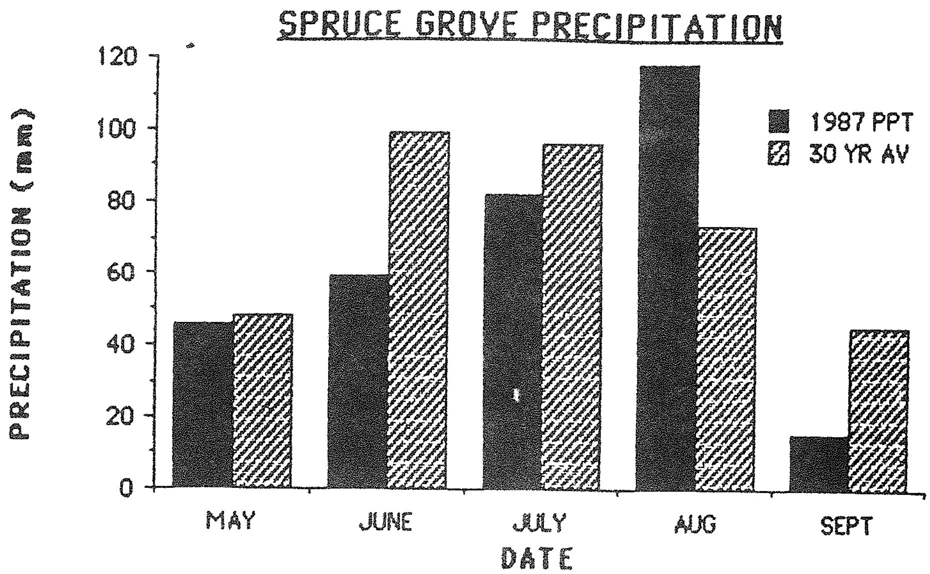
Actual mean temperature (^{O}C) for this site were: May 11.6, June 16.2, July 17.0, August 13.2 and September 13.6. Temperature, in ^{O}C, at +C or -C from the 30 year average: May +1, June +2, July +1, August -2 and September +3. Rainfall as a percent of the 30 year average: May 95%, June 60%, July 86%, August 161% and September 43%.

b) Edmonton, W240 (Small Scale Trials)

Actual mean temperature (^{O}C) for this site were: May 12.5, June 17.0, July 17.5, August 14.0 and September 14.0. Temperature, in ^{O}C, at +C or -C from the 30 year average: May +2, June +2, July 0, August -2 and September +3. Rainfall, as a percent of the 30 year average: May 184%, June 52%, July 137%, August 95% and September 170%. A major tornado touched down 2 miles away on July 31, 1987.

Data summarized in Figures 6 and 7. A major feature of this season was an unusually dry and hot June, at both sites, and high temperatures in May in Edmonton, as well as late May snowfall.

FIGURE 6


SPRUCE GROVE PRECIPITATION
PRECIPITATION (mm)
120
100
80
60
40
20
0
1987 PPT
30 YR AV
MAY
JUNE
JULY
AUG
SEPT
DATE

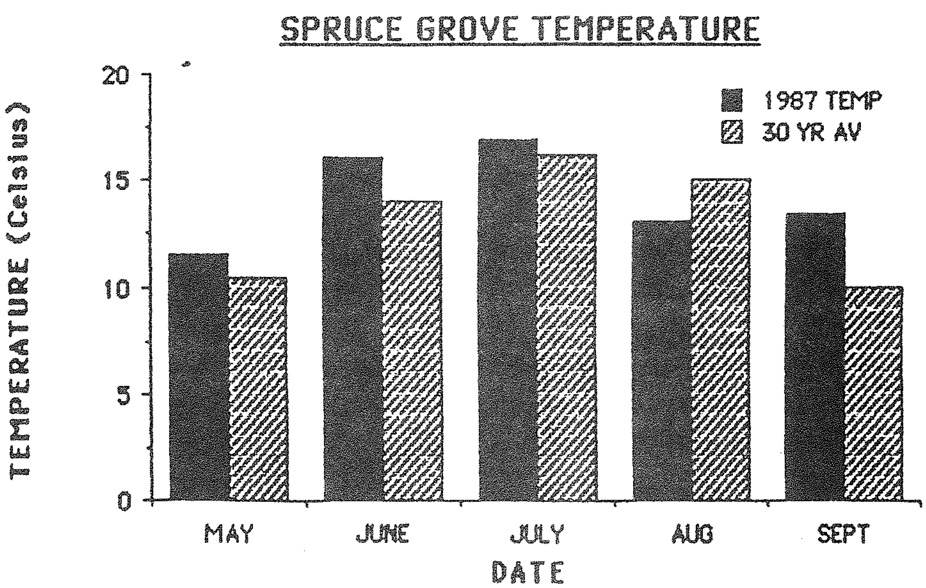
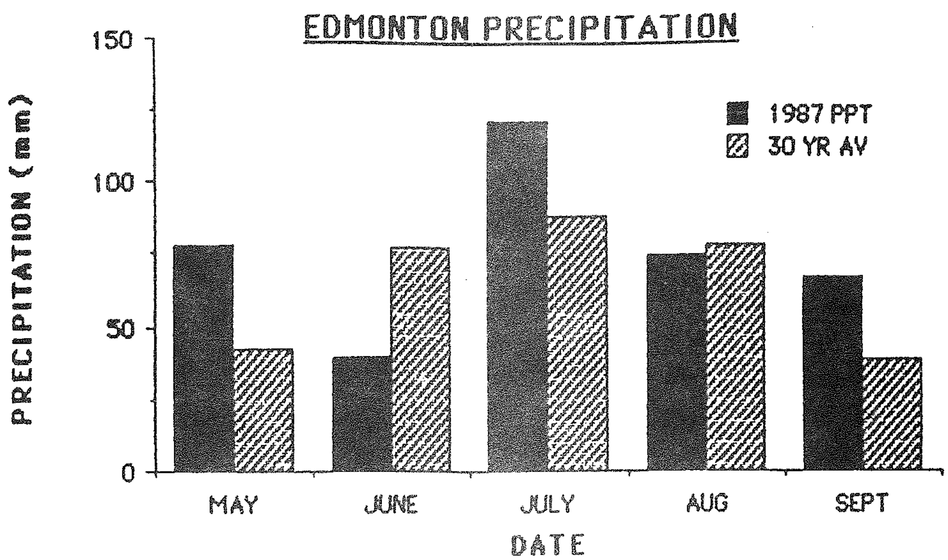
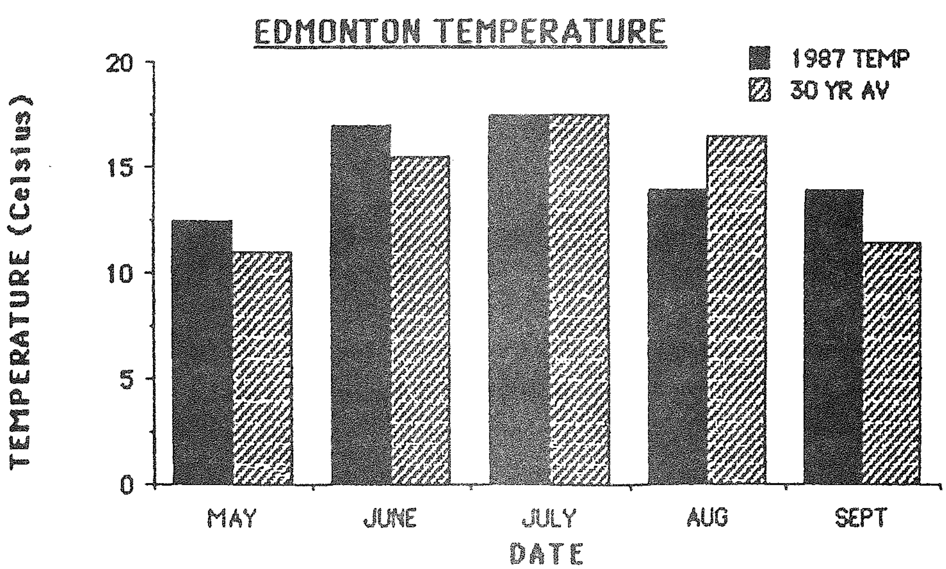

SPRUCE GROVE TEMPERATURE
TEMPERATURE (Celsius)
20
15
10
5
0
1987 TEMP
30 YR AV
MAY
JUNE
JULY
AUG
SEPT
DATE

FIGURE 7



EDMONTON PRECIPITATION
1987 PPT
30 YR AV
PRECIPITATION (mm)
150
100
50
0
MAY
JUNE
JULY
AUG
SEPT
DATE



EDMONTON TEMPERATURE
1987 TEMP
30 YR AV
TEMPERATURE (Celsius)
20
15
10
5
0
MAY
JUNE
JULY
AUG
SEPT
DATE

EXTENSION ACTIVITIES

a) Field days.

i) Edmonton Research Station and Spruce Grove, ICM Tour, University of Alberta, Joint with Alberta Agriculture, August 7 with 100+ attendees.

b) Meetings, Publications and Presentations.

1. Briggs, K.G., J.P. Tewari and W.H. Vanden Born, 1987. High yielding cultivars for the Parkland Region of Western Canada. Poster Presentation. 2nd National Wheat Research Conference "Profitable wheat production - solutions now". Nat. Assoc. of Wheat Growers Foundation, Kansas City, Missouri. February 24-26.

2. Briggs, K.G., 1987. Maximum economic yield studies on spring wheat. Abstract Proceedings, Union Carbide Western Small Grains Management Conference, Banff, February 11-13, 1987.

3. Crops Day Seminar, Briggs, K.G. "ICM and Semidwarf Wheats." Alberta Agriculture Field Service Board. 50 attending. March 3, 1987, Ponoka.

PART 2

MANITOBA

AG-QUEST, Independent Agricultural Research Services

Personnel: D.R.S. Rourke, Director
R.J. Doell, Research Associate

EXECUTIVE SUMMARY OF 1987 MANITOBA RESULTS

Weather conditions in 1987 had a great influence on the outcome of the trials, both directly and indirectly. The months of April, May and June all had above normal temperatures and below normal precipitation. This placed crops under drought stress, hastening development and generally reducing height, tillering and yield. The hot dry weather also limited infection and spread of diseases, particularly rusts which although present had much less effect than in 1986.

Winter wheat was generally seeded in the first week of September 1986 and resumed growth in early April 1987 with no evidence of winterkill. Spring wheat was seeded during the first week of May, about the same time as 1985 and 3 weeks earlier than 1986. Plant establishment in spring wheat trials was good, as a result of timely rainfall and improved seeding equipment.

The results of the 1987 trials will be briefly summarized under the topics of PGR's, fungicides, fertility, varieties and seeding rate & row spacing for both winter wheat and spring wheat.

PLANT GROWTH REGULATORS

Drought conditions in spring resulted in reduced plant height on all experiments and no lodging occurred in any of the trials of both winter wheat and spring wheat.

PGR's were tested on two cultivars of winter wheat, Norstar a tall wheat and Norwin, a semi-dwarf. In both cultivars, Cerone and Terpel C reduced plant height and delayed maturity slightly. Cycocel had no effect on plant height but did result in non significant yield increases in both cultivars. Plant heights for the untreated check were 74 cm for Norstar and 48 cm for Norwin.

PGR's were tested on four spring wheat cultivars, two semi dwarf cultivars, Oslo and HY320 and two tall cultivars, Katepwa and Arcola. Plant heights for the untreated checks are 49 cm, 57 cm, 58 cm and 64 cm for Oslo, Hy320, Katepwa and Arcola respectively. PGR's did not affect plant heights significantly in any of the four varieties. Yield increases with PGR applications were general for all cultivars with the exception of Cerone at .08 on all cultivars and Cycocel at .46 kg on Katepwa both of which decreased yield. Changes in yield were non significant, though a yield increase of 480 kg/ha was noted on Katepwa when Terpal C was applied at .69 kg at ZGS 32. Better forecasting of lodging conditions would be useful as lodging is infrequent and yield enhancement cannot be depended on.

FUNGICIDES

Fungicide results were quite variable in 1987. Disease levels were low, due to early crop maturity and dry weather. Fungicides, namely Tilt and Dithane M45 were applied on two winter wheat cultivars, Norwin and Norstar. On Norwin, all fungicides tested were found to increase yields, though differences from the untreated check were not significant. Fungicides did not affect levels of tanspot/septoria. Norwin is resistant to leaf rust. On both trials involving Norstar, fungicides tended to delay maturity, as a result of delayed senescence due to diseases. In the Fungicide X N trial, fungicides increased yields significantly compared to the untreated check. However in the Fungicide X Seeding Rate trial, fungicides actually decreased yields, especially where Tilt was applied. It appeared that the Seeding Rate trial was under greater drought stress at time of application and this coupled with the later application time may have reduced yields.

On both spring wheat cultivars tested, HY320 and Katepwa, the fungicides Tilt and Dithane M45 reduced disease levels of rust and tanspot/septoria. On HY320, applications of Tilt resulted in a non-significant yield increase, while Dithane decreased yields. On Katepwa, both fungicides reduced yields, with the greatest reductions occurring when Dithane was applied. These results are contrary to the Cultivar x Management Trial where good fungicide response was obtained. The Fungicide x Row spacing trial was seeded 4 days earlier and was at a later growth stage at the time of spraying, ZGS 55-60 as opposed to the Cultivar x Management trial which was at ZGS 50-55. High temperatures of about 32 C the week prior to and during application coupled with the later application timing may have resulted in crop injury. During time of potential crop stress, perhaps earlier applications (ie. ZGS 37-39 as in U.S. recommendations) could eliminate this problem.

FERTILITY

Limited available moisture in spring reduced the response of both spring wheat and winter wheat to applied fertilizers.

In winter wheat, rates of 120 and 240 kg N broadcast in spring as well as 80 and 180 kg N fall banded increased yields significantly over the unfertilized check. However the 40 kg rate did not result in yields significantly higher than the unfertilized check or lower than the highest yielding treatments. Split applications did not differ significantly from single broadcast applications. Rates of N over 120 kg/ha tended to delay maturity slightly. The micronutrients Copper, Zinc and Magnesium had no effect on wheat yields at the rates tested, perhaps because at moderate yields they are not limiting.

In Katepwa spring wheat, yields increased as nitrogen applied increased up to a maximum of 120 kg N/ha. Additional N over 120 kg/ha did not result in yield increases. All rates of N examined resulted in significant yield increases compared to the unfertilized check. Split applications caused plants to be slightly shorter and lower yielding, but differences were not significant. In HY320 all nitrogen applications except the 40 kg rate increased yield significantly over the unfertilized check. Yields tended to increase up to a maximum of 4500 kg/ha at 240 kg N/ha. Split applications were not significantly different from single applications and appear to have potential largely as a means of deferring risk or increasing protein.

VARIETIES

All winter wheat cultivars showed good winter survival, regardless of their hardiness due to an exceptionally mild winter and continual snow cover. Increasing inputs, whether extra N or fungicides or both, tended to decrease yields compared to the conventional management (I) for all varieties except Thunderbird. Bighorn was the highest yielding variety under all managements except management 3 where Norstar was the highest yielding and Bighorn was second highest. Lowest yielding varieties in managements I, II, III and IV were Thunderbird, Norwin, Norwin and Rose respectively.

Of the spring wheat varieties, Wheaton was the highest yielding under all management levels except where extra nitrogen and fungicides were both applied, in which case Owens was the highest yielding. Extra N increased yields for all cultivars except Arcola. Fungicides increased yields for all cultivars, more than additional N. Generally the hard red spring wheats and durum wheat had the lowest yields regardless of management though differences were generally not significant. Due to their higher prices, red spring and durum wheats may still be more attractive, regardless of management.

SEED RATE & ROW SPACING

Row spacing and seeding rate had no effects on either disease levels or subsequent yield in Norstar winter wheat, possibly due to complications caused by the drought and high temperatures. The 400 seeds/m2 seeding rate resulted in the highest yields in Norwin, though differences were not significant.

Seeding rate had no effect on either disease levels or yield in HY320 or Katepwa. Row spacing also had no effect on disease but narrow row spacing of 11 cm resulted in significantly higher yields than the 15 and 23 cm row spacings for both Katepwa and HY320. Yield increases were about 700 kg/ha for Katepwa and 900 kg/ha for HY320. This may be a result of less competition between plants within the row resulting in high plant stands and more heads/m2, kernels/head and a higher thousand kernel weight.

SECTION 1

EXPERIMENT 1 CROP DENSITY X FUNGICIDE ON NORSTAR WINTER WHEAT
MINTO, 1987

OBJECTIVE: To determine the effect of crop density and fungicide interactions on disease infection and yields of Norstar winter wheat.

TREATMENT LIST
FACTOR I ROW SPACING
1. 9 CM ROW SPACING
2. 18 CM ROW SPACING
FACTOR II SEEDING RATE
1. 300 SEEDS/M2
2. 500 SEEDS/M2
FACTOR III FUNGICIDE
1. UNTREATED CHECK
2. DITHANE M-45 ZGS 50 AND 10 DAYS LATER
3. TILT ZGS 50
4. TILT (2 APPLICATIONS) ZGS 50 AND 20 DAYS LATER

MATERIALS AND METHODS
Norstar winter wheat was seeded into standing barley stubble near Minto, Manitoba on September 3, 1986 at rates of 300 or 500 seeds/m2 in combination with row spacings of 9 and 18 cm. 50 kg/ha P205 and 30 kg/ha K20 were applied with the seed. 80 kg/ha of N as ammonium nitrate was broadcast April 15 and 40 kg/ha N was broadcast May 15 at ZGS 31. Weeds were controlled with an application of Estaprop at 1.75 l/ha on May 11. Fungicides were applied using a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Initial application of both Tilt and Dithane were made June 8 at 18 C when crop was at Zadoks 50-55. The second application of Dithane was made June 16 at 30 C when crop was at Zadoks 60. The second application of Tilt (treatment 4) was made on June 29 at 15 C when crop was at Zadoks 75. Rainfall 1 week after treatment was 8 mm, 22 mm and 8 mm respectively. Disease levels in the plots were assessed on July 10 using a Horsfall & Barratt scale where 0 is disease free and 9 is greater than 50% leaf area infected on all leaves. Plots were harvested July 27 and grain yields adjusted to 14.5% moisture.

RESULTS AND CONCLUSIONS
ROW SPACING
Row spacing had no effects on plant establishment or winter survival as shown by the April plant counts. Row spacing did not affect plant height, disease levels, heads/m2, kernels/head or thousand kernel weight (TKW). There were no significant differences in yield, though the wider row spacing did have slightly higher yields, probabely the result of slight increases in heads/m2 and TKW. This trend was opposite to that found in the spring wheat trials. The winter wheat suffered a longer period of drought at early stages of development than did the spring wheat.

SEEDING RATE
Seeding rate had a significant effect on plant density with 199 plants/m2 or 65% of seeding rate for 300 viable seeds/m2 and 271 plants/m2 or 54% of seeding rate fo 500 viable seeds/m2. Seeding rate did not affect plant height, disease levels, heads/m2, TKW or kernels/head. Yields were about 110 kg/ha

higher with the 300 seeds/m2 seeding rate but the differences was not significant. Due to the interaction with the early spring drought, treatments which were slower in utilizing the soil moisture appear to have done better in 1987. These treatments include those with wide row spacing and low seeding rates.

FUNGICIDE

All fungicide treatments reduced the levels of leaf rust but had no effect on levels of tanspot/septoria. Application of Tilt reduced plant height, with the double application resulting in a significant reduction in height compared to the untreated check. Tilt had the same effect on the number of heads/m2. The untreated check was the highest yielding treatment, though not significantly different from the Dithane treatment. Both Tilt treatments resulted in yields significantly lower than either the check or the Dithane treated plots. Hot dry weather in May and June hastened crop maturity and reduced the spread and effect of diseases, minimizing the effect of fungicides. Due to the drought conditions and low levels of diseases, farmers would have been advised not to spray under these conditions. The fungicides, particularly Tilt appeared to place extra stress on the plant causing yield reductions. Tilt applications appear to be mostly negative on plots with high seed rates. High seed rates gave higher yields, 4213 kg/ha (average of 9 & 18 cm row spacing) vs 3859 kg/ha for the low seed rate when no fungicides were applied. When fungicides were applied the low seeding rates gave higher yields than the high seeding rate. Thousand kernel weights were also lower for plots treated with Tilt, though differences were not significant. Fungicides reduced kernels/head though reductions were not significant.

TABLE M1. CROP DENSITY X FUNGICIDE - NORSTAR

TMT	SEED RATE	ROW SPAC CM	FUNG	PLANTS /M2	LEAF RUST	TS/ SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERN /HEAD	YIELD KG/HA
1	300	9	CHK	222	7	6	73	481	33.2	25	3965
2	300	9	DITH	222	5	6	77	533	32.9	24	4244
3	300	9	TILT	222	6	6	73	519	32.8	20	3412
4	300	9	2TILT	222	5	6	66	438	32.2	27	3777
5	300	18	CHK	190	7	6	73	622	32.7	19	3754
6	300	18	DITH	190	6	6	74	507	33.6	25	4175
7	300	18	TILT	190	6	6	74	532	32.0	21	3521
8	300	18	2TILT	190	5	6	68	501	31.7	20	3256
9	500	9	CHK	277	7	6	75	527	31.9	25	4091
10	500	9	DITH	277	6	6	73	560	31.1	21	3709
11	500	9	TILT	277	5	6	69	499	31.5	20	3232
12	500	9	2TILT	277	5	6	68	457	30.5	21	2962
13	500	18	CHK	267	7	6	75	500	32.5	26	4335
14	500	18	DITH	267	6	6	76	519	31.2	23	3817
15	500	18	TILT	267	6	6	67	499	29.9	20	2941
16	500	18	2TILT	267	5	6	66	515	30.2	19	2810
L.S.D. .05				24	1	1	10	98	2.8	5	1046
C.V.				7	7	3	10	13	6	16	20

TABLE M2. MAIN EFFECTS

ROW SPACING	PLANTS /M2	LEAF RUST	TS/ SEPT	PLANT HGT/CM	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA
9 CM	243	6	6	69	483	30.9	22	3508
18 CM	228	6	6	72	524	31.7	22	3576
L.S.D. .05	35	–	–	8	70	3.1	3	598
SEEDING RATE								
300 SEEDS/M2	199	6	6	70	498	31.5	22	3597
500 SEEDS/M2	272	6	6	71	509	31.1	22	3487
L.S.D. .05	23	–	–	6	67	2.5	3	480
FUNGICIDES								
CHECK	238	7	6	74	532	32.6	24	4036
DITHANE	238	6	6	74	531	32.2	23	3924
TILT	238	6	6	70	503	31.3	20	3230
2 TILT	238	5	6	63	447	29.1	20	2978
L.S.D. .05	–	–	–	8	66	3.3	4	678

EXPERIMENT 2 CROP DENSITY X FUNGICIDE - NORWIN

OBJECTIVE: To determine the effects of crop density and fungicides on disease levels and subsequent yield of Norwin winter wheat.

TREATMENT LIST

FACTOR 1 - SEEDING RATE

1. 200 SEEDS/M2 18 CM ROW SPACING
2. 300 SEEDS/M2 18 CM ROW SPACING
3. 400 SEEDS/M2 18 CM ROW SPACING
4. 500 SEEDS/M2 18 CM ROW SPACING

FACTOR 2 - FUNGICIDE

1. UNTREATED CHECK	
2. DITHANE M-45	ZGS 50 AND 10 DAYS LATER
3. TILT	ZGS 50
4. TILT (2 APPLICATIONS)	ZGS 50 AND 20 DAYS LATER

MATERIALS AND METHODS

Norwin winter wheat was seeded into standing barley stubble near Minto, Manitoba on August 30, 1986 at rates of 200, 300, 400 and 500 seeds/m2 and a row spacing of 18 cm. 60 kg/ha P205 and 30 kg/ha K20 was banded with the seed. 80 kg/ha N as ammonium nitrate was broadcast April 15 and 40 kg/ha N was broadcast May 14. Weeds were controlled with Estaprop applied at 1.75 l/ha on May 11. Fungicides were applied using a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Initial applications of Tilt and Dithane were made June 4 at 15 C when wheat was at Zadoks 50-55. The second Dithane application was made June 11 at 20 C when wheat was at Zadoks 60. The second Tilt applications (treatment 4 only) was made June 24 at 12 C when wheat was at Zadoks 75. There was a trace of tanspot on the lower leaves at the time of spraying. Disease levels were assessed on June 24 using a Horsfall & Barrett scale where 0 is disease free and 9 is greater than 50% leaf area infected on all leaves. There was no evidence of leaf rust in the experiment. Plots were harvested July 28 and yields adjusted to 14.5% moisture.

RESULTS AND CONCLUSIONS

SEEDING RATES

Seeding rate had no effect on plant height, heads/m2, kernel weight or kernels/head. Seeding rate had no effect on disease levels. There were no differences in tanspot/septoria and there was no leaf rust on the variety Norwin so no ratings were taken. There were no significant differences in yield, though the 400 seeds/m2 yielded over 300 kg/ha more than the other seeding rates.

FUNGICIDES

Fungicides tested had no visual effect on the levels of tanspot/septoria according to the June 24 rating. Application of Tilt resulted in a significant increase in plant heights compared to the untreated check and the Dithane treatment. Dithane appeared to reduce heads/m2 though the reduction was not significant compared to the other treatments. All fungicide treatments increased yield. The greatest increase of over 500 kg/ha for the single Tilt application was significantly more than the untreated check. Hot dry weather in May and June hastened crop maturity and thereby reduced diseases on the plant, minimizing the fungicide effects. Thousand kernel weights were also significantly increased by fungicide application.

TABLE M3. CROP DENSITY X FUNGICIDE - NORWIN

TRMT	SEED RATE	FUNG	TS/ SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA
1	200	CHK	5	49	714	31.4	16	3484
2	200	DITH	5	48	646	31.6	17	3492
3	200	TILT	5	52	637	33.7	19	4129
4	200	2 TILT	5	52	632	32.7	18	3642
5	300	CHK	5	49	690	29.9	15	3193
6	300	DITH	5	50	665	31.9	18	3945
7	300	TILT	5	53	676	32.8	18	3879
8	300	2 TILT	5	53	701	32.7	18	4092
9	400	CHK	5	49	666	30.9	20	4095
10	400	DITH	5	51	612	30.8	21	3988
11	400	TILT	5	53	681	33.5	20	4410
12	400	2 TILT	5	54	707	34.1	17	4139
13	500	CHK	5	50	669	29.9	17	3441
14	500	DITH	5	50	635	30.1	18	3424
15	500	TILT	5	54	689	34.1	18	4069
16	500	2 TILT	5	50	686	32.1	18	3892
L.S.D. .05			1	3	86	2.2	3	899
C.V.			3	4	9	5	13	16

TABLE M4. MAIN EFFECTS

SEEDING RATE	TS SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA
200 seeds/m2	5	50	657	32.3	18	3687
300 seeds/m2	5	51	683	31.8	17	3777
400 seeds/m2	5	52	666	32.3	20	4158
500 seeds/m2	5	51	670	31.6	18	3706
L.S.D. .05	1	2	49	1.7	3	590
FUNGICIDES						
CHECK	5	49	685	30.5	17	3553
DITHANE	5	50	639	31.1	19	3712
TILT	5	53	671	33.5	19	4122
2 TILT	5	52	682	32.9	18	3941
L.S.D.	1	1	43	0.9	2	427

EXPERIMENT 3 NITROGEN FERTILITY X FUNGICIDE IN WINTER WHEAT
MINTO 1987

OBJECTIVE: To determine the effect of fungicides on winter wheat grown under 10 different rates and timings of N applications

TREATMENT LIST
FACTOR 1 - NITROGEN APPLICATION*
1. 0 KG/HA BROADCAST ZGS 21
2. 40 KG/HA BROADCAST ZGS 21
3. 80 KG/HA BROADCAST ZGS 21
4. 120 KG/HA BROADCAST ZGS 21
5. 160 KG/HA BROADCAST ZGS 21
6. 200 KG/HA BROADCAST ZGS 21
7. 240 KG/HA BROADCAST ZGS 21
8. 80 KG/HA BANDED ZGS 00
9. 120 KG/HA BANDED ZGS 00
10. 180 KG/HA BANDED ZGS 00

FACTOR 2 - FUNGICIDE
1. UNTREATED CHECK
2. TILT @ .125 KG/HA ZGS 45
3. TILT @ .125 KG/HA/.125 KG/HA ZGS 45 + 21 DAYS LATER
*All nitrogen as granular ammonium nitrate

MATERIALS AND METHODS
Norstar winter wheat was planted near Minto, Manitoba on September 3, 1986 at a rate of 300 seeds/m2 and a row spacing of 19 cm. 40 kg/ha P205 and 24 kg/ha K20 was banded with the seed. Subplot size was 2.2 x 7.5 m and each treatment was replicated four times in a split block design. Weeds were controlled with Estaprop applied at 1.75 l/ha on May 11. Treatments 8, 9 and 10 were banded prior to seeding August 30. Treatments 2-7 were broadcast April 13 onto damp soil. Tilt was applied with a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Application at ZGS 45 was made June 8 and 21 days later on June 29. Rainfall/week after treatment was 8 mm for both dates. The maturity rating was done July 21 using a scale of 0-9 where 0 is early milk stage, 5 is yellow kernel and 9 is dead ripe. Plant heights and heads/m2 were measured just prior to harvest. Plots were harvested July 28 with a K.E.M. plot combine. Yields were adjusted to 14.5% moisture and thousand kernel weights (TKW) determined from the sample. All data was analyzed at the .05 level and means compared using the appropriate L.S.D. value.

RESULTS AND DISCUSSION

NITROGEN

There was a slight delay in maturity as nitrogen applied exceeded 120 kg/ha. There were no significant differences in plant height. Plots where no nitrogen was applied had significantly less heads/m2 than all other treatments except the 240 kg N treatment. All other treatments did not differ from each other. Nitrogen levels had no significant effect on either thousand kernel weight or the number of kernels/head. The highest yields were obtained with 80 kg N fall banded. These yields as well as the 120 kg spring, 240 spring and 160 fall banded were all significantly higher yielding than the untreated check plots. All other treatments are not significantly different from either the highest or the lowest yields. Water Use Efficiency (WUE) did not appear to be affected much by the level of nitrogen applied. With the exception of 40 kg/ha (WUE=546) all WUE were in the 210-276 range regardless of amount or timing of nitrogen. Increasing N increased protein content up to a maximum of 13.9% at 200 kg/ha. Fall banded treatments had lower protein than comparable spring broadcast applications.

FUNGICIDES

Fungicides delayed maturity, in spite of the low disease levels and generally early maturity in 1987. Plants also grew taller as a result of fungicides. Fungicides had no significant effect on heads/m2 or thousand kernel weight, though TKW increased where fungicides were applied. Compared to the untreated check, one application of Tilt increased the number of kernels/head. Fungicides also significantly increased yield, about 200 kg/ha for 2 applications and 355 kg/ha for 1 application over all nitrogen treatments. Fungicides did not appear to have an effect on protein content, with one Tilt application lowering protein .5% and 2 applications having no effect compared to the check.

TABLE M5 NITROGEN FERTILITY X FUNGICIDE - WINTER WHEAT

TREATMENT KG/HA N	FUNG.	MATURITY 0-9	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA	% PROTEIN
1. 0	CHK	9	72	434	33.0	24	3478	11.3
2. 0	TILT	8	74	419	34.7	25	3540	10.9
3. 0	2 TILT	9	78	512	34.6	22	3937	11.3
4. 40	CHK	8	72	507	36.2	20	3686	12.6
5. 40	TILT	8	78	544	37.1	21	4298	11.0
6. 40	2 TILT	8	73	481	33.1	25	3950	13.2
7. 80	CHK	8	76	516	33.4	22	3704	12.7
8. 80	TILT	8	76	487	33.7	25	4136	13.1
9. 80	2 TILT	8	73	537	33.7	22	3970	13.4
10. 120	CHK	7	72	537	33.6	23	4031	13.5
11. 120	TILT	7	76	531	34.9	23	4138	13.1
12. 120	2 TILT	7	76	576	32.7	23	4322	13.5
13. 160	CHK	8	69	534	32.5	22	3748	14.1
14. 160	TILT	7	71	509	32.9	23	3875	18.4
15. 160	2 TILT	7	74	600	34.8	21	4328	13.6
16. 200	CHK	7	69	543	32.5	21	3698	14.0
17. 200	TILT	6	73	535	34.9	23	4209	14.0
18. 200	2 TILT	7	72	544	33.5	21	3818	13.7
19. 240	CHK	7	72	532	34.1	21	3848	14.3
20. 240	TILT	7	75	453	34.1	31	4214	13.6
21. 240	2 TILT	6	71	517	34.8	23	4088	13.3
22. 80B	CHK	8	74	507	33.7	24	4068	12.0
23. 80B	TILT	8	78	521	32.8	26	4471	11.7
24. 80B	2 TILT	7	73	519	35.0	23	4147	12.8
25. 120B	CHK	8	71	536	33.3	22	3953	13.0
26. 120B	TILT	7	74	531	32.3	25	4191	13.0
27. 120B	2 TILT	7	75	523	33.5	22	3767	13.6
28. 180B	CHK	8	73	575	31.5	21	3769	13.6
29. 180B	TILT	8	78	517	32.6	27	4458	12.5
30. 180B	2 TILT	6	71	494	33.7	24	3993	13.1
L.S.D. .05		2	6	90	3.5	5	650	
C.V.		15	6	12	7	14	12	

TABLE M6 MAIN EFFECTS OF NITROGEN FERTILITY X FUNGICIDE

NITROGEN KG/HA	MATURITY 0-9	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA	% PROTEIN
0	9	75	455	34.1	24	3652	11.2
40	8	74	511	35.4	22	3978	11.8
80	8	75	513	33.6	23	3937	13.1
120	7	74	548	33.7	23	4164	13.4
160	7	71	548	33.4	22	3984	13.7
200	7	71	540	33.6	22	3908	13.9
240	7	72	500	34.3	25	4050	13.7
80 BANDED	8	75	516	33.8	24	4228	12.2
120 BANDED	7	73	530	30.3	23	3970	13.2
180 BANDED	7	74	528	32.6	24	4073	13.2
L.S.D. .05	1	4	53	3.3	3	339	
FUNGICIDE							
CHECK	8	72	522	32.5	22	3798	13.2
TILT	7	75	505	34.0	25	4153	12.6
2 TILT	7	74	530	33.9	23	4032	13.1
L.S.D. .05	1	2	28	1.8	2	212	

TABLE M7 WATER USE EFFICIENCY*

TRMT	YIELD (KG/HA)**	SOIL WATER AT HARVEST	WATER USED	WUE
1	3545	22.69	25.17	234
2	3662	31.15	16.71	546
3	3824	23.99	23.87	276
4	4076	21.02	26.84	242
5	3698	23.25	24.61	253
8	4132	22.88	24.98	276
9	3957	18.99	28.87	210

*Water Used = Precip. in growing season +
(soil water at seeding - soil water at harvest)
= 15.5 cm + (32.36 cm - cm)
WUE = Yield/(Water used - 10 cm)
**Mean Yield of Reps B & D

TABLE M8 PLANT TISSUE ANALYSIS

TREATMENT KG/HA N	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn
1 0	3.5H	0.28S	2.9S	0.27S	0.27S	0.15S	5.7S	185S	67S	22S
2 40	4.2VH	0.28S	3.2H	0.36S	0.37S	0.15S	6.5S	110S	62S	23S
3 80	4.2VH	0.28S	3.1H	0.34S	0.28S	0.16S	6.0S	96S	69S	23S
4 120	4.6VH	0.29S	3.3H	0.38S	0.28S	0.15S	4.6S	92S	53S	23S
5 160	4.9VH	0.30S	3.1H	0.38S	0.28S	0.15S	5.0S	90S	58S	23S
6 200	4.6VH	0.31S	3.4H	0.35S	0.31S	0.17S	5.2S	91S	64S	25S
7 240	4.4VH	0.30S	3.4H	0.33S	0.29S	0.15S	4.8S	89S	58S	24S
8 80 BANDED	4.3VH	0.28S	2.8S	0.33S	0.26S	0.16S	5.7S	95S	58S	22S
9 120 BANDED	4.4VH	0.29S	3.1H	0.35S	0.28S	0.16S	5.0S	90S	54S	23S
10 180 BANDED	4.3VH	0.27S	3.2H	0.33S	0.31S	0.16S	4.8S	85S	61S	24S

L=LOW
M=MARGINAL
S=SUFFICIENT
H=HIGH
VH=VERY HIGH

EXPERIMENT 4 TIMING OF N APPLICATION ON WINTER WHEAT, MINTO 1987

OBJECTIVE: To determine the optimum timings for two rates of nitrogen application.

TREATMENT LIST

1. 120 KG/HA N	ZGS 21
2. 80/40 KG/HA N	ZGS 21/31
3. 160 KG/HA N	ZGS 21
4. 80/40/40 KG/HA N	ZGS 21/31/49
5. SPOON FEED (80/20*/20*/20*/20*)	ZGS 21/31/39/49/60

*Liquid N 28-0-0, all other N is granular ammonium nitrate

MATERIALS AND METHODS

Norstar winter wheat was planted near Minto, Manitoba on September 3, 1986 at a rate of 300 seeds/m2 and a row spacing of 19 cm. 40 kg/ha P205 and 24 kg/ha of K20 were banded with the seed. Plot size was 2 x 7.5 m and treatments were replicated four times in a randomized complete block design. Weeds were controlled with Estaprop applied at 1.75 l/ha on May 11. Tilt was applied June 8 at a rate of .5 l/ha to control foliar diseases. Individual treatments were applied April 15, May 14, May 27, June 8, June 16 corresponding with ZGS 21, 31, 39, 49 and 60 respectively. Treatments 1, 2, 3 and 4 as well as the first application of treatment 5 were broadcast by hand. The last four applications of treatment 5 were applied with a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Plant heights and heads/m2 were measured just prior to the harvest on July 28. Plots were harvested with a K.E.M. plot combine and grain yields adjusted to 14.5% moisture. Thousand kernel weights were determined from the harvest samples. Data was analyzed at the .05 level and means compared using Duncan's M.R.T.

RESULTS AND DISCUSSION

Rates and timing of nitrogen application had no effect on plant heights, heads/m2, yield, kernels/head or kernel weight. Split applications did tend to lower the number of heads/m2. The 120 kg/ha rate of N, whether applied in a single application or as a split tended to yield more than plots where 160 kg/ha N was applied, either singly or as a split application. Split applications tended to lower protein levels in the grain, though only treatment 5 reduced levels by more than .3%.

TABLE M9 NITROGEN TIMING ON WINTER WHEAT

TREATMENT KG/HA N	ZGS	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA	% PROTEIN
1. 120	21	76a	584a	34.5a	23a	4615a	12.9
2. 80/40	21/31	75a	523a	34.3a	27a	4706a	12.6
3. 160	21	73a	601a	33.6a	23a	4594a	13.5
4. 80/40/40	21/31/49	71a	598a	34.2a	21a	4336a	13.3
5. 80/20*/20* /20*/20*	21/31/39/49/60	72a	564a	34.3a	23a	4426a	12.5
C.V.		6	11	3	15	10	

Means in the same column followed by the same letter do not differ at the 5% level according to Duncan's Multiple Range Test.

*Liquid N 28-0-0. All other nitrogen is granular ammonium nitrate.

EXPERIMENT 5 WINTER WHEAT MICRONUTRIENT TRIAL

OBJECTIVE: To determine if applications of selected micronutrients would result in increased crop growth and yield of Norstar winter wheat.

TREATMENT LIST

1. UNTREATED CHECK
2. COPPER AT 1 L/HA OF 7.5% EDTA APPLIED AS A FOLIAR SPRAY AT ZGS 31
3. MAGNESIUM AT 2 L/HA OF 2.5% EDTA APPLIED AS A FOLIAR SPRAY AT ZGS31
4. ZINC AT 2 L/HA OF 9% EDTA APPLIED AS A FOLIAR SPRAY AT ZGS 31

MATERIALS AND METHODS
Norstar winter wheat was planted near Minto, Manitoba on September 3, 1986 at a rate of 300 seeds/m2 and a row spacing of 19 cm. 40 kg/ha P205 and 24 kg/ha of K20 were banded with the seed. 120 kg/ha of N as ammonium nitrate was broadcast April 15. Plot size was 2 x 7.5 m and treatments were replicated four times in a randomized complete block design. Weeds were controlled with Estaprop applied at 1.75 l/ha on May 11. Tilt was applied June 8 at a rate of 0.5 l/ha to control foliar diseases. Individual treatments were applied May 14 at 20 C when wheat plants were at ZGS 31. Treatments were applied using a compressed air bicycle sprayer delivering a volume of 110 l/ha at 275 kPa. Plant heights and heads/m2 were measured just prior to harvest on July 28. Plots were harvested with a K.E.M. plot combine and grain yields adjusted to 14.5% moisture. Thousand kernel weights were determined from the harvest samples. Data was analyzed at the .05 level and means compared using Duncan's M.R.T.

RESULTS AND DISCUSSION
The addition of micronutrients at the rates and timings tested did not appear to have an effect on any of the parameters measured. It is possible however that under more favorable growing conditions an increased yield may have resulted in a greater need for and response from application of micronutrients.

TABLE M10 WINTER WHEAT MICRONUTRIENT TRIAL

TREATMENT	PLANT HGT.CM.	HEADS /M2	KERN.WT. GM/1000	KERNELS /HEAD	YIELD KG/HA	% PROTEIN
CHECK	74a	492a	33.7a	27a	4377a	13.2
COPPER	74a	522a	33.2a	25a	4268a	12.8
MAGNESIUM	74a	532a	33.6a	25a	4312a	13.2
ZINC	71a	505a	32.8a	25a	4073a	12.9
C.V.	4	7	3	11	5	

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 6 PLANT GROWTH REGULATORS ON NORSTAR WINTER WHEAT
MINTO 1987

OBJECTIVE: To determine the effects of plant growth regulators on lodging control and yield of Norstar winter wheat.

TREATMENT LIST

PGR	RATE (KG/HA)	ZADOKS GROWTH STAGE
1. UNTREATED CHECK	---	--
2. CYCOCEL	0.46	31
3. CYCOCEL	0.69	31
4. CYCOCEL	1.15	31
5. CYCOCEL	1.38	31
6. TERPEL C	0.69	39
7. CERONE	0.15	39
8. CERONE	0.30	39
9. CYCOCEL/CERONE	0.69/0.08	31/39
10. CYCOCEL/CERONE	0.69/0.15	31/39
11. CYCOCEL/CERONE	0.69/0.30	31/39

MATERIALS AND METHODS

Norstar winter wheat was seeded September 3, 1986 at a rate of 300 seeds/m2, a depth of 3 cm and a row spacing of 19 cm. 40 kg/ha P205 and 24 kg/ha K20 were banded with the seed. 120 kg/ha N as 34-0-0 was broadcast on April 15. The soil is a Ryerson clay loam with an O.M. of 5% and a pH of 7.8. The experimental design was a randomized complete block with 4 replicates and a plot size of 2 x 7.5m. Broadleaf weeds were controlled by an application of Estaprop at a rate of 1.75 l/ha on May 11. Tilt was applied at a rate of .250 l/ha on June 8 to control foliar diseases. Individual treatments were applied using a compressed air bicycle sprayer delivering a volume of 200 l/ha for treatments 2, 3, 4, 5, 9a, 10a, 11a and a volume of 110 l/ha for treatments 6, 7, 8, 9b, 10b and 11b at a pressure of 275 kPa. Treatments 2, 3, 4, 5, 9a, 10a and 11a were applied May 14 at 20 C when wheat was ZGS 31. Treatments 6, 7, 8, 9b, 10b and 11b were applied May 27 at 23 C when wheat was at ZGS 37-39. Plant heights were measured July 12 by sampling 10 spots in each plot. There was no lodging in this experiment. Maturity was rated July 21 using a scale of 0-9 where 9 is dead ripe, 5 is mid-dough , light brown kernal and 0 is early milk stage. Heads/m2 were determined June 26 on the basis of two 1/4 m2 samples in each plot. Plots were harvested July 28 with a K.E.M. plot combine and TKW determined from the sample. All measurements were analyzed at the 5% level using Duncan's MRT.

RESULTS AND CONCLUSIONS

The plant heights of plots treated with Cycocel did not differ significantly from the untreated check. Plots treated with ethephon, either alone, as part of a tank mix or in split application with Cycocel had significantly shorter plants than the untreated check. These ethephon treated plots also tended to be later maturing though differences were not significant. Treatments including ethephon also resulted in more heads/m2 than the untreated control or those plots receiving only Cycocel, but only the .30 kg rate of Cerone resulted in significantly more heads/m2 than the untreated check. Cycocel applied at .46, 1.15 and 1.38 kg/ha resulted in a non-significant increase in kernels/head compared to the untreated check. All other treatments reduced the number of kernels/head. The greatest reduction in kernels/head occurred with the .30 kg rate of Cerone. This resulted in significantly less kernels/head than the.46, 1.15 and 1.38 kg rates of Cycocel. TKW was not affected significantly by any of the PGR's, although the highest TKW (.69 kg/ha CCC) was significantly higher than the lowest TKW (.30 kg/ha Cerone). There were no significant differences in grain yield. The treatments involving a single application of Cycocel had consistently higher yields than treatments including ethephon. In two instances the 1.15 and 1.38 kg rates of Cycocel outyielded the untreated check by 280 and 100 kg/ha respectively.

TABLE M11 PLANT GROWTH REGULATORS ON NORSTAR WINTER WHEAT

TREATMENT	RATE KG/HA	HEADS /M2	PLANT HGT(CM)	MATURITY 0-9	KERN.WT. GM/1000	KERNELS /HEAD	YIELD KG/HA
1. CHECK	--	448bc	74a	7.5ab	33.2ab	26ab	3879a
2. CYCOCEL	0.46	435c	71abc	7.8ab	32.2ab	27a	3815a
3. CYCOCEL	0.69	477abc	74a	8.0a	35.2a	23ab	3715a
4. CYCOCEL	1.15	447bc	73ab	7.3ab	33.8ab	28a	4163a
5. CYCOCEL	1.38	444bc	73ab	7.5ab	33.1ab	28a	3982a
6. TERPEL C	0.69	551ab	64d	6.5a	31.8ab	21ab	3746a
7. CERONE	0.15	511abc	64d	6.5a	31.6ab	23ab	3635a
8. CERONE	0.30	559a	65cd	6.5a	31.2b	20b	3472a
9. CCC/ CERONE	0.69/.08	495abc	67bcd	6.8ab	31.4ab	24ab	3661a
10. CCC/ CERONE	0.69/.15	500abc	68bcd	6.5a	32.1ab	22ab	3585a
11. CCC/ CERONE	0.69/.30	501abc	66cd	6.5a	32.3ab	22ab	3481a
C.V.		14	5	12	7	17	18

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 7 PLANT GROWTH REGULATORS ON NORWIN WINTER WHEAT
MINTO 1987

OBJECTIVE: To determine the effects of plant growth regulators on lodging and yield of Norwin winter wheat.

TREATMENT LIST

PGR	RATE (KG/HA)	ZADOKS GROWTH STAGE
1. UNTREATED CHECK	--	--
2. CYCOCEL	0.46	31
3. CYCOCEL	0.69	31
4. CYCOCEL	1.15	31
5. CYCOCEL	1.38	31
6. CERONE	0.15	45
7. CERONE	0.30	45
8. TERPEL C	0.69	45
9. TERPEL C	0.69	31

MATERIALS AND METHODS
Norwin winter wheat was seeded September 12, 1986 at a rate of 300 seeds/m2, a depth of 3 cm and a row spacing of 19 cm. 40 kg/ha of P205 and 24 kg/ha K20 were banded with the seed. 120 kg/ha of N as 34-0-0 was broadcast on April 15. The soil is a Ryerson clay loam with an O.M. of 5% and a pH of 7.8. The experimental design was a randomized complete block with 4 replicates and a plot size of 2 x 7.5 m. Broadleaf weeds were controlled by an application of Estaprop at a rate of 1.75 l/ha on May 11. Tilt was applied at a rate of .250 l/ha on June 4 to control foliar diseases. Individual treatments were applied using a compressed air bicycle sprayer at a pressure of 275 kPa. Treatments 2, 3, 4, 5 and 9 were applied May 14 at 20 C in a volume of 200 l/ha when the wheat was at ZGS 31. Treatments 6, 7 and 8 were applied May 27 at 23 C in a volume of 110 l/ha when the wheat was at ZGS 45. Heads/m2 were determined June 26 by sampling two 1/4 m2 areas in each plot. Plant heights were measured July 13 by sampling 10 locations in each plot. There was no lodging in this experiment. Maturity was rated July 21 using a scale of 0-9 where 9 is dead ripe, 5 is mid-dough and 0 is early milk stage. Plots were harvested July 26 with a K.E.M. plot combine and TKW determined from the grain sample. All measurements were analyzed at the 5% level using Duncan's M.R.T.

RESULTS AND CONCLUSIONS
Plots treated with Cerone or Terpel C at ZGS 45 were significantly shorter than the untreated check or plots treated with Cycocel or Terpel C at ZGS 31. Cerone at .30 kg/ha and Terpel C applied at ZGS 45 also delayed maturity of the crop. Other PGR treatments did not affect maturity. All PGR treatments, with the exception of the 1.15 kg rate of CCC increased the number of heads/m2 when compared to the untreated check. Except for the Terpel C applied at ZGS 45, the increases were not significantly different from the check. With the exception of Cycocel at the .69 and 1.38 kg/ha rate, all PGR's tested reduced the number of kernels/head compared to the untreated check. Differences were significant only for the .69 kg/ha rate of Terpel C applied at ZGS 45 which had 4 kernels/head less than the untreated check. There were no significant differences in TKW or yield, though the 0.69 kg/ha rate of Cycocel resulted in a yield enhancement of 135 kg/ha compared to the untreated check.

TABLE M12 PLANT GROWTH REGULATORS ON NORWIN WINTER WHEAT

TREATMENT	RATE KG/HA	HEADS /M2	PLANT HGT(CM)	MATURITY 0-9	KERN.WT. GM/1000	KERNELS /HEAD	YIELD KG/HA
1. CHECK	--	528B	48a	8.0a	32.3a	19a	3041a
2. CYCOCEL	0.46	580b	48a	7.8ab	32.0a	16ab	2852a
3. CYCOCEL	0.69	561b	49a	7.8ab	31.7a	19a	3278a
4. CYCOCEL	1.15	523b	47a	7.8ab	31.7a	18a	2865a
5. CYCOCEL	1.38	536b	49a	8.0a	32.8a	19a	3177a
6. CERONE	0.15	604ab	44b	7.8ab	31.3a	16ab	3039a
7. CERONE	0.30	607ab	42b	6.5c	32.4a	16ab	3025a
8. TERPEL C	0.69	671a	42B	6.8bc	32.0a	14b	2955a
9. TERPEL C	0.69	569b	47a	7.8ab	32.4a	17ab	3064a
C.V.		10	4	9	6	14	9

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

significantly higher TKW than any other variety. Norwin and Rose had significantly lower TKW's than any other varieties. Absolvent had the largest number of kernels/head and Norwin had the smallest number, though differences were not significant. There were significant differences in yield between varieties over all managements. The highest yielding variety, Bighorn was significantly higher yielding than Norwin, Thunderbird or Ram. The lowest yielding variety, Norwin was significantly lower than Bighorn or Norstar. All other varieties did not differ significantly. Redwin, Thunderbird and Rose had the highest protein levels over all 4 managements, with averages of over 14%.

MANAGEMENT
Over all varieties, the conventional + fungicide and conventional + N hastened maturity over the conventional and conventional + N + F managements. All managements decreased plant heights compared to the conventional management. Conventional + N, conventional + F and conventional + N + F all resulted in significantly lower heads/m2 than the untreated check. Thousand kernel weight was lowered by conventional + N and conventional + F though it was significant only with conventional + F. Conventional + N + F had virtually the same TKW as the conventional management. Increases in management over the conventional all resulted in increased kernels/head though it was significant only for conventional + F. All increases in management resulted in significant yield decreases with the greatest reduction with the conventional + N + F. Adding an additional 40 kg/ha N or fungicide or both reduced yields in all varieties except Thunderbird. All inputs tested resulted in significantly lower yields in Norwin. Bighorn had the highest ields in all management levels except conventional + F where Norstar was the highest yielding variety. Thunderbird was the lowest yielding variety under conventional management. Norwin was the lowest under conventional + N and conventional + F; Rose was the lowest under conventional + N + F. Adding extra N and fungicides increased the harvest index in 5 varieties and decreased it in 2, while it had no effect on Ram. Protein tended to increase as inputs increased, with the greatest increases where extra N was added. Higher protein levels at higher input levels were probably partly due to concurrent yield decreases from fungicide applications.

EXPERIMENT 8 CULTIVAR X MANAGEMENT ON WINTER WHEAT
MINTO 1987

OBJECTIVE: To determine the potential suitability of 8 winter wheat cultivars for Manitoba and their response to 4 management levels.

TREATMENT LIST

CULTIVAR	ORIGIN
1. NORSTAR	ALBERTA
2. REDWIN	MONTANA
3. NORWIN	MONTANA
4. BIGHORN	U.S.A.
5. THUNDERBIRD	AGR.PRO
6. RAM	U.S.A.
7. ROSE	S.DAK
8. ABSOLVENT	GERMANY

MANAGEMENT

I.	300 seeds/m2	80 kg/ha N
II.	300 seeds/m2	80 kg/ha N + 40 kg/ha N @ 31
III.	300 seeds/m2	80 kg/ha N + Tilt @ .125 kg @ 55
IV.	300 seeds/m2	80 kg/ha N + 40 kg/ha N @ 31 + Tilt @ .125 @ 55

MATERIALS AND METHODS
Eight winter wheat cultivars were seeded into standing barley stubble near Minto, Manitoba on August 30, 1986 at a rate of 300 seeds/m2 and a row spacing of 18 cm. Plot size was 2.2 x 7.5 m and each treatment was replicated 4 times in a split block design. 50 kg/ha P205 and 30 kg/ha K20 were banded with the seed. Nitrogen was applied at 80 kg/ha N on April 15 and an additional 40 kg/ha N was applied to management II and IV on May 15. All nitrogen was 34-0-0 broadcast. Weeds were controlled with Estaprop applied at 1.75 l/ha on May 11. Tilt was applied to management III and IV on June 4 at a rate .125 kg/ha at ZGS 50-65. Plant counts were done April 21. Disease levels were minimal so ratings were not done on this experiment. Plant heights and heads/m2 were measured just prior to harvest. Plots were harvested on July 27 with a K.E.M. plot combine. Samples were also taken on management I and IV for harvest index. Thousand kernel weights were determined from grain samples after harvest. Data was analyzed at the 5% level and treatment means compared using the appropriate L.S.D. value.

RESULTS AND CONCLUSIONS

VARIETY
There were no significant differences in plant populations between varieties and there did not appear to be any winterkill on any of the varieties due to the mild winter and adequate snow cover. Plant populations ranged from 65 to 90% of the 300 viable seeds/m2 planted the previous fall. There were no significant differences in maturity, though Ram tended to be a little later maturing than the other varieties. The differences in plant height were to be expected due to varietal differences. All plants were short in 1987, due to high temperatures and below normal precipitation in April, May and June. Absolvent had significantly fewer heads/m2 than all other varieties. Redwin and Ram were significantly higher than Absolvent but had a significantly lower number of heads/m2 than all other varieties except Thunderbird. There were significant differences in thousand kernel weight with Absolvent having a

TABLE M13 CULTIVAR X MANAGEMENT IN WINTER WHEAT

VARIETY	MGMT	PLANTS /M2	MATURITY 0-9	PLANT HGT CM	HEADS /M2	KERN.WT GM/1000	KERN /HEAD	YIELD KG/HA	HARV INDEX %
1 NORSTAR	I	212	7	78	658	34.6	20	4372	37
2 NORSTAR	II	212	8	70	545	32.5	21	3751	
3 NORSTAR	III	212	9	69	451	32.1	25	3550	
4 NORSTAR	IV	212	8	71	500	32.7	21	3371	39
5 REDWIN	I	261	8	64	605	33.3	18	3491	36
6 REDWIN	II	261	9	62	456	33.0	23	3436	
7 REDWIN	III	261	8	62	452	32.6	22	3250	
8 REDWIN	IV	261	8	63	505	34.0	19	3256	41
9 NORWIN	I	227	9	51	645	28.6	21	3874	38
10 NORWIN	II	227	9	42	533	27.4	18	3559	
11 NORWIN	III	227	9	47	521	28.9	20	2950	
12 NORWIN	IV	227	9	48	554	28.2	19	2924	41
13 BIGHORN	I	203	9	55	631	32.8	20	4045	44
14 BIGHORN	II	203	9	53	529	33.4	21	3779	
15 BIGHORN	III	203	9	53	557	33.1	19	3468	
16 BIGHORN	IV	203	9	52	503	34.0	21	3516	42
17 T-BIRD	I	224	8	54	599	31.5	16	2985	42
18 T-BIRD	II	224	9	54	498	30.4	20	3066	
19 T-BIRD	III	224	9	54	486	30.5	23	3366	
20 T-BIRD	IV	224	8	52	469	31.1	23	3331	45
21 NORSTAR	I	191	9	66	572	30.1	21	3510	42
22 NORSTAR	II	191	8	66	535	32.1	19	3154	
23 NORSTAR	III	191	9	70	538	32.3	22	3747	
24 NORSTAR	IV	191	8	67	556	32.5	17	3083	43
25 RAM	I	223	8	59	594	33.2	18	3585	43
26 RAM	II	223	9	54	427	30.8	25	3195	
27 RAM	III	223	8	55	508	32.6	20	3239	
28 RAM	IV	223	9	56	467	31.4	20	2962	43
29 ROSE	I	274	8	63	619	28.1	23	3975	39
30 ROSE	II	274	9	59	548	29.4	22	3599	
31 ROSE	III	274	9	59	586	26.8	21	3248	
32 ROSE	IV	274	8	59	607	27.8	16	2746	41
33 ABSOLV'T	I	205	9	62	450	37.9	22	3661	45
34 ABSOLV'T	II	205	9	61	418	36.9	22	3382	
35 ABSOLV'T	III	205	9	61	412	35.3	23	3360	
36 ABSOLV'T	IV	205	9	62	383	38.2	27	3406	44
37 NORSTAR	I	227	8	71	639	32.2	18	3790	43
38 NORSTAR	II	227	8	65	561	31.0	21	3653	
39 NORSTAR	III	227	9	66	512	31.4	24	3761	
40 NORSTAR	IV	227	8	67	570	34.4	17	3191	43
L.S.D. .05		48	1	7	91	2	5	815	7
C.V.		15	9	8	12	5	19	17	12

TABLE M14 MAIN EFFECTS

CULTIVAR	PLANTS /M2	MATURITY 0-9	PLANT HGT.CM	HEADS /M2	KERN.WT. GM/1000	KERNEL /HEAD	YIELD KG/HA	HARV. INDEX %
1.NORSTAR	212	8	72	539	32.9	22	3761	38
2.REDWIN	261	8	63	505	33.2	20	3358	38
3.NORWIN	227	7	47	563	28.3	19	3077	40
4.BIGHORN	203	9	53	555	33.3	20	3702	43
5.T'BIRD	224	9	54	513	30.9	21	3187	44
6.NORSTAR	191	8	67	550	31.7	19	3373	43
7.RAM	223	6	56	499	32.0	21	3245	43
8.ROSE	274	8	60	590	28.0	20	3392	40
9.ABSOLV'T	205	9	61	416	37.1	24	3452	45
10.NORSTAR	227	8	67	571	32.3	20	3599	43
L.S.D. .05	51	3	5	47	1.4	3	416	4
MANAGEMENT								
I	225	8	62	601	32.2	20	3729	41
II	225	8	59	505	31.7	21	3357	
III	225	8	59	502	31.6	22	3394	
IV	225	8	60	511	32.4	20	3179	42
L.S.D. .05		1	2	29	0.6	2	261	3

TABLE M15 YIELDS - CULTIVAR X MANAGEMENT

CULTIVAR	MANAGEMENT I	II	III	IV	$\bar{X}$
NORSTAR*	3890	3519	3692	3215	3578
REDWIN	3490	3435	3249	3255	3358
NORWIN	3874	2559	2949	2924	3077
BIGHORN	4045	3779	3468	3516	3702
THUNDERBIRD	2985	3066	3366	3331	3187
RAM	3584	3195	3239	2962	3245
ROSE	3975	3599	3248	2746	3392
ABSOLVENT	3661	3381	3360	3406	3452

L.S.D. .05 815
*MEAN OF 3 TREATMENTS

TABLE M16 PROTEIN - CULTIVAR X MANAGEMENT

CULTIVAR	MANAGEMENT				
	I	II	III	IV	$\bar{X}$
NORSTAR	10.8	12.4	13.5	12.0	12.2
REDWIN	13.2	14.3	14.2	14.9	14.2
NORWIN	11.2	12.9	12.2	12.6	12.2
BIGHORN	12.0	13.1	12.6	13.8	12.9
THUNDERBIRD	14.4	14.4	14.5	15.2	14.6
NORSTAR	12.1	14.1	14.4	14.2	13.8
RAM	12.5	12.8	13.3	13.2	13.0
ROSE	13.6	14.1	14.4	14.0	14.0
ABSOLVENT	12.2	13.6	12.7	13.5	13.0
NORSTAR	12.4	13.5	12.6	14.2	13.2
$\bar{X}$	12.4	13.5	13.4	13.8	13.3

TABLE M17 WINTER WHEAT PRODUCTION COSTS $/HA, MANITOBA 1987

INPUTS	MANAGEMENT			
	I	II	III	IV
LAND	49.40	49.40	49.40	49.40
INSURANCE	12.35	12.35	12.35	12.35
SEED & TMT	9.88	9.88	9.88	9.88
N 80,80/40kg/ha N	35.20	52.80	35.20	52.80
P 50 kg/ha P205	30.29	30.29	30.29	30.29
K 30 kg/ha K20	6.60	6.60	6.60	6.60
ESTAPROP	9.88	9.88	9.88	9.88
FUNGICIDE-TILT	-	-	39.52	39.52
-DITHANE	-	-	19.76*	19.76*
FUEL	22.23	23.47	23.47	24.71
REPAIRS	17.29	17.29	17.29	17.29
SUB TOTAL	193.12	211.96	233.88	252.72
			214.12*	232.96*
MACH DEPRECIATION	29.64	29.64	29.64	29.64
MACH INVESTMENT	23.71	23.71	23.71	23.71
LABOUR & MGMT	39.52	39.52	39.52	39.52
TOTAL	285.99	304.83	326.75	345.59
			306.99*	325.83*

TABLE M18 WINTER WHEAT GROSS $/HA, MINTO 1987

CULTIVAR	MANAGEMENT			
	I	II	III	IV
NORSTAR 1	293.03* 301.53**	265.09	278.12	242.19
REDWIN	262.90	258.76	246.25	245.20
NORWIN	291.83	192.77	222.15	220.26
BIGHORN	304.71	284.67	261.24	264.86
THUNDERBIRD	224.86	230.96	253.56	250.92
RAM	269.98	240.68	243.99	223.13
ROSE	299.44	271.11	244.67	206.86
ABSOLVENT	275.78	254.78	253.11	256.57

1 MEAN OF THREE TREATMENTS
* #1CWRW @ 75.33/TONNE
**NON-BOARD FEED @ 77.53/TONNE
(MULTIPLY #1CWRW GROSS X 1.029)

TABLE M19 WINTER WHEAT PROFIT $/HA*, MINTO 1987

CULTIVAR	MANAGEMENT			
	I	II	III	IV
NORSTAR	99.91	53.13	64.00	9.23
REDWIN	69.78	46.80	32.13	12.23
NORWIN	98.71	(19.19)	8.03	(12.72)
BIGHORN	111.58	72.71	47.12	31.90
THUNDERBIRD	31.74	19.00	39.44	17.96
RAM	76.86	28.72	29.87	(9.83)
ROSE	106.32	59.15	30.55	(26.10)
ABSOLVENT	82.66	42.73	38.99	23.61

* #1CWRW @ 75.33/TONNE
-FUNGICIDE IS DITHANE M45
-DOES NOT INCLUDE DEPRECIATION AND RETURN TO LABOUR OF 92.87

In 1987, winter wheat yields decreased as more inputs were used due to a spring drought. This trend, coupled with the increase in production costs resulted in lower returns for the management levels using the most inputs. Under management level I, only four cultivars, namely Norstar, Norwin, Bighorn and Rose were able to cover the costs of production.

EXPERIMENT 9 CROP DENSITY X FUNGICIDE - KATEPWA
MINTO 1987

OBJECTIVE: To determine the effects of crop density and fungicides on disease levels and subsequent yield of Katepwa wheat

TREATMENT LIST
FACTOR 1 SEEDING RATE
1. 300 SEEDS/M2
2. 500 SEEDS/M2
FACTOR 2 ROW SPACING
1. 11 CM
2. 15 CM
3. 23 CM
FACTOR 3 FUNGICIDES
1. UNTREATED CHECK

2. DITHANE M45	ZGS 50 AND 10 DAYS LATER
3. TILT	ZGS 50
4. TILT (2 APPLICATIONS)	ZGS 50 AND 20 DAYS LATER

MATERIALS AND METHODS
Katepwa wheat was seeded near Minto, Manitoba on April 29, 1987 at rates of 300 and 500 seeds/m2 in combination with row spacing of 11, 15 and 23 cm. 60 kg/ha P205 and 30 kg/ha K20 were banded prior to seeding. 80 kg/ha N was broadcast as ammonium nitrate on May 6 and a further 40 kg/ha was broadcast June 10. Weeds were controlled with applications of Hoegrass II at 3.75 l/ha on May 26 and Estaprop at 1.75 l/ha on June 9. Fungicides were applied using a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Initial treatments of Tilt and Dithane were applied June 22 at 25 C when wheat was at Zadoks 55 and there was a trace of tanspot/septoria on the lower leaves. The second application of Dithane was applied June 29 at 15 C when wheat was at Zadoks 65. The second application of Tilt (treatment 4 only) was applied July 13 at 15 C when wheat was at Zadoks 75. Rainfall 1 week after treatment was 15 mm, 8 mm and 30 mm respectively. Disease levels were assessed July 20 using a Horsfall & Barratt scale where 0 is disease free and 9 is greater than 50% leaf area infected on all leaves. Plots were harvested August 13 and yields adjusted to 14.5% moisture.

RESULTS AND CONCLUSIONS
ROW SPACING
Increasing the row spacing decreased the plants/m2 over both seeding rates. Over both seeding rates, which average 400 seeds/m2, the 11 cm row spacing resulted in 304 plants/m2 or 76% of planted viable seeds; the 15 cm row spacing resulted in 268 plants/m2 or 67% of planted viable seeds and the 23 cm row spacing resulted in 238 plants/m2 or 65% of planted viable seeds. The lower populations in the wider row spacings may be due to increased competitions between plants within the row. Increasing row spacing also tended to increase disease levels. Row spacing did not affect plant height or TKW. Heads/m2 decreased significantly as row spacing increased from 11 cm to 23 cm. The 15 cm row spacing resulted in the lowest number of kernels/head, significantly less than the 11 or 23 cm row spacing. The 11 cm row spacing resulted in significantly higher yields than 15 or 23 cm row spacing. Yields were over 700 and 600 kg/ha more than 15 or 23 cm row spacing respectively.

SEEDING RATE

An increase in seeding rate increased the plants/m2, though only 72% of the 300 seeds/m2 and 65% of the 500 plants/m2 resulted in plants. An increase in seeding rate did not affect plant height, nor did it have a significant effect on disease levels. Increasing the seeding rate resulted in a significant increase in heads/m2 and a significant decrease in both TKW and kernels/head. The 500 seeds/m2 rate yielded significantly less than the 300 seeds/m2 rate by about 200 kg/ha.

FUNGICIDES

All fungicide treatments reduced levels of both leaf rust and tanspot/septoria, with the best control achieved with the Dithane and double Tilt applications. Fungicides significantly reduced plant height. Dithane appeared to lower the number of heads/m2 compared to the other treatments. All fungicide treatments reduced yield significantly, with the greatest reduction occurring in Dithane treated plots. Yield reductions may be the result of heat stress suffered by the crop in May and June, both before and during time of fungicide application. This stress also hastened crop maturity and reduced the spread of disease and it's negative effects on crop yield. Fungicides did not affect thousand kernel weight.

TABLE M20 EFFECT OF CROP DENSITY AND FUNGICIDES ON KATEPWA WHEAT

TMT	SEED RATE	ROW SPG	FUNG	PLANT COUNTS	LF RUST	TS/ SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERN /HEAD	YIELD KG/HA
1	300	11	CHK	236	6	6	62	607	37.1	18	3903
2	300	11	DITH	236	2	4	53	518	37.4	16	3050
3	300	11	TILT	236	3	4	56	528	37.3	18	3486
4	300	11	2 TILT	236	2	4	54	529	36.3	18	3300
5	500	11	CHK	372	6	7	57	638	36.1	15	3476
6	500	11	DITH	372	2	4	51	558	35.4	16	3106
7	500	11	TILT	372	3	5	53	604	35.7	15	3183
8	500	11	2 TILT	372	3	4	54	591	35.4	15	3118
9	300	15	CHK	214	6	7	56	504	36.3	17	2957
10	300	15	DITH	214	2	4	52	462	37.0	15	2483
11	300	15	TILT	214	4	5	53	528	35.9	14	2646
12	300	15	2 TILT	214	2	4	54	529	37.1	14	2639
13	500	15	CHK	321	6	7	55	565	35.0	14	2701
14	500	15	DITH	321	2	4	51	512	34.7	12	2153
15	500	15	TILT	321	3	5	55	566	35.5	13	2530
16	500	15	2 TILT	321	2	4	51	583	35.2	12	2515
17	300	23	CHK	201	6	7	57	451	36.6	19	3047
18	300	23	DITH	201	2	4	52	423	35.6	17	2503
19	300	23	TILT	201	4	5	52	466	36.2	16	2666
20	300	23	2 TILT	201	2	4	51	479	36.3	17	2799
21	500	23	CHK	275	6	7	58	548	35.5	15	2895
22	500	23	DITH	275	2	4	51	475	34.4	14	2228
23	500	23	TILT	275	4	5	53	507	35.4	16	2628
24	500	23	2 TILT	275	2	4	54	481	35.3	14	2415
L.S.D. .05				112		1	7	76	1.9	3	545
C.V.				29		11	9	10	4	13	14

TABLE M21 MAIN EFFECTS

ROW SPACING	PLANT COUNTS	LEAF RUST	TS/ SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT. GM/1000	KERNEL /HEAD	YIELD KG/HA
11 CM	304	3	5	55	572	36.3	16	3328
15 CM	268	3	5	53	531	35.8	14	2578
23 CM	238	3	5	54	479	35.7	17	2648
L.S.D. .05	122	-	-	2	50	1	2	201
SEEDING RATE								
300 SEEDS/M2	217	3	5	54	502	36.6	16	2956
500 SEEDS/M2	323	3	5	54	552	35.3	14	2746
L.S.D. .05	67	-	-	1	24	1	2	133
FUNGICIDE								
CHK	270	6	7	58	552	36.1	16	3163
DITH	270	2	4	52	491	35.7	15	2587
TILT	270	3	5	54	533	36.0	15	2857
2 TILT	270	2	4	53	532	35.9	15	2798
L.S.D. .05	1	-	-	3	28	1	1	233

EXPERIMENT 10 CROP DENSITY X FUNGICIDE - HY320
MINTO 1987

OBJECTIVE: To determine the effects of crop density and fungicides on disease levels and subsequent yield of HY320 wheat.

TREATMENT LIST
FACTOR 1 SEEDING RATE
1. 300 SEEDS/M2
2. 500 SEEDS/M2
FACTOR 2 ROW SPACING
1. 11 CM
2. 15 CM
3. 23 CM
FACTOR 3 FUNGICIDES
1. UNTREATED CHECK

2. DITHANE M45 -	ZGS 50 AND 10 DAYS LATER
3. TILT	ZGS 50
4. TILT (2 APPLICATIONS)	ZGS 50 AND 20 DAYS LATER

MATERIALS AND METHODS
HY320 wheat was seeded near Minto, Manitoba on April 29, 1987 at rates of 300 and 500 seeds/m2 in combination with row spacings of 11, 15 and 23 cm. 60 kg/ha P205 and 30 kg/ha K20 were banded prior to seeding. 80 kg/ha N was broadcast as ammonium nitrate on May 6 and a further 40 kg/ha was broadcast June 10. Weeds were controlled with applications of Hoegrass II at 3.75 l/ha on May 26 and Estaprop at 1.75 l/ha on June 9. Fungicides were applied using a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. The initial treatments of Tilt and Dithane were applied June 22 at 25 C when wheat was at Zadoks 55 and there was a trace of tanspot/septoria on the lower leaves. The second application of Dithane was applied June 29 at 15 C when wheat was at Zadoks 65. The second application of Tilt (treatment 4 only) was applied July 13 at 15 C when wheat was at Zadoks 75. Rainfall one week after treatment was 15 mm, 8mm and 30 mm respectively. Disease levels were assessed July 20 using a Horsfall and Barratt scale where 0 is disease free and 9 is greater than 50% leaf area infected on all leaves. Plots were harvested August 13 and yields adjusted to 14.5% moisture.

RESULTS AND CONCLUSIONS

ROW SPACING
Row spacing had a marked effect on plant population as shown by the plants/m2. Over both seeding rates, which average 400 seeds/m2, the 11 cm row spacing resulted in 311 plants/m2 or 78% of viable seeds planted; the 15 cm row spacing resulted in 279 plants/m2 or 70% of viable seeds planted and the 23 cm row spacing resulted in 260 plants/m2 or 65% of viable seeds planted. The lower populations in the wider row spacing may be due to increased competition between plants within the rows. Increasing row spacing had no significant effect on plant diseases. Row spacing effects on heads/m2 and TKW were not significant, though the narrower spacings tended toward more heads/m2 and higher TKW's. The 11 cm row spacing also resulted in significantly more kernels/head than the 15 or 23 cm row spacing. The 11 cm row spacing resulted in significantly higher yields than the 15 or 23 cm row spacing. There were no differences in plant height.

SEEDING RATE

As expected, an increase in seeding rate increased the plants/m2, though only 79% of the 300 seeds/m2 and 66% of the 500 seeds/m2 resulted in plants. The increase in seeding rate also corresponded to a slight increase in disease levels of rust and tanspot/septoria. The increased seeding rates also resulted in significantly shorter plants but also significantly more heads/m2. The 300 seeds/m2 rate had significantly more kernels/head and a significantly higher TKW resulting in a yield increase of about 100 kg/ha over the 500 seeds/m2 seeding rate.

FUNGICIDES

All fungicides were effective in reducing disease levels of both tanspot/septoria and leaf rust though Tilt appeared more effective than Dithane in controlling leaf rust. Plots treated with Tilt had significantly taller plants than plots treated with Dithane or the untreated check. Dithane tended to reduce heads/m2, but not significantly when compared to the untreated check. Increases in yield due to fungicide applications were minimal due to the early maturity of the crop and low disease levels, both a result of hot dry weather in May and June. Yields tended to be reduced by applications of Dithane and increased by the application of Tilt but when compared to the untreated check, differences were not significant. Fungicides increased thousand kernel weight in all cases. Only Tilt treatments had a significantly greater TKW than the untreated check.

TABLE M22 MAIN EFFECTS

ROW SPACING	PLANT COUNTS	LEAF RUST	TS/ SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT. GM/1000	KERNELS /HEAD	YIELD KG/HA
11 CM	311	4	4	54	348	50.0	26	4413
15 CM	279	4	5	53	337	49.7	21	3472
23 CM	260	4	5	52	296	48.7	24	3338
L.S.D. .05	56	-	-	4	47	1.4	2	545
SEEDING RATE								
300 SEEDS/M2	236	4	5	54	309	50.5	25	3806
500 SEEDS/M2	331	4	5	52	344	48.4	22	3675
L.S.D. .05	38	-	-	1	23	0.9	2	235
FUNGICIDE								
CHECK	283	6	6	52	332	48.0	24	3698
DITHANE M45	283	4	4	50	307	49.0	22	3244
TILT	283	4	4	56	334	50.4	25	4170
2 TILT	283	3	4	53	335	50.5	24	3852
L.S.D. .05	1	-	-	4	27	1.3	3	519

TABLE M23 EFFECT OF CROP DENSITY AND FUNGICIDES ON HY320 WHEAT

TMT	SEED RATE	ROW SPG	FUNG	PLANT COUNTS	LEAF RUST	TS/ SEPT	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERN /HEAD	YIELD KG/HA
1	300	11	CHK	278	6	5	53	329	48.3	27	4212
2	300	11	DITH	278	3	4	54	344	50.9	25	4323
3	300	11	TILT	278	4	4	54	359	51.2	26	4763
4	300	11	2TILT	278	3	4	54	319	51.6	27	4389
5	500	11	CHK	344	6	6	55	366	47.5	26	4566
6	500	11	DITH	344	3	4	51	312	49.9	26	4040
7	500	11	TILT	344	3	4	59	364	50.0	28	4958
8	500	11	2TILT	344	3	5	50	389	50.9	21	4056
9	300	15	CHK	224	6	6	54	354	49.5	22	3699
10	300	15	DITH	224	3	5	52	294	53.2	19	2806
11	300	15	TILT	224	4	4	57	304	51.7	26	4023
12	300	15	2TILT	224	3	4	57	299	51.9	27	3978
13	500	15	CHK	334	6	6	48	362	47.0	18	3073
14	500	15	DITH	334	3	5	47	333	46.3	19	2871
15	500	15	TILT	334	3	4	55	384	49.8	19	3538
16	500	15	2TILT	334	3	4	52	363	48.3	22	3786
17	300	23	CHK	206	6	6	51	262	48.7	26	3330
18	300	23	DITH	206	3	5	49	261	47.7	23	2784
19	300	23	TILT	206	5	4	56	289	50.6	28	4072
20	300	23	2TILT	206	3	5	54	299	51.4	22	3299
21	500	23	CHK	314	6	6	49	317	47.3	22	3308
22	500	23	DITH	314	3	5	46	296	46.0	20	2642
23	500	23	TILT	314	5	5	56	304	49.0	25	3665
24	500	23	2TILT	314	3	4	53	340	48.7	23	3603
L.S.D. .05				58	1	1	10	73	3.1	8	1213
C.V.				14	12	13	13	16	4	23	23

EXPERIMENT 11 NITROGEN FERTILITY ON KATEPWA SPRING WHEAT
MINTO 1987

OBJECTIVE: To determine the effect of nitrogen rates and timing on Katepwa wheat.

TREATMENT LIST

1.	0 kg/ha N	
2.	40 kg/ha N	ZGS 00
3.	80 kg/ha N	ZGS 00
4.	120 kg/ha N	ZGS 00
5.	160 kg/ha N	ZGS 00
6.	200 kg/ha N	ZGS 00
7.	240 kg/ha N	ZGS 00
8.	80/40 kg/ha N	ZGS 00/31
9.	80/40/40 kg/ha N	ZGS 00/31/50
10.	80/20*/20*/20*/20* kg/ha N	ZGS 00/31/39/49/60

*Liquid N (28-0-0); all other applications are granular ammonium nitrate (34-0-0)

MATERIALS AND METHODS
Katepwa spring wheat was seeded near Minto, Manitoba on May 4 at a rate of 300 seeds/m2 and a row spacing of 15 cm. 60 kg/ha P205 and 30 kg/ha K20 were banded just prior to seeding. Plot size was 2 x 7.5 m and each treatment was replicated six times in a randomized complete block design. Weeds were controlled with applications of Hoegrass II at 1.09 kg/ha May 26 and Estaprop at 1.02 kg/ha on June 9. All granular nitrogen was broadcast. Liquid N was applied with a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Treatments were applied on May 6, June 10, Jun 16, June 19, June 22 and June 29 corresponding to ZGS 00, 31, 39, 49, 50 and 60. Rainfall 1 week after treatment was 0mm, 8mm, 22mm, 22mm, 15mm and 8mm respectively. The maturity rating was done August 6 using a scale of 0-9 where 0 is early milk, 5 is yellow kernel and 9 is dead ripe. Plant heights and heads/m2 were measured just prior to harvest. Plots were harvested August 13 with a K.E.M. plot combine. Yields were adjusted to 14.5% moisture and thousand kernel weights determined from each sample. Data was analyzed at the .05 level and means compared using Duncan's M.R.T. Soil samples were taken to a depth of 120 cm on May 7 and August 17 to determine Water Use Efficiency (WUE).

RESULTS AND DISCUSSION
The nitrogen response of Katepwa was moderate in 1987, due to hot dry weather in May and June which limited plant growth. Increasing nitrogen delayed maturity and though rates of 80-160 kg/ha were significantly later than the untreated check, there was no difference between these rates and 40 kg/ha. Split applications were not significantly different from single broadcast applications. Increasing N up to about 160 kg/ha also increased plant heights. Split applications resulted in shorter plants but differences were not significant. As nitrogen rates increased from 0 to 160 kg/ha, heads/m2 increased steadily and then dropped off at rates of 200 and 240 kg/ha. Split applications resulted in a consistently lower number of heads/m2 than single applications. Effects of nitrogen on kernels/head were minimal. 240 kg/ha N resulted in significantly more kernels/head than the untreated check, but all other rates did not differ significantly from these two. Thousand kernel

weights (TKW) tended to increase as applied nitrogen increased to 240 kg/ha. Split applications were generally lower than single applications but differences were not significant. Grain yields increased steadily as nitrogen increased, up to a maximum yield of 4238 kg/ha at 120 kg N/ha. Higher rates resulted in slightly lower yields, though they were not significantly different from the maximum. Split applications were lower yielding than single applications of N, but differences were not significant. Water Use Efficiency (WUE) followed the same general trend as yields, with an increase in WUE up to 120 kg N/ha. The 80/40 split result in a decrease in WUE, while split applications of 160 kg N/ha resulted in slight increases in WUE.As applied N increased, protein levels increased to a maximum of 15.6% at 200 kg/ha N. All split applications resulted in slightly higher protein and lower yields than corresponding single applications.

TABLE M24 WATER USE EFFICIENCY*

TRMT	YIELD**	SOIL WATER AT HARVEST	WATER USED	WUE
1.	3175	20.72	30.30	156
2.	3847	20.38	30.64	186
3.	3916	21.56	29.46	201
4.	4442	22.92	28.10	245
5.	4333	20.26	30.76	209
8.	4068	18.01	33.01	177
9.	4330	22.13	28.89	229
10.	4169	21.26	29.76	211

*Water Used = Precip. in growing season +
(soil water at seeding - soil water at harvest)
= 19.2 cm + (31.82 cm - cm)
WUE = Yield/(water used - 10 cm)
**Mean Yield of Reps A & C

TABLE M25 NITROGEN FERTILITY ON KATEPWA SPRING WHEAT

TREATMENT KG/HA N	MATURITY 0-9	PLANT HGT.CM.	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA	% PROTEIN
1. 0	9.0a	69c	441d	36.0d	19b	2943d	11.1
2. 40	8.5ab	73abc	471cd	37.4bcd	20ab	3536c	12.8
3. 80	8.0bcd	72bc	508bc	37.1cd	20ab	3708bc	13.1
4. 120	8.0bcd	78ab	550ab	38.8ab	21ab	4328a	14.5
5. 160	8.0bcd	79a	570a	38.6abc	21ab	4327a	14.3
6. 200	7.5cd	75abc	507bc	38.1abc	22ab	4272a	15.6
7. 240	7.3d	76ab	485cd	39.5a	23a	4326a	14.8
8. 80/40	8.2bc	74abc	495bcd	38.1abc	22ab	4076ab	14.7
9. 80/40/40	7.8bcd	76ab	516abc	38.3abc	22ab	4137ab	14.9
10. 80/20/20/20	7.8bcd	75abc	524abc	38.1abc	22ab	4026ab	15.1
C.V.	7	7	9	3	11	10	

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

TABLE M26 PLANT TISSUE ANALYSIS

TREATMENT KG/HA N	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn
1 0	3.6H	0.33S	3.1H	0.26S	0.30S	0.24S	6.1S	180S	40S	23S
2 40	4.2VH	0.33S	3.3H	0.29S	0.28S	0.28S	6.5S	120S	48S	25S
3 80	4.5VH	0.32S	3.3H	0.35S	0.31S	0.30S	6.5S	120S	56S	24S
4 120	4.6VH	0.33S	3.3H	0.32S	0.33S	0.30S	6.7S	130S	50S	25S
5 160	4.6VH	0.33S	3.3H	0.27S	0.33S	0.30S	6.9S	120S	48S	26S
6 200	4.9VH	0.33S	3.4H	0.30S	0.32S	0.27S	6.1S	120S	48S	25S
7 240	4.8VH	0.34S	3.4H	0.30S	0.33S	0.29S	7.7S	120S	54S	26S
8 80/40	4.5VH	0.32S	3.2H	0.29S	0.33S	0.30S	8.5S	120S	55S	24S
9 80/40/40	4.5VH	0.34S	3.4H	0.34S	0.31S	0.28S	8.2S	140S	54S	27S
10 80/20/20/20/20	4.9VH	0.34S	3.0H	0.34S	0.35S	0.29S	7.1S	160S	52S	29S

L=LOW
M=MARGINAL
S=SUFFICIENT
H=HIGH
VH=VERY HIGH

EXPERIMENT 12 NITROGEN FERTILITY ON HY320 SPRING WHEAT -- MINTO 1987

OBJECTIVE: To determine the nitrogen response curve of HY320 wheat

TREATMENT LIST

1. 0 kg/ha N	ZGS 00
2. 40 kg/ha N	ZGS 00
3. 80 kg/ha N	ZGS 00
4. 120 kg/ha N	ZGS 00
5. 160 kg/ha N	ZGS 00
6. 200 kg/ha N	ZGS 00
7. 240 kg/ha N	ZGS 00
8. 80/40 kg/ha N	ZGS 00/31
9. 80/40/40 kg/ha N	ZGS 00/31/50
10. 80/20*/20*/20*/20* kg/ha N	ZGS 00/31/39/49/60

* Liquid N (28-0-0); all other applications are granular ammonium nitrate (34-0-0)

MATERIALS AND METHODS

HY320 spring wheat was seeded near Minto, Manitoba on May 4, 1987 at a rate of 300 seeds/m2 and a row spacing of 15 cm. 60 kg/ha P205 and 30 kg/ha K20 were banded just prior to seeding. Plot size was 2 x 7.5 m and each treatment was replicated six times in a randomized complete block design. Weeds were controlled with applications of Hoegrass II at 1.09 kg/ha May 26 and Estaprop at 1.02 kg/ha on June 9. All granular nitrogen was broadcast. Liquid N was applied with a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Treatments were applied on May 6, June 10, June 16, June 19, June 22 and June 29 corresponding to ZGS 00, 31, 39, 49, 50 and 60. Rainfall 1 week after treatment was 0mm, 8mm, 22mm, 15mm and 8mm respectively. The maturity rating was done August 6 using a scale of 0-9 where 0 is early milk, 5 is yellow kernel and 9 is dead ripe. Plant heights and heads/m2 were measured just prior to harvest. Plots were harvested August 13 with a K.E.M. plot combine. Yields were adjusted to 14.5% moisture and thousand kernel weights determined from each sample. Data was analyzed at .05 level and means compared using Duncan's M.R.T. Soil samples were taken to a depth of 120 cm on May 7 and August 21 to determine Water Use Efficiency (WUE).

RESULTS AND DISCUSSION

Nitrogen response on HY320 wheat in 1987 was lower than expected, due to below normal precipitation and above normal temperatures in May and June. Increasing applied N tended to delay maturity. Split applications were not different from single applications. The shortest plants resulted from 80/40/40, being significantly shorter than 40, 160, 240, 80/40 or spoon feed (treatment 10) though not significantly shorter from the other treatments. 240 kg/ha N and the 80/40 split resulted in the highest yields, significantly greater than the untreated check or 40 kg/ha. All other treatments were significantly higher than the untreated check but did not differ from 240 and 80/40 kg/ha. All treatments increased yields significantly except for 40 kg/ha which had a non significant increase of 750 kg/ha. There were no significant differences in TKW. The plots receiving 120 or 240 kg/ha N had significantly more kernels/head than the untreated check or the 40 kg/ha treatment. All other treatments were intermediate. Water Use Efficiency (WUE) increased as applied N increased. Split applications reduced WUE, with the liquid N split resulting in the greatest reduction. Protein levels increased as single application rates increased to a maximum protein of 14.6% at 200 kg/ha N. Split applications tended to result in higher protein levels than single applications, with the greatest increase occuring with the 80/40/40 split application.

TABLE M27 WATER USE EFFICIENCY*

TRMT	YIELD**	SOIL WATER AT HARVEST	WATER USED	WUE
1.	2857	29.10	30.42	140
2.	3685	31.47	28.05	204
3.	4076	28.22	31.30	191
4.	4637	32.40	27.12	271
5.	5120	30.94	28.58	276
8.	4913	27.61	31.91	224
9.	4990	30.02	29.50	256
10.	4661	26.58	32.94	203

*Water Used = Precipitation in growing season + (soil water at seeding - soil water at harvest)
= 29.5 cm + (30.02 cm - cm)
WUE = Yield/(Water used - 10 cm)
**Mean Yield of Reps A & B

TABLE M28 NITROGEN FERTILITY ON HY320 WHEAT

TREATMENT KG/HA N	MATURITY 0-9	PLANT HGT.CM	HEADS /M2	KERN.WT GM/1000	KERNELS /HEAD	YIELD KG/HA	% PROTEIN
1. 0	7.0a	58ab	250b	48.1a	23c	2728c	11.2
2. 40	6.5ab	62a	320a	47.3a	23c	3487bc	12.7
3. 80	6.0bc	60ab	302ab	48.0a	25abc	3662ab	13.1
4. 120	5.5bcd	61ab	295ab	49.1a	28ab	3973ab	13.3
5. 160	4.8d	63a	333a	48.4a	27abc	4351ab	13.5
6. 200	5.3cd	61ab	328a	49.0a	23bc	3796ab	14.6
7. 240	5.5bcd	63a	328a	47.8a	29a	4532a	14.4
8. 80/40	5.5bcd	63a	353a	47.8a	26abc	4412a	13.5
9. 80/40/40	5.3cd	54b	331a	48.8a	24bc	3921ab	14.8
10. 80/20/20/20/20	5.8bcd	62a	352a	47.4a	26abc	4257ab	13.6
C.V.	11	8	11	3	11	14	

Means in the same column followed by the same letter do not differ at the 5% level according to Duncan's Multiple Range Test.

TABLE M29 PLANT TISSUE ANALYSIS

TREATMENT KG/HA N	N	P	K	S	Ca	Mg	Cu	Fe	Mn	Zn
1. 0	4.3VH	0.35S	2.7S	0.36S	0.22S	0.27S	8.5S	120S	36S	34S
2. 40	4.5VH	0.36S	2.7S	0.39S	0.23S	0.27S	8.9S	110S	38S	33S
3. 80	4.6VH	0.35S	2.8S	0.47H	0.25S	0.29S	8.3S	110S	41S	34S
4. 120	4.9VH	0.36S	2.8S	0.43H	0.24S	0.32S	7.6S	120S	47S	35S
5. 160	4.8VH	0.35S	2.9S	0.45H	0.27S	0.30S	7.5S	120S	43S	32S
6. 200	5.0VH	0.35S	2.8S	0.42H	0.27S	0.30S	7.3S	110S	46S	30S
7. 240	4.9VH	0.37S	2.9S	0.44H	0.32S	0.38S	8.8S	130S	46S	35S
8. 80/40	4.8VH	0.35S	2.7S	0.42H	0.31S	0.28S	7.4S	130S	42S	33S
9. 80/40/40	4.7VH	0.36S	2.8S	0.39H	0.34S	0.29S	8.0S	110S	41S	35S
10. 80/20/20 /20/20	5.1VH	0.37S	2.6S	0.47H	0.29S	0.27S	7.8S	150S	39S	32S

L=LOW
M=MARGINAL
S=SUFFICIENT
H=HIGH
VH=VERY HIGH

EXPERIMENT 13 SPRING WHEAT MICRONUTRIENT TRIAL
MINTO 1987

OBJECTIVE: To determine the effects of P, K, Cu, Mg and Zn on the growth and yield of Katepwa spring wheat.

TREATMENT LIST

RATES OF NUTRIENTS IN KG/HA

	N	P	K	Cu	Mg	Zn	KPO4
1.	120	60	30	-	-	-	-
2.	120	-	30	-	-	-	-
3.	120	60	-	-	-	-	-
4.	120	60	30	-	-	.075	-
5.	120	60	30	-	.05	-	-
6.	120	60	30	.18	-	-	-
7.	120	60	30	-	-	-	4.0
8.	120	40-	20	-	-	-	-
9.	120	80	60	-	-	-	-

MATERIALS AND METHODS
Katepwa wheat was seeded near Minto, Manitoba on May 14, 1987 at a rate of 300 seeds/m2 and a row spacing of 18 cm. All P205 and K20 was banded with the seed. 75 kg/ha N as ammonium nitrate was also banded between rows at the time of seeding. An additional 40 kg/ha of N as ammonium nitrate was broadcast June 23. Individual treatments (4, 5, 6, 7) were applied with a compressed air bicycle sprayer delivering a volume of 110 l/ha at a pressure of 275 kPa. Treatments 4, 5 and 6 were applied June 18 at ZGS 31 when the temperature was 25 C. Treatment 7 was applied July 7 at ZGS 61 when the temperature was 18 C. Weeds were controlled with Hoegrass II applied at 1.09 kg/ha May 26 and with Estaprop applied at 1.02 kg/ha June 9. Plant counts were done June 1. Heads/m2 and plant heights were determined just prior to harvest. Plots were harvested August 22 with a K.E.M. combine. Yields were adjusted to 14.5% moisture and thousand kernel weights determined from grain samples. Data was analyzed at the .05 level and means compared using Duncan's M.R.T.

RESULTS AND CONCLUSIONS
Levels of P and K at planting had no effect on crop emergence and plant population. Plots where no P was applied or where P was applied in combination with Zn or Mg tended to be shorter than where P was applied alone. Level of P had no effect on plant height. Treatments applied had no significant effect on either heads/m2 or kernels/head, though the KP04 treatment had 3-5 more kernels/head than the other treatments. The highest TKW resulted from the KP04 treatment. Micronutrients Zn, Mg or Cu did not affect TKW in a positive manner. The highest yield was obtained by addition of 80/60 P/K though this was not significantly higher than the 40/20 P/K, P alone, P,K and Zn, or P, K + KP04. The lowest yield as a result of K alone was about 400 kg/ha below the top yield but is significantly different only from the 80/60 rate of P/K and P + K + KP04, indicating a slight phosphate response.

TABLE M30 SPRING WHEAT MICRONUTRIENT TRIAL

TREATMENT/RATE(KG/HA) N	P	K		PLANTS /M2	PLANT HGT.CM	HEADS /M2	KERN.WT GM/1000	KERNEL /HEAD	YIELD KG/HA
1. 120	60	30		258a	72abc	409a	35.6b	20a	2891bc
2. 120	-	30		271a	70c	409a	34.7b	19a	2745c
3. 120	60	-		255a	74a	421a	36.8ab	20a	3022abc
4. 120	60	30	+.075 Zn	265a	71bc	475a	34.6b	18a	3002abc
5. 120	60	30	+.05 Mg	265a	71bc	403a	35.3b	21a	2853bc
6. 120	60	30	+.18 Cu	288a	73ab	451a	35.5b	18a	2873bc
7. 120	60	30	+4.0 KP04	260a	72abc	401a	38.0a	23a	3096ab
8. 120	40	20		255a	74a	445a	37.0ab	18a	2999abc
9. 120	80	60		274a	74a	412a	36.8ab	21a	3211a
C.V.				9	2	13	4	19	6

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 14 PLANT GROWTH REGULATORS ON OSLO WHEAT
MINTO 1987

OBJECTIVE: To determine the effects of plant growth regulators on lodging control and yield enhancement of Oslo wheat.

TREATMENT LIST

PGR	RATE (KG/HA)	ZADOKS GROWTH STAGE
1. UNTREATED CHECK	--	--
2. CYCOCEL	0.46	31
3. CYCOCEL	0.69	31
4. CYCOCEL	1.15	31
5. CERONE	0.08	39
6. CERONE	0.15	39
7. CERONE	0.30	39
8. TERPEL C	0.46	32
9. TERPEL C	0.46	39
10. TERPEL C	0.69	32
11. TERPEL C	0.69	39
12. CYCOCEL/CERONE	0.69/0.15	31/39

MATERIALS AND METHODS
Oslo wheat was seeded May 4, 1987 at a rate of 300 seeds/m2, a depth of 4 cm and a row spacing of 15 cm. 60 kg/ha of P205 and 30 kg/ha K20 were banded just prior to seeding. 120 kg/ha N as 34-0-0 was broadcast on May 6. The soil is a Ryerson clay loam with an O.M. of 5% and a pH of 7.8. The experimental design was a randomized complete block with 4 replicates and a plot size of 2 x 7.5m. Weeds were controlled with applications of Hoegrass II at 3.50 l/ha on May 26 and Estaprop at 1.75 l/ha on June 9. Tilt was applied at .250 l/ha on June 22 to control foliar diseases. PGR treatments were applied using a compressed air bicycle sprayer operating at a pressure of 275 kPa. Treatments 2, 3, 4 and 12a were applied June 8 at 18 C in 200 l/ha when wheat was at ZGS 31. Treatments 8 and 10 were applied June 11 at 22 C in 100 l/ha when wheat was ZGS 32. Treatments 5, 6, 7, 9, 11 and 12b were applied June 16 at 25 C in 100 l/ha when wheat was at ZGS 45. Plant heights were measured at 10 locations in each plot on August 13. There was no lodging in this experiment. Heads/m2 were determined by sampling two 1/4 m2 areas in each plot on July 21. Plots were harvested August 20 with a K.E.M. plot combine. TKW's were determined from grain samples. All data was analyzed at the 5% level using Duncan's MRT.

RESULTS AND CONCLUSIONS
None of the PGR's tested reduced plant height significantly when compared to the untreated check. There were no significant differences in heads/m2 when compared to the untreated check, though the .69 kg rate of Cycocel had significantly more heads/m2 than did the .08 rate of Cerone. Similarly, TKW was not affected by the plant growth regulators nor were the number of kernels/head. Differences in yield were not significant and with the exception of the .08 kg/ha rate of Cerone, all treatments resulted in yield increases. The largest increases of about 300 kg/ha resulted from applications of Cerone at .15 and .3 kg/ha rates, Terpel C at the .46 kg rate applied at ZGS 32 and the split application of Cycocel and Cerone.

TABLE M31 PLANT GROWTH REGULATORS ON OSLO WHEAT

TREATMENT	RATE KG/HA	GROWTH STAGE	HEADS /M2	PLANT HGT.(CM)	KERNELS GM/1000	KERNELS /HEAD	YIELD KG/HA
1. CHECK	--	--	355ab	49a	44.4a	17a	2591a
2. CYCOCEL	0.46	31	391ab	48a	46.7a	17a	2785a
3. CYCOCEL	0.69	31	425a	46a	47.5a	14a	2710a
4. CYCOCEL	1.15	31	363ab	47a	46.2a	17a	2772a
5. CERONE	0.08	39	336b	46a	46.5a	15a	2346a
6. CERONE	0.15	39	371ab	49a	45.7a	17a	2889a
7. CERONE	0.30	39	397ab	51a	43.2a	17a	2894a
8. TERPEL C	0.46	32	404ab	49a	45.3a	16a	2878a
9. TERPEL C	0.46	39	380ab	46a	45.3a	16a	2622a
10. TERPEL C	0.69	32	417ab	46a	42.6a	16a	2797a
11. TERPEL C	0.69	39	396ab	45a	44.5a	16a	2813a
12. CYC/ CERONE	0.69/0.15	31/39	398ab	48a	46.3a	16a	2918a
C.V.			12	8	8	18	17

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 15 PLANT GROWTH REGULATORS ON KATEPWA WHEAT
MINTO 1987

OBJECTIVE: To determine the effects of plant growth regulators on lodging control and yield enhancement of Katepwa wheat.

TREATMENT LIST

PGR	RATE (KG/HA)	ZADOKS GROWTH STAGE
1. UNTREATED CHECK	--	--
2. CYCOCEL	0.46	31
3. CYCOCEL	0.69	31
4. CYCOCEL	1.15	31
5. CERONE	0.08	39
6. CERONE	0.15	39
7. CERONE	0.30	39
8. TERPEL C	0.46	32
9. TERPEL C	0.46	39
10. TERPEL C	0.69	32
11. TERPEL C	0.69	39
12. CYCOCEL/CERONE	0.69/0.15	31/39

MATERIALS AND METHODS

Katepwa wheat was seeded May 4, 1987 at a rate of 300 seeds/m2, a depth of 4 cm and a row spacing of 15 cm. 60 kg/ha of P205 and 30 kg/ha K20 were banded just prior to seeding. 120 kg/ha as 34-0-0 was broadcast on May 6. The soil is a Ryerson clay loam with an o.m. content of 5% and a pH of 7.8. The experimental design was a randomized complete block with 4 replicates and a plot size of 2 x 7.5m. Weeds were controlled with applications of Hoegrass II at 3.50 l/ha on May 26 and Estaprop at 1.75 l/ha on June 9. Tilt was applied at .250 l/ha on June 22 to control foliar diseases. PGR treatments were applied using a compressed air bicycle sprayer operating at a pressure of 275 kPa. Treatments 2, 3, 4 and 12a were applied June 8 at 18 C in 200 l/ha when wheat was at ZGS 31. Treatments 8 and 10 were applied June 11 at 22 C in 100 l/ha when wheat was at ZGS 32. Treatments 5, 6, 7, 9, 11 and 12b were applied June 16 at 25 C in 100 l/ha when wheat was at ZGS 39. Plant heights were measured at 10 locations in each plot on August 13. There was no lodging in this experiment. Heads/m2 were determine by sampling two 1/4 m2 areas in each plot July 21. Plots were harvested August 20 with a K.E.M. plot combine. TKW's were determined from grain samples. All data was analyzed at the 5% level using Duncan's MRT.

RESULTS AND CONCLUSIONS

Plant growth regulators did not have a significant effect on plant heights in Katepwa. The number of heads/m2 did not differ from the untreated check, however plots treated with Terpel C @ .69 kg/ha at ZGS 32 had significantly more heads/m2 than any of the plots receiving a single application of Cycocel, or an application of Cerone at the .08 kg rate. Treatments had no significant effect on the number of kernels/head. Applications of Terpel C @ .46 kg at ZGS 32 and Terpel C @ .69 at ZGS 39 resulted in TKW's that were significantly lower than the untreated check or any of the single Cycocel applications. There were no significant differences in grain yield between treatments, however the low rates of Cycocel and Cerone tended to yield less than the untreated check. All other treatments resulted in yield increases. The largest increases resulted from Terpel C applied at ZGS 32, where the .46 and .69 rate produced yield increases of 320 and 480 kg/ha respectively.

TABLE M32 PLANT GROWTH REGULATORS ON KATEPWA WHEAT

TREATMENTS	RATE KG/HA	GROWTH STAGE	HEADS /M2	PLANT HGT. CM.	KERN. WT. GM/1000	KERNELS /HEAD	YIELD KG/HA
1. CHECK	--	--	436ab	58a	37.3ab	18a	2912a
2. CYCOCEL	0.46	31	399ab	57a	37.6a	18a	2693a
3. CYCOCEL	0.69	31	408b	57a	38.0a	20a	2937a
4. CYCOCEL	1.15	31	394b	58a	38.5a	22a	3104a
5. CERONE	0.08	39	391b	54a	36.6abc	19a	2692a
6. CERONE	0.15	39	480ab	61a	36.4abc	18a	3101a
7. CERONE	0.30	39	426ab	52a	35.2bc	20a	2957a
8. TERPEL C	0.46	32	459ab	55a	34.8c	21a	3235a
9. TERPEL C	0.46	39	468ab	54a	37.0abc	18a	3051a
10. TERPEL C	0.69	32	517a	56a	35.3bc	19a	3394a
11. TERPEL C	0.69	39	494ab	52a	34.8c	18a	3075a
12. CYC/ CERONE	0.69/0.15	31/39	467ab	58a	36.3abc	18a	2983a
C.V.			14	12	4	13	16

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 16 PLANT GROWTH REGULATORS ON ARCOLA WHEAT
MINTO 1987

OBJECTIVE: To determine the effects of plant growth regulators on lodging control and yield enhancement of Arcola spring wheat.

TREATMENT LIST

PGR	RATE (KG/HA)	ZADOKS GROWTH STAGE
1. UNTREATED CHECK	--	--
2. CYCOCEL	0.46	31
3. CYCOCEL	0.69	31
4. CYCOCEL	1.15	31
5. CERONE	0.08	39
6. CERONE	0.15	39
7. CERONE	0.30	39
8. TERPEL C	0.46	32
9. TERPEL C	0.46	39
10. TERPEL C	0.69	32
11. TERPEL C	0.69	39
12. CYCOCEL/CERONE	0.69/0.15	31/39

MATERIALS AND METHODS
Arcola wheat was seeded May 4, 1987 at a rate of 300 seeds/m2, a depth of 4 cm and a row spacing of 15 cm. 60 kg/ha of P205 and 30 kg/ha of K20 were banded just prior to seeding. 120 kg/ha N as 34-0-0 was broadcast on May 6. The soil is a Ryerson clay loam with an o.m. content of 5% and a pH of 7.8. The experimental design was a randomized complete block with 4 replicates and plot size of 2 x 7.5 m. Weeds were controlled with applications of Hoegrass II at 3.50 l/ha on May 26 and Estaprop at 1.75 l/ha on June 9. Tilt was applied at .250 l/ha on June 22 to control foliar diseases. PGR treatments were applied using a compressed air bicycle sprayer operating at a pressure of 275 kPa. Treatments 2, 3, 4 and 12a were applied June 8 at 18 C in 200 l/ha when wheat was at ZGS 31. Treatments 8 and 10 were applied June 11 at 22 C in 100 l/ha when wheat was at ZGS 32. Treatments 5, 6, 7, 9, 11 and 12b were applied June 16 at 25C in 100 l/ha when wheat was at ZGS 39. Plant heights were measured at 10 locations in each plot on August 13. There was no lodging in this experiment. Heads/m2 were determined by sampling two 1/4 m2 areas in each plot July 21. Plots were harvested August 20 with a K.E.M. plot combine. TKW's were determined from grain samples. All data was analyzed at the 5% level using Duncan's MRT.

RESULTS AND CONCLUSIONS
There were no significant differences in plant height as a result of PGR applications. Heads/m2 and TKW did not differ from the untreated check but the highest TKW (CCC/Cerone split application) was significantly greater than the lowest (Cerone @ .08 kg/ha). All PGR's increased the number of kernels/head compared to the untreated check. A significant increase of over 5 kernels resulted from applications of Terpel C @ .69 at ZGS 32. All treatments, with the exception of Cerone at the .08 kg rate, yielded more than the untreated check. The largest yield increase was 900 kg/ha with Terpel C @ .69 kg applied at ZGS 32. All other Terpel treatments, as well as the CCC/Cerone split application resulted in yield increases of over 700 kg/ha.

TABLE M33 PLANT GROWTH REGULATORS ON ARCOLA WHEAT

TREATMENT	RATE KG/HA	GROWTH STAGE	HEADS /M2	PLANT HGT. CM.	KERN.WT. GM/1000	KERNELS /HEAD	YIELD KG/HA
1. CHECK	--	--	346a	64a	54.0ab	13b	2618ab
2. CYCOCEL	0.46	31	349a	66a	52.3ab	14ab	2620ab
3. CYCOCEL	0.69	31	322a	64a	55.3ab	17ab	3001ab
4. CYCOCEL	1.15	31	330a	63a	54.6ab	16ab	2925ab
5. CERONE	0.08	39	316a	61a	41.3b	14ab	2290b
6. CERONE	0.15	39	360a	63a	52.5ab	16ab	3110ab
7. CERONE	0.30	39	367a	65a	53.6ab	15ab	3026ab
8. TERPEL C	0.46	32	362a	61a	51.6ab	18ab	3340a
9. TERPEL C	0.46	39	348a	66a	55.1ab	18ab	3369a
10. TERPEL C	0.69	32	351a	64a	52.7ab	19a	3524a
11. TERPEL C	0.69	39	375a	60a	53.9ab	17ab	3384a
12. CYC/ CERONE	0.69/0.15	31/39	342a	63a	57.3a	17ab	3367a
C.V.			10	8	6	19	20

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 17 PLANT GROWTH REGULATORS ON HY320 WHEAT
MINTO 1987

OBJECTIVE: To determine the effects of plant growth regulators on lodging control and yield enhancement of HY320.

TREATMENT LIST

PGR	RATE (KG/HA)	ZADOKS GROWTH STAGE
1. UNTREATED CHECK	--	--
2. CYCOCEL	0.46	31
3. CYCOCEL	0.69	31
4. CYCOCEL	1.15	31
5. CERONE	0.08	39
6. CERONE	0.15	39
7. CERONE	0.30	39
8. TERPEL C	0.46	32
9. TERPEL C	0.46	39
10. TERPEL C	0.69	32
11. TERPEL C	0.69	39
12. CYCOCEL/CERONE	0.69/0.15	31/39

MATERIALS AND METHODS
HY320 wheat was seeded May 4, 1987 at a rate of 300 seeds/m2 at a depth of 4 cm and a row spacing of 15 cm. 60 kg/ha of P205 and 30 kg/ha of K20 were banded just prior to seeding. 120 kg/ha as 34-0-0 was broadcast on May 6. The soil is a Ryerson clay loam with an O.M. of 5% and a pH of 7.8. The experimental design was a randomized complete block with 4 replicates and a plot size of 2 x 7.5 m. Weeds were controlled with applications of Hoegrass II at 3.50 l/ha on May 26 and Estaprop at 1.75 l/ha on June 9. Tilt was applied at .250 l/ha on June 22 to control foliar diseases. PGR treatments were applied using a compressed air bicycle sprayer operating at a pressure of 275 kPa. Treatments 2, 3, 4 and 12a were applied June 8 at 18 C in 200 l/ha when wheat was at ZGS 30. Treatments 8 and 10 were applied June 11 at 22 C in 100 l/ha when wheat was at ZGS 31. Treatments 5, 6, 7, 9, 11 and 12b were applied June 16 at 25 C in 100 l/ha when wheat was at ZGS 39. Plant heights were measured at 10 locations in each plot on August 13. There was no lodging in this experiment. Heads/m2 were determined by sampling two 1/4 m2 areas in each plot July 21. Plots were harvested August 20 with a K.E.M. plot combine. TKW's were determined from grain samples. All data was analyzed at the 5% level using Duncan's MRT.

RESULTS AND CONCLUSIONS
PGR's had no significant effect on plant height or heads/m2 of HY320. All PGR treatments lowered TKW, though differences were significant only in the case of Terpel C @ .46 kg at ZGS 39 and @ .69 kg at ZGS 32. All PGR's resulted in an increased number of kernels/head though differences were significantly in only 3 cases, Cycocel @ .69 kg, and both timings of the .69 kg rate of Terpel C which had up to 8 kernels/head more than the untreated check. All PGR treatments increased yield with the exception of Cerone @ .08 kg where there yield was lower than the untreated check. Yields of treated plots did not differ significantly from the untreated check. The largest increases in yield were 625 kg, 600 and 565 kg/ha for Terpel C at .46 ZGS 39, .69 ZGS 32 and .69 ZGS 39 respectively.

TABLE M34 PLANT GROWTH REGULATORS ON HY320 WHEAT

TREATMENT	RATE KG/HA	GROWTH STAGE	HEADS /M2	PLANT HGT. CM.	KERN.WT. GM/1000	KERNELS /HEAD	YIELD KG/HA
1. CHECK	--	--	372a	57a	52.3a	20b	3873ab
2. CYCOCEL	0.46	31	335a	57a	50.2ab	25ab	4123ab
3. CYCOCEL	0.69	31	339a	58a	45.9abc	28a	4193ab
4. CYCOCEL	1.15	31	354a	57a	48.3abc	26ab	4235ab
5. CERONE	0.08	39	339a	56a	50.7ab	22b	3721b
6. CERONE	0.15	39	337a	56a	50.5ab	25ab	4252ab
7. CERONE	0.30	39	382a	58a	49.2abc	22b	4060ab
8. TERPEL C	0.46	32	364a	56a	46.3abc	26ab	4191ab
9. TERPEL C	0.46	39	379a	57a	45.2bc	26ab	4499a
10. TERPEL C	0.69	32	366a	55a	43.2c	29a	4473ab
11. TERPEL C	0.69	39	357a	53a	45.3abc	28a	4438ab
12. CYC/ CERONE	0.69/0.15	31/39	353a	53a	49.8abc	26ab	4304ab
C.V.			12	6	9	15	11

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

EXPERIMENT 18 CULTIVAR X MANAGEMENT ON SPRING WHEAT
MINTO 1987

OBJECTIVE: To determine the responses of 8 spring wheat cultivars to 4 levels of management.

TREATMENT LIST

CULTIVAR	ORIGIN	TYPE
1. HY320	SASKATCHEWAN	SEMI-DWARF PRAIRIE SPRING
2. OSLO	N.AM.PLANT BR.	SEMI-DWARF
3. MARSHALL	MINNESOTA	SEMI-DWARF
4. WHEATON	MINNESOTA	SEMI-DWARF
5. OWENS	IDAHO	SEMI-DWARF SOFT WHITE SPRING
6. COLUMBUS	MANITOBA	TALL-HARD RED SPRING
7. KATEPWA	MANITOBA	TALL-HARD RED SPRING
8. ARCOLA	MANITOBA	TALL-DURUM

MANAGEMENT
I. 300 SEEDS/M2 60 KG/HA N
II. 300 SEEDS/M2 80 KG/HA N + 40 KG/HA N @ 31
III. 300 SEEDS/M2 60 KG/HA N + TILT @ .125 KG/HA @ 55
IV. 300 SEEDS/M2 80 KG/HA N + 40 KG/HA N @ 31 + TILT @.125 KG/HA @ 55

MATERIALS AND METHODS
Eight cultivars of wheat were treated with Vitavax and seeded near Minto, Manitoba on May 4, 1987 at a rate of 300 seeds/m2 with 15 cm row spacing. 60 kg/ha P205 and 30 kg/ha K20 were banded prior to seeding. All nitrogen was applied as broadcast ammonium nitrate. 60 kg/ha N were applied to management I and III and 80 kg/ha N were applied to managements II and IV on May 6 and 40 kg/ha N were applied to management II and IV on June 9 at ZGS 31. Tilt was applied to managements III and IV on June 22 at a rate of .125 kg/ha at ZGS 55-60. Application was made in 100 l/ha with a compressed air bicycle sprayer operating @ 275 kPa. Plot size was 3 x 7.5m and all plots were replicated four times in a split block design. Weeds were controlled with applications of Hoegrass II at 1.09 kg/ha on May 26 and Estaprop at 1.02 kg/ha on June 9. Plant counts and head counts taken on 2 1/4 m2 areas in each plot May 19 and July 20 respectively. Plant heights were taken just prior to harvest. Plots were rated for foliar plant diseases on July 20, using the Horsfall-Barratt rating scale modified by Couture. Plots were harvested August 13 with a K.E.M. plot combine. Yields were adjusted to 14.5% moisture and thousand kernels weights determined from the harvest samples. Data was analyzed at the .05 level and means compared using the appropriate L.S.D. values. Samples were also collected from all plots in management I and IV for harvest index determination.

RESULTS AND CONCLUSIONS

CULTIVARS

Plant populations accounted for about 75% of viable seeds planted. Populations ranged from a high of 95% for Owens, to a low of 60% for Arcola. All other cultivars were intermediate and with the exception of Columbus, did not differ from Arcola. As expected, there were significant differences in plant height due to different growth habits in the varieties. Marshall, Wheaton and Arcola had significantly lower levels of leaf rust than the other varieties. Oslo had significantly more Tanspot/septoria than either HY320 or Arcola. All other varieties did not differ from these two extremes. HY320 had significantly less heads/m2 than any other variety. Katepwa, Marshall and Owens had significantly more heads/m2 than HY320, Oslo, Wheaton or Arcola. Columbus was intermediate. Owens had significantly more kernels/head than any other variety except HY320 and Wheaton. Arcola had significantly less kernels/head than any other variety There were significant differences in kernels weight, with Arcola having the highest TKW of 54.8 g/1000 and Owens and Katepwa having the lowest of 38.8 g/1000. Over all managements, Wheaton and Owens yielded significantly more than all other varieties except HY320 and Marshall. Lowest overall yields were on Columbus, followed by Katepwa, Arcola and Oslo. There were significant differences in harvest index between varieties with the semi-dwarf varieties generally having a higher HI than the tall varieties. Over all management levels, the lowest yielding cultivars, namely Oslo, Katepwa, Columbus and Arcola also had the highest protein levels, all over 14%. Owens, the highest yielding cultivar, had the lowest protein content of 11.9%.

MANAGEMENT

Nitrogen had no effect on plant height, but fungicides, alone or together with nitrogen increased plant height significantly. Levels of both leaf rust and Tanspot/septoria were significantly decreased with the use of fungicides. Nitrogen had virtually no effect on disease levels. Additional nitrogen significantly increased heads/m2 over all varieties, as did fungicides. Nitrogen and fungicides together (management 4) resulted in significantly more heads than nitrogen alone, but only a few more than fungicides alone. Management had no effect on kernels/head or thousand kernel weight. Over all varieties, conventional plus fungicides and nitrogen increased yields over conventional plus fungicides, though differences were not significant. The addition of fungicides alone resulted in significant yield increases over conventional and conventional plus N managements. The addition of fungicides increased yields in all 8 varieties, while the addition of nitrogen resulted in yield increases in only 6 of 8 varieties. The yield increase due to fungicides was greater than or equal to the increase due to nitrogen. Increases in yield as a result of adding both nitrogen and fungicides were greater than that of fungicides alone in only 4 cases, none of them significant. Yield increases in Columbus, Katepwa or Arcola were not significant regardless of the management used. Over all varieties, management did not have a significant effect on harvest index (H.I). Management level IV compared to level I resulted in an increased in H.I. for Arcola, Katepwa, Owens and Oslo and a decrease in H.I. for HY320, Wheaton and Columbus though differences between varieties were not significant. There were no significant Management X Variety interactions in this trial. Highest protein levels were recorded in management level IV, where all cultivars had proteins of about 15% or higher except Owens which had only 13.5% and was the highest yielding cultivar. The additional 40 kg/ha N applied in managements II and IV raised protein approximately 2%. Fungicides increased protein 1.2%, regardless of nitrogen levels.

TABLE M35 CULTIVAR X MANAGEMENT - SPRING WHEAT

CULTIVAR	MGMT	PLANTS /M2	PLANT HGT CM	LF RUST	TS/ SEPT	HEADS /M2	KERN.WT GM/1000	KERN /HEAD	YIELD KG/HA	HARV INDEX %
1.HY320	I	205	59	5	6	304	48.5	22	3075	50
2.HY320	II	205	59	6	6	346	48.9	22	3533	
3.HY320	III	205	68	1	5	369	47.1	24	4146	
4.HY320	IV	205	67	2	4	367	48.9	23	4169	48
5.OSLO	I	206	51	6	6	334	46.7	18	2699	44
6.OSLO	II	206	55	6	7	375	43.8	20	3330	
7.OSLO	III	206	58	2	6	428	44.2	22	4130	
8.OSLO	IV	206	59	2	6	461	44.6	19	3801	45
9.MARSHALL	I	230	50	4	6	388	40.1	21	3250	46
10.MARSHALL	II-	230	55	3	6	468	40.0	18	3468	
11.MARSHALL	III	230	63	1	4	457	40.3	20	3605	
12.MARSHALL	IV	230	61	1	4	501	41.1	20	4186	46
13.WHEATON	I	216	54	2	6	377	46.5	20	3525	48
14.WHEATON	II	216	56	4	6	379	45.7	21	3794	
15.WHEATON	III	216	65	1	5	425	44.5	24	4448	
16.WHEATON	IV	216	61	1	4	460	45.1	21	4296	47
17.OWENS	I	285	54	5	6	405	38.2	23	3448	48
18.OWENS	II	285	53	5	7	412	37.2	22	3435	
19.OWENS	III	285	62	2	6	481	39.4	24	4422	
20.OWENS	IV	285	62	2	4	512	40.5	23	4764	48
21.COLUMBUS	I	252	69	5	6	363	42.3	20	2914	44
22.COLUMBUS	II	252	67	6	6	426	41.2	18	3134	
23.COLUMBUS	III	252	78	2	5	465	40.9	17	3151	
24.COLUMBUS	IV	252	76	1	4	457	43.0	18	3536	43
25.KATEPWA	I	183	62	6	6	445	37.8	17	2836	44
26.KATEPWA	II	183	61	6	7	448	35.7	19	3160	
27.KATEPWA	III	183	72	2	6	488	39.2	19	3506	
28.KATEPWA	IV	183	65	3	5	486	42.4	18	3504	47
29.ARCOLA	I	182	73	2	6	368	55.4	14	2976	40
30.ARCOLA	II	182	69	1	6	392	56.4	12	2763	
31.ARCOLA	III	182	83	1	5	426	52.1	17	3777	
32.ARCOLA	IV	182	79	1	3	409	55.2	16	3637	43
L.S.D. .05		43	9	2	1	74	4	5	915	4
C.V.		14	11	55	12	13	7	18	18	7

TABLE M36 MAIN EFFECTS - CULTIVAR X MANAGEMENT, SPRING WHEAT

CULTIVAR	PLANTS /M2	PLANT HGT.CM	LF RUST	TS SEPT	HEADS /M2	KERN.WT GM/1000	KERN /HEAD	YIELD KG/HA	HARV INDEX %
HY320	205	63	4	5	346	48	23	3731	49
OSLO	206	55	4	6	400	45	20	3490	45
MARSHALL	230	57	2	5	453	40	20	3627	46
WHEATON	216	59	2	5	410	45	22	4016	47
OWENS	285	58	4	6	452	39	23	4017	48
COLUMBUS	252	72	3	5	428	42	18	3184	43
KATEPWA	183	65	4	6	466	39	18	3251	45
ARCOLA	182	76	1	5	399	55	15	3288	42
L.S.D. .05	47	6	1	1	42	3	2	494	3
MANAGEMENT									
I	220	59	4	6	373	44	19	3090	45
II	220	59	5	6	406	44	19	3327	
III	220	69	2	5	442	43	21	3898	
IV	220	66	2	4	456	45	20	3986	46
L.S.D. .05		3	1	1	26	1	2	324	2

TABLE M37 % PROTEIN - CULTIVAR X MANAGEMENT

CULTIVAR	MANAGEMENT I	II	III	IV	$\bar{X}$
HY320	11.3	13.2	11.7	15.3	12.9
OSLO	13.9	14.2	14.3	15.6	14.5
MARSHALL	12.8	13.5	14.0	15.0	13.8
WHEATON	11.5	13.6	13.0	14.9	13.3
OWENS	10.0	12.2	11.9	13.5	11.9
COLUMBUS	13.7	15.5	13.9	15.5	14.7
KATEPWA	13.1	15.6	15.4	16.8	15.2
ARCOLA	11.2	15.5	14.3	16.9	14.5
$\bar{X}$	12.2	14.2	13.6	15.4	

TABLE M38 YIELDS CULTIVAR X MANAGEMENT, MINTO 1987

CULTIVAR	MANAGEMENT I	II	III	IV
HY320	3075	3533	4146	4169
OSLO	2699	3330	4130	3801
MARSHALL	3250	3468	3605	4186
WHEATON	3525	3794	4448	4296
OWENS	3448	3534	4422	4764
COLUMBUS	2914	3134	3151	3536
KATEPWA	2836	3160	3506	3504
ARCOLA	2976	2763	3777	3637

TABLE M39 SPRING WHEAT PRODUCTION COSTS $/HA
MANITOBA 1987

INPUTS	MANAGEMENT I	II	III	IV
LAND	49.40	49.40	49.40	49.40
INSURANCE	12.35	12.35	12.35	12.35
SEED & TMT	9.88	9.88	9.88	9.88
N	18.59	42.38	18.59	42.38
P	36.35	36.35	36.35	36.35
K	6.60	6.60	6.60	6.60
ESTAPROP	9.88	9.88	9.88	9.88
HOEGRASS II	34.58	34.58	34.58	34.58
FUNGICIDE-TILT	-	-	39.52	39.52
-DITHANE*	-	-	19.76	19.76
FUEL	22.23	23.47	23.47	24.71
REPAIRS	17.29	17.29	17.29	17.29
SUBTOTAL	217.15	242.18	256.67	281.70
			236.91*	261.94*
MACH.DEPRECIATION	29.64	29.64	29.64	29.64
MACH.INVESTMENT	23.71	23.71	23.71	23.71
LABOUR & MGMT	39.52	39.52	39.52	39.52
TOTAL	310.02	335.05	349.54	374.57

**TOTAL COSTS DO NOT INCLUDE MACHINERY DEPRECIATION OR RETURN TO LABOUR

TABLE M40 SPRING WHEAT GROSS $/HA PRICE STRUCTURE I
MANITOBA 1987

CULTIVAR	MANAGEMENT I	II	III	IV
HY320 1	188.68	216.78	254.40	255.81
OSLO 1	165.61	204.32	253.40	233.23
MARSHALL 2	182.72	194.97	202.67	234.32
WHEATON 2	198.18	213.72	250.07	241.52
OWENS 3	245.77	244.85	315.20	339.58
COLUMBUS 4	286.94*	308.60*	310.28*	348.19*
KATEPWA 4	273.02	311.17*	345.23*	345.04*
ARCOLA 5	286.50	265.99	363.61	350.13

1 #1CWPS @ 61.36/TONNE
2 WHEAT BOARD FEED @ 56.22/TONNE
3 #1CWSWS @ 71.28/TONNE
4 #QCW @ 96.27/TONNE
5 #1CW AMBER DURUM @ 96.27/TONNE
* #1CW 13.5 @ 98.47/TONNE

TABLE M41 SPRING WHEAT PROFITS/HA 1 PRICE STRUCTURE I
MANITOBA 1987

CULTIVAR	MANAGEMENT			
	I	II	III	IV
HY320 2	(28.47)	(25.40)	17.49	(6.13)
OSLO 2	(51.54)	(37.86)	16.49	(28.71)
MARSHALL 3	(34.43)	(47.21)	(34.24)	(27.62)
WHEATON 3	(18.97)	(28.46)	13.16	(20.42)
OWENS 4	28.62	2.67	78.29	77.64
COLUMBUS 5	69.79	66.42	73.37	86.25
KATEPWA 5	55.87	68.99	108.32	83.10
ARCOLA 6	69.35	23.81	126.70	88.19

1 DOES NOT INCLUDE DEPRECIATION OR
RETURN TO LABOUR OF 92.87
2 #1CWPS @ 61.36/TONNE
3 WHEAT BOARD FEED @ 56.22/TONNE
4 #1CWSWS @ 71.28/TONNE
5 #1CW @ 96.27/TONNE
6 #1CW AMBER DURUM @ 96.27/TONNE
7 #1CW 13.5 @ 98.47/TONNE

TABLE M42 SPRING WHEAT GROSS $/HA PRICE STRUCTURE II
MANITOBA 1987 (USING NON BOARD FEED)

CULTIVAR	MANAGEMENT			
	I	II	III	IV
HY320 1	238.40	273.91	321.44	323.22
OSLO 1	209.25	258.17	320.20	294.69
MARSHALL 1	251.97	268.87	279.50	324.54
WHEATON 1	273.29	294.15	344.85	333.07
OWENS 1	267.32	266.32	342.84	369.35
COLUMBUS 2	286.94*	308.60*	310.28*	348.19*
KATEPWA 2	273.02	311.17*	345.23*	345.04*
ARCOLA 3	286.50	265.99	363.61	350.13

1 NON BOARD FEED @ 77.53/TONNE
2 #1CW @ 96.27/TONNE
3 #1CW AMBER DURUM @ 96.27/TONNE
*#1CW 13.5 @ 98.47/TONNE

TABLE M43 SPRING WHEAT PROFIT $/HA 1 PRICE STRUCTURE II
MANITOBA 1987 (USING NON BOARD FEED)

CULTIVAR	MANAGEMENT I	II	III	IV
HY320 2	21.25	31.73	84.53	61.28
OSLO 2	(7.90)	15.99	83.29	32.75
MARSHALL 2	34.82	26.69	42.59	62.60
WHEATON 2	47.38	51.97	107.94	71.13
OWENS 2	50.17	24.14	105.93	107.41
COLUMBUS 3	69.79	66.42*	73.37*	86.25*
KATEPWA 3	55.87	68.99*	108.32*	83.10*
ARCOLA 4	69.35	23.82	126.70	88.19

1 DOES NOT INCLUDE DEPRECIATION OR RETURN TO LABOUR OF 92.87
2 NON BOARD FEED @ 77.53/TONNE
3 #1CW @ 96.27/TONNE
4 #1CW AMBER DURUM @ 96.27/TONNE
* #1CW 13.5 @ 98.47/TONNE

Yields of spring wheat tested increased as the number of inputs increased, with the result that management level IV had the highest yields in 4 of 8 cultivars. In the other 4 cultivars, management III (fungicide only) resulted in the highest yield.

When the economics of the management levels and cultivars are compared under price structure I, only Arcola and Katepwa under management III were able to cover the costs of production. In spite of lower yields, the HRS varieties were more profitable due to the higher prices they command.

Under price structure II, where a minimum 77.53/tonne feed price is used for all varieties except the HRS and durum wheats, higher yielding cultivars like Wheaton and Owens compare favourably with the higher priced wheats. As the price difference between these two types of wheat diminishes, the higher yielding varieties look more attractive.

SECTION 2

MINTO LARGE SCALE WINTER WHEAT TRIAL

MATERIALS AND METHODS

Norstar winter wheat was seeded at 70 kg/ha on September 3, 1986 near Minto, Manitoba. 20 kg/ha N, 40 kg/ha P205 and 20 kg/ha K20 were applied with the seed. 85 kg/ha N as 34-0-0 was broadcast in April, 1987. Weeds were controlled with an application of Estaprop on May 7. 40 kg/ha N were applied to treatments 2 and 4 at ZG 39. The fungicide Tilt was applied to treatments 3 and 4 at ZGS 65. Plots were harvested by sampling six square meter areas in each treatment on August 4. Samples were dried to a constant moisture and weighed to determine crop yield. Thousand kernel weights were taken from the samples. All data was analyzed at the 5% level using Duncan's Multiple Range Test.

RESULTS AND CONCLUSIONS

The addition of nitrogen resulted in an increase of almost 400 kg/ha compared to the check. This difference was not significant. When fungicides were added, yields were decreased by nearly 200 kg/ha compared to the check and when nitrogen and fungicides were added, decreases were over 350 kg/ha. There were no significant differences between treatments. The lack of fungicide response is probably partly due to the hot dry weather at spraying as well as the dry spring. This resulted in a low incidence of disease and may have caused some antagonism to the fungicide. There were no significant differences in thousand kernel weights, though all treatments resulted in a greater TKW than the untreated check.

TABLE M44 RESULTS OF 1987 MINTO LARGE SCALE WINTER WHEAT TRIAL

TREATMENT	YIELD KG/HA	KERNEL WEIGHT GM/1000
1. CONVENTIONAL	2849a	28.9a
2. CONVENTIONAL + N	3239a	29.3a
3. CONVENTIONAL + FUNGICIDE	2669a	30.1a
4. CONVENTIONAL + N + FUNGICIDE	2486a	29.1a
C.V.	26	6

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

MINTO LARGE SCALE SPRING WHEAT TRIAL

MATERIALS AND METHODS

Columbus wheat was planted at 75 kg/ha near Minto, Manitoba on April 24, 1987. 50 kg/ha N and 40 kg/ha P205 were banded before seeding. Weeds were controlled with applications of Avenge and Estaprop on May 23 and May 30 respectively. Applications were made at label rates. Additional 40 kg/ha N was applied to treatments 2 and 4 at ZGS 31. Fungicides (Tilt) were applied to treatments 3 and 4 at ZGS 45. At this time, tillers were beginning to die off due to drought. Plots were harvested August 4 by sampling six square meter areas/plot. Samples were dried to a constant moisture and threshed. Thousand kernel weights were determined from threshed samples. Data was analyzed at the 5% level using Duncan's Multiple Range Test.

RESULTS AND CONCLUSIONS

There were no significant differences in yield between treatments. The addition of N resulted in a 300 kg/ha yield increase and the addition of either the fungicide or fungicide and N resulted in an increase of 500 kg/ha. There were no significant differences in thousand kernel weights.

TABLE M45 RESULTS OF 1987 MINTO LARGE SCALE SPRING WHEAT TRIAL

TREATMENT	YIELD KG/HA	KERNEL WEIGHT GM/1000
1. CONVENTIONAL	2074a	38.3a
2. CONVENTIONAL + N	2381a	38.5a
3. CONVENTIONAL + FUNGICIDE	2587a	39.2a
4. CONVENTIONAL + N + FUNGICIDE	2567a	38.5a
C.V.	17	3

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

PORTAGE LA PRAIRIE LARGE SCALE WINTER WHEAT TRIAL

MATERIALS AND METHODS

Norstar winter wheat was seeded into a standing canola crop on July 15, 1986. 40 kg/ha N was broadcast the following spring. An additional 40 kg/ha N was broadcast at ZGS 31 on treatments 2 and 4. Tilt was applied at ZGS 50 to treatments 3 and 4. Plots were harvested by sampling six square meter areas in each plot on August 6. Samples were dried to a constant moisture and threshed with a K.E.M. plot combine. Thousand kernel weights were determined from the samples. Data was analyzed at the 5% level using Duncan's Multiple Range Test.

RESULTS AND CONCLUSIONS

All inputs resulted in significant yield increases in winter wheat at Portage la Prairie. The addition of N resulted in an increase of 1600 kg/ha over the check. The addition of fungicide increased yield by 800 kg/ha. Additions of both N and fungicide resulted in a 1200 kg/ha increase, which did not differ significantly from either of the single inputs. All inputs increased TKW significantly compared to the untreated check, but the increase in TKW did not account for all the increase in yield.

TABLE M46 RESULTS OF 1987 PORTAGE LARGE SCALE WINTER WHEAT TRIAL

TREATMENT	YIELD KG/HA	KERNEL WEIGHT GM/1000
1. CONVENTIONAL	2469c	28.5c
2. CONVENTIONAL + N	4072a	30.7ab
3. CONVENTIONAL + FUNGICIDE	3313b	29.9b
4. CONVENTIONAL + N + FUNGICIDE	3783ab	31.8a
C.V.	16	4

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

PORTAGE LA PRAIRIE LARGE SCALE SPRING WHEAT TRIAL

MATERIALS AND METHODS

Katepwa spring wheat was seeded near Portage la Prairie in May 1987. Additional N (40 kg/ha) was applied at ZGS 31. Four sets of square meter samples were taken in each treatment in September. Samples were dried to a constant moisture and threshed with a K.E.M. plot combine. Thousand kernel weights were determined from the threshed sample. Data was analyzed at the 5% level using the Duncan's Multiple Range Test.

RESULTS AND CONCLUSIONS

The addition of 40 kg/ha of N increased grain yield by almost 100 kg/ha, but the increase was not significant. The increase in yield can be attributed to the increase in thousand kernel weight as the addition of nitrogen significantly raised the thousand kernel weight. Disease levels appeared to be non-significant when a fungicide would normally be applied and consequently the decision was made not to treat for disease.

TABLE M47 RESULTS OF 1987 PORTAGE LA PRAIRIE SPRING WHEAT TRIAL

TREATMENT	YIELD KG/HA	KERNEL WEIGHT GM/1000
1. CONVENTIONAL	2653a	31.1b
2. CONVENTIONAL + N	2750a	32.6a
C.V.	12	2

Means in the same column followed by the same letter do not differ significantly at the 5% level according to Duncan's Multiple Range Test.

SECTION 3

LOCATION DESCRIPTION MINTO, MANITOBA 1987

WEATHER SUMMARY

TEMPERATURE (C)	APRIL	MAY	JUNE	JULY	AUGUS	SEPT
1987 AVERAGE	9.6	15.0	18.6	19.6	16.1	13.2
97 YEAR AVERAGE	3.1	10.5	15.2	18.7	17.3	11.5
DIFFERENCE	+6.5	+4.5	+3.4	+0.9	-1.2	+1.7

PRECIPITATION (MM)

1987 TOTAL	1.0	42.2	51.6	94.2	109.7	19.2
97 YEAR AVERAGE	30.7	48.7	79.4	70.5	64.7	47.3
% OF AVERAGE	3.	87	65	134	170	41

SOIL FERTILITY

	KG/HA			
	NO3 0-60 CM	P2O5 0-15 CM	K2O 0-60 CM	SO4 0-60 CM
WINTER WHEAT (TESTED FALL 1986)	46	16	626	164+
SPRING WHEAT (TESTED SPRING 1987)	36	13	591	164+

SOIL TYPE: RYERSON CLAY LOAM - 27% SAND, 48% SILT, 25% CLAY
pH 7.8
O M 5.5

SOIL CAPABILITY FOR AGRICULTURE: CLASS 2 - soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices (CANADA LAND INVENTORY)

1987 EXTENSION ACTIVITY

FIELD DAYS

Intensive Wheat Management Tour July 9
attendance 60
University of Manitoba - Agriculture Diploma Student Tour July
attendance 65
Weed Tour (Expert Committee on Weeds) July 17
attendance 20

MEETINGS AND PRESENTATIONS

Intensive Management of Wheat in Canada - update
Canada Grains Council, Annual Meeting, Winnipeg, Manitoba
Attendance 200+
Disease Problems in Wheat
BASF ICM Meeting, Brandon, Manitoba
Attendance 35
ICM update, Souris Valley Farm Business Management, Elgin, Man.
Attendance 30
ICM Crop Production, Cargill Managers Meeting, Saskatoon, Sask.
November 1987, Attendance 25
Spring Wheat MEY Workshop, NDSU + NDAA, Fargo, N.D. Jan 6-8, 1988
Attendance 200
Canada Grains Council, Review of Results - Intensive Wheat Management
Winnipeg, Manitoba Jan. 29, 1988, expected attendance 25
Practical Implications of ICM, Redfern Yield Club, Rivers, Manitoba
February 2, 1988 Attendance 20
Proposed - series of presentations throughout major agriculture districts of Manitoba, Feb-March
Summary at Canada Grains Council Annual Meeting, April 1988

MODIFIED HORSFALL-BARRATT SCALE*

Adjustment of the 0-9 assessment scale to defined degrees of disease intensity on various leaf levels of cereals.

Leaf Level**	Intensity of symptoms*** on leaves for each score									
	0	1	2	3	4	5	6	7	8	9
I	free	free	free	free	free	free	scattered	light-mod.	mod.-severe	severe
II	free	free	free	free	scattered-light	light-mod.	mod.	severe	severe	severe
III	free	isolated	scattered	light	mod.-severe	severe	severe	severe	severe	severe

*Couture, Luc. 1980 Assessment of severity of foliage diseases of cereals in Cooperative tests. Canadian Plant Disease Survey 60:1, 8-10.
**Leaf Level: I=Upper Leaves
II=Middle Leaves
III=Lower Leaves
***Free: 0%, isolated: 1%, scattered: 5%, light: 10%. moderate: 25%, severe:50%

PART 3

QUEBEC

Technical Services
Cooperative Federee de Quebec

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EXECUTIVE SUMMARY OF 1987 QUEBEC RESULTS

The weather conditions had a great influence on the results obtained in 1987. The year was characterized by unequal rainfall and high temperatures. Rainfall was above average in May, June and September but below average in April, July and August. Water stresses were evident between the second week of June and the second week of September. The situation of the trials also influenced the results. The soil was a heavy clay with low organic matter and compaction was high; this reduced the water holding capacity of the field. These conditions are very representative of the soil conditions in the St-Hyacinthe region.

The winter wheat escaped some of the drought. The yields were higher than those obtained in spring wheat. Winterkill was limited to one plot in 1987. The plants resumed growth in early April, and the small amount of rainfall permitted us to apply fertilizer nitrogen early. The spring wheat was planted in the first week of May. Plant establishment was good due to the more than adequate water supply.

CULTIVARS

Thirty-three cultivars of spring wheat were planted under two management regimes. The cultivars responded differently to the management. The average response was of 456 kg/ha; some cultivars responded more to management (up to 1208 kg/ha). The best yields were obtained with European cultivars unlicensed in Canada. The use of plant growth regulators reduced the height of the plants but there was no difference in lodging.

The winter wheat cultivars also had very different responses to management regimes. The twenty-two cultivars had yields that varied between 2567 kg/ha and 8438 kg/ha. The management regimes had an effect on thousand kernel weight, height, and mildew infection. The use of fungicides explains the differences noted in thousand kernel weight and mildew infection; the use of a plant growth regulator reduced the height of the plants but not the degree of lodging.

NITROGEN FERTILITY

The nitrogen fertility influenced significantly the yield of the spring wheat Max, which went from 1494 kg/ha to 3809 kg/ha in one experiment. The optimum fertility level was situated between 180 and 210 kg/ha for yield. Increasing the level of nitrogen also increased the height of the plants and the level of protein. The maximum level of protein was obtained at the 210 kg/ha level of nitrogen. The timing of the applications influenced the yield negatively when the total amount was split in three applications; the last application was done in a very dry period and the plants could not benefit from that last application. Nevertheless, the late application increased the thousand kernel weight and the level of protein. The source of nitrogen did not affect significantly the yield. It affected the number of heads/sq.meter, the hectoliter weight, the heading date and the level of septoria infection. This was explained by higher losses of nitrogen by leaching in late May and early June.

The nitrogen trial in winter wheat also showed a yield response that went from 2327 kg/ha to 4444 kg/ha with the optimum between 120 and 220 kg/ha. The source of nitrogen influenced significantly the yield with an advantage of 627 kg/ha for the urea. Lodging and humidity at harvest were also affected by the nitrogen level with the highest rates causing more lodging and less moisture at harvest.

POPULATION

Responses to plant population were again this year variable. Plant population had no significant effect on yield in one experiment and a significant but small effect in another experiment. It is evident that the very dry summer limited the yield responses that we could expect in these experiments. By increasing the population we also decreased the thousand kernel weight which was penalized by the water stress. In the other experiment, the number of kernels/head was affected negatively by increased population for the same reason.

In winter wheat, plant population had no significant effect on all parameters except lodging which increased with higher plant population. This was explained by increased disease pressure in the higher populated plots.

PLANT GROWTH REGULATORS

The plant growth regulators had signficant effects on thousand kernel weights, hectoliter weights, heading dates, maturity dates and height of plants. Some plant growth regulators were hard on the plants and lowered the quality of the grain. The lodging was very low and no plant growth regulator had any effect on that parameter.

In winter wheat, the plant growth regulator had an effect on height of the plants, maturity date and on the hectoliter weight. Again some of the products used reduced the hectoliter weight.

FUNGICIDES

The fungicides had a significant effect on yield, thousand kernel weight, hectoliter weight and tan spot control in the spring wheat experiments. The increase in yield was limited by the very dry conditions to approximately 200 kg/ha. The treatments containing systemic products or multiple applications that provided long coverage gave better results.

In winter wheat, the fungicides increased the thousand kernel weight, reduced the lodging and the mildew and septoria ratings. The treatments containing Bayleton reduced the mildew and the treatments containing Tilt reduced the septoria.

3 Small scale trials

3.1 Spring wheat

3.1.1 Experiment 01 - Cultivar * Management

3.1.1.1 Objective

Determine the effect of management (conventional vs intensive) on different cultivars of spring wheat.

3.1.1.2 Treatment list

Factor A

1- Conventional management

- population density ==> 300 viable seeds / m2
- row width ==> 12 cm
- fertility ==> 100-100-100 à ZGS 0
- herbicides ==> Pardner / Hoe-grass à ZGS 12
MCPA à ZGS 32

2- Intensive management

- population density ==> 425 viable seeds / m2
- row width ==> 12 cm
- fertility ==> 100-100-100 à ZGS 0
90-0-0 à ZGS 30
- herbicides ==> Pardner / Hoe-grass à ZGS 12
MCPA à ZGS 32
- fungicides ==> Tilt à ZGS 30
Tilt à ZGS 49-60
- PGR ==> Cycocel extra à ZGS 30

Factor B

1	CASAVANT	12	CFQA-08	23	CFQB-09
2	CFQ-01	13	CFQA-09	24	CFQC-01
3	CFQ-02	14	CFQA-10	25	HY-320
4	CFQ-03	15	CFQB-01	26	CFQD-01
5	CFQA-01	16	CFQB-02	27	CFQD-02
6	CFQA-02	17	CFQB-03	28	SINTON
7	CFQA-03	18	CFQB-04	29	COLOMBUS
8	CFQA-04	19	CFQB-05	30	KATEPWA
9	CFQA-05	20	CFQB-06	31	MAX
10	CFQA-06	21	CFQB-07	32	ROBLIN
11	CFQA-07	22	CFQB-08	33	CFQE-01

3.1.1.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a gleysol of the Ste-Rosalie series. Because these soils may have a deficient drainage, this farm was tile drained.

The field was plowed the preceding fall and disked two times in the spring, the last disking incorporating the fertilizer that was applied before planting. The soil analysis was:

- water pH	: 6.4	- buffer pH	: 7.0
- P (Bray II)	: 264	- K (Amm.Ac)	: 423
- Mg (Amm.Ac)	: 597	- CEC	: 21.06
- O.M.	: 1.2%		

The previous crop was barley. Fertilizer was applied prior to planting; 210 Kg/ha of 0-45-0 and 167 kg/ha of 0-0-60 were mixed together and applied on the 25th of april and 216 kg/ha of 46-0-0 were applied on the 27th of april using a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil.

Thirty three spring wheat cultivars were seeded on may 5th 1987, using a Kincaid cone seeder at a depth of 2.5 cm. The row width was 12 cm. The number of seeds per envelope was adjusted according to the thousand kernel weight and to the germinating power of each cultivar. The seeding rate were 300 viable seeds and 425 viable seeds per square meter for the conventional and the intensive management respectively. Plot size was of 1m * 5m and each treatment was replicated four times in a split-block design.

The plots were sprayed with a mixture of Pardner (Bromoxynil, 336 gr a.i./ha) and Hoe-grass (Diclofop-methyl, 710 gr a.i./ha) in 275 litres/ha of water, on may 26th at ZGS 12 using a conventional farm sprayer (Hardy), at 5.5 km/hr. There was a second application of herbicides (MCPA 300 gr a.i./ha) needed on the 18th of june at ZGS 32 using the conventional farm sprayer.

The ICM plots received supplemental treatments of nitrogen and were sprayed with fungicides and plant growth regulators. The supplemental nitrogen (265 kg/ha of 34-0-0) was applied on the 6th of june at ZGS 30 using the pneumatic spreader.

The fungicide Tilt (Propiconazole, 125 gr a.i./ha) was applied at ZGS 30 on june 6th and at ZGS 49-50 on july 1st, using a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha.

The plant growth regulator Cycocel extra (Chlormequat chloride, 240 gr a.i./ha) was applied on june 6th at ZGS 30, using a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha.

Plant counts were done three weeks after planting. Height is the average of the straw length (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 21st using a Kincaid plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads).

The results were analyzed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.1.1.4 Results and discussion

<u>Management</u>

Management had a significant effect on yield, plants/sq.meter, heads/sq.meter and height. The response in yield to management was of 456 kg/ha. It is explained by added nitrogen, higher plant population, greater number of heads per square meter and by the use of fungicides. The small yield increase obtained is explained by an important water stress during the flowering and grain filling periods. The increase in plant density, and in heads/sq.meter is explained by different seeding rates. The tillering ratio decreased from 1.55 to 1.44. The height of the plants was also affected by management. The use of a plant growth regulator decreased the average height of the cultivars.

<u>Cultivar</u>

All parameters measured, except septoria and tan spot, showed significant differences. These variations are explained by the very different genetic by material that was tested. The yields varied from 2631 kg/ha to 4627 kg/ha with the maximum yield obtained with an european cultivar and the lowest yield obtained with a french cultivar. The cultivars responded differently to the management. The yield responses varied from -35 kg/ha to 1208 kg/ha. The highest yielding cultivars seem to have the highest response to management.

There were significant differences in plant densities; the lowest yielding cultivar was penalized by a very low plant density. The heads per square meter were also significantly different. The tillering ratio varied from 1.22 to 2.02; there was no significant correlation with yield. The thousand kernel weight was also significantly different with the lowest yielding cultivars having the lower thousand kernel weights. There were significant differences in heading dates with the western cultivars being earlier than the european cultivars. This difference did not appear in the maturity dates. Lodging was not a factor in this experiment; the Canadian cultivars had significantly higher lodging ratings than the european cultivars.

TABLE Q-01 Summary of results from trial Coop-01 Cultivar * Management

Coop - 01

	YIELD		PL/M2		HDS/M2	
1 Conv	3669.81	a	229.67	a	355.77	a
2 ICM	4125.54	b	293.18	b	422.55	b
22 CFQB-08	4627.40	a	302.75	ab	379.25	abcdefg
18 CFQB-04	4541.60	ab	289.37	abcd	437	abcde
23 CFQB-09	4493.90	abc	264.62	abcde	472.87	a
24 CFQC-01	4440.20	abc	283.62	abcde	453.50	abc
15 CFQB-01	4351.50	abcd	294.12	abc	437.25	abcde
10 CFQA-06	4243.20	abcde	236.87	cde	382.62	abcdefg
21 CFQB-07	4204.40	abcdef	284.37	abcde	354.50	cdefg
1 CASAVANT	4190.10	abcdef	241.75	bcde	390	abcdef
12 CFQA-08	4189.10	abcdef	262.62	abcde	435	abcde
17 CFQB-03	4155.10	bcdefg	269.75	abcde	372.50	bcdefg
14 CFQA-10	4136.40	bcdefg	266.75	abcde	377.37	abcdefg
4 CFQ-03	4136.10	bcdefg	265.87	abcde	340.50	defg
5 CFQA-01	4091.20	bcdefgh	264.62	abcde	374.87	bcdefg
9 CFQA-05	4070.70	cdefgh	275.62	abcde	397.25	abcde
19 CFQB-05	4067	cdefgh	255.37	abcde	409.87	abcde
13 CFQA-09	4040.20	cdefgh	262.62	abcde	391.50	abcdef
6 CFQA-02	3921.90	defghi	267.87	abcde	385.50	abcdefg
7 CFQA-03	3915.80	defghi	254.37	abcde	374.62	abcdefg
11 CFQA-07	3909.70	defghi	311.62	a	460.87	ab
3 CFQ-02	3898.80	defghi	253	abcde	431.50	abcde
20 CFQB-06	3861.10	efghi	272.87	abcde	376	abcdefg
25 HY-320	3807.60	efghij	301.12	ab	368.12	bcdefg
26 CFQD-01	3799.10	efghij	260.62	abcde	353.12	defg
31 MAX	3746.60	fghijk	247.50	bcde	354.12	cdefg
8 CFQA-04	3724.60	fghijk	245.25	bcde	401.50	abcde
16 CFQB-02	3659	hijk	228.12	de	357.87	cdefg
27 CFQD-02	3553.90	ijk	233.75	cde	337.87	efg
29 COLOMBUS	3409.30	jk	260.62	abcde	422.25	abcde
2 CFQ-01	3395.70	jk	225.37	cde	287.50	g
30 KATEPWA	3320.20	k	286.62	abcde	461	ab
32 ROBLIN	3128.40	k	243.12	bcde	340.75	defg
28 SINTON	3107	k	268	abcde	438.50	abcd
33 CFQE-01	2630.70	l	146.37	f	295.25	fg
TRA	**		*		*	
TRB	**		**		**	
TRA*TRB	**		ns		ns	
C.V.	9.74		19.37		20.73	

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-02 Effect of management on yield response of cultivars.

Coop 01

		Average		Conv	ICM
22	CFQB-08	4627.40	a	4413.02	4841.82
18	CFQB-04	4541.60	ab	4233.27	4849.82
23	CFQB-09	4493.90	abc	4155.72	4859.97
24	CFQC-01	4440.20	abc	4158.67	4672.42
15	CFQB-01	4351.50	abcd	4324.47	4478.37
10	CFQA-06	4243.20	abcde	3965.25	4521.15
21	CFQB-07	4204.40	abcdef	3849.90	4558.85
1	CASAVANT	4190.10	abcdef	4171.55	4208.60
12	CFQA-08	4189.10	abcdef	4001.50	4376.75
17	CFQB-03	4155.10	bcdefg	3767.75	4542.40
14	CFQA-10	4136.40	bcdefg	4076.57	4196.21
4	CFQ-03	4136.10	bcdefg	3916.25	4355.87
5	CFQA-01	4091.20	bcdefgh	3803.80	4213.80
9	CFQA-05	4070.70	cdefgh	3530.70	4611.10
19	CFQB-05	4067	cdefgh	4070.40	4063.55
13	CFQA-09	4040.20	cdefgh	3843.12	4237.25
6	CFQA-02	3921.90	defghi	3611.05	4232.75
7	CFQA-03	3915.80	defghi	3485.45	4346.10
11	CFQA-07	3909.70	defghi	3901.35	3918.07
3	CFQ-02	3898.80	defghi	3720.75	4077.02
20	CFQB-06	3861.10	efghi	3831.82	3890.27
25	HY-320	3807.60	efghij	3947.07	3912.92
26	CFQD-01	3799.10	efghij	3789.92	3808.20
31	MAX	3746.60	fghijk	3476.80	4016.47
8	CFQA-04	3724.60	fghijk	3453.22	3995.95
16	CFQB-02	3659	hijk	3322.40	3995.62
27	CFQD-02	3553.90	ijk	3400.92	3706.97
29	COLOMBUS	3409.30	jk	3331.55	3487.12
2	CFQ-01	3395.70	jk	2791.87	3999.57
30	KATEPWA	3320.20	k	3115.52	3524.80
32	ROBLIN	3128.40	k	2936.37	3320.47
28	SINTON	3107	k	3006.87	3137.32
33	CFQE-01	2630.70	l	2076.37	3184.95

TABLE Q-03 Summary of results from trial Coop-01 Cultivar * Management (cont'd)

	TKW	KGHL	HEADING
1 Conv	35.07 a	76.06 a	55.78 a
2 ICM	35.49 a	76.16 a	56.50 a
22 CFQB-08	35.30 cdefg	78.04 abcd	58.63 abc
18 CFQB-04	34.45 defg	75.79 gh	58.88 ab
23 CFQB-09	35.94 cdef	77.49 bcde	59 ab
24 CFQC-01	34.51 defg	78.65 ab	57.75 abcd
15 CFQB-01	38.05 bcd	75.05 hij	57.13 bcdef
10 CFQA-06	37.45 bcde	76.76 efg	54.50 defgh
21 CFQB-07	34.90 defg	75.31 hij	56.88 bcdefg
1 CASAVANT	32.58 efg	77.38 abcde	59.75 ab
12 CFQA-08	35.79 cdef	75.70 hij	58.13 abcd
17 CFQB-03	36.64 cde	75.14 hij	57.25 bcdef
14 CFQA-10	37.84 bcd	74.55 ijk	58.25 abcd
4 CFQ-03	43.89 a	76.11 fgh	57.25 bcdef
5 CFQA-01	36.81 cde	75.10 hij	56.38 bcdefg
9 CFQA-05	33.74 defg	75.78 ghi	57.38 abcde
19 CFQB-05	33.24 defg	77.24 cdef	58.13 abcd
13 CFQA-09	30.41 ghi	75.01 hij	53.63 efghi
6 CFQA-02	cde	74.46 jkl	56 bcdefg
7 CFQA-03	37.21 cde	74.26 jkl	56.50 bcdefg
11 CFQA-07	37.80 bcd	76.73 efg	58.63 abc
3 CFQ-02	35.28 cdefg	74.28 jkl	54.88 cdefgh
20 CFQB-06	32.65 efg	77.14 cdef	58.50 abc
25 HY-320	42.09 ab	77.28 cdef	50.38 ij
26 CFQD-01	34.54 defg	78.34 abc	53.38 fghi
31 MAX	34.73 defg	76.85 defg	56 bcdefg
8 CFQA-04	37.88 bcd	75.89 gh	57.25 bcdef
16 CFQB-02	40.29 abc	75.73 ghi	58.75 abc
27 CFQD-02	43.63 a	73.31 l	49.38 j
29 COLOMBUS	27.79 hij	78.84 a	52.25 hij
2 CFQ-01	42.94 a	73.74 kl	61.25 a
30 KATEPWA	25.94 ij	77.76 abcde	49.75 j
32 ROBLIN	25.60 j	73.78 kl	49.63 j
28 SINTON	26.71 hij	76.60 efg	53.25 ghi
33 CFQE-01	31.14 fgh	77.15 cdef	58 abcd
TRA	ns	ns	ns
TRB	**	**	**
TRA*TRB	ns	*	ns
C.V.	11.89	1.38	5.77

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-04 Summary of results from trial Coop-01 Cultivar * Management (cont'd)

	MATURITY		HEIGHT		LODG	
1 Conv	100.38	a	88.88	a	.36	a
2 ICM	100.50	a	86.22	b	.41	a
22 CFQB-08	99.88	cdefghi	96	c	.23	f
18 CFQB-04	99.88	cdefghi	85.75	hijklmn	.33	def
23 CFQB-09	99	defghij	83.13	klmnopq	.20	f
24 CFQC-01	97.38	ijk	90.88	de	.28	def
15 CFQB-01	99.13	defghij	88.13	efghi	.25	ef
10 CFQA-06	98.75	defghijk	88.25	efghi	.38	def
21 CFQB-07	99.63	cdefghi	89.63	defg	.23	f
1 CASAVANT	106	a	104	a	3.20	a
12 CFQA-08	100.75	cdefghi	85.50	ijklmno	.20	f
17 CFQB-03	101.13	bcdefgh	85.88	ghijklm	.20	f
14 CFQA-10	100.63	cdefghi	82.50	lmnopq	.50	cde
4 CFQ-03	104.50	ab	86.13	fghijkl	.20	f
5 CFQA-01	98.13	ghijk	89.50	defgh	.20	f
9 CFQA-05	101	bcdefghi	84	jklmnop	.23	f
19 CFQB-05	99.50	cdefghi	96.88	c	.25	ef
13 CFQA-09	101.88	bcdef	90.50	de	.25	ef
6 CFQA-02	99.75	cdefghi	89.13	defghi	.20	f
7 CFQA-03	97.63	hijk	87.38	efghij	.20	f
11 CFQA-07	103	abc	89.75	def	.20	f
3 CFQ-02	101.38	bcdefg	82.13	nopq	.20	f
20 CFQB-06	102	bcdef	87.88	efghi	.20	f
25 HY-320	106	a	75.50	r	.38	def
26 CFQD-01	95.50	k	92	d	.73	bc
31 MAX	98.38	fghijk	86.63	fghijk	.23	f
8 CFQA-04	100.38	cdefghi	82.25	mnopq	.20	f
16 CFQB-02	102.25	bcde	79.88	q	.20	f
27 CFQD-02	95.88	jk	83.88	jklmnop	.20	f
29 COLOMBUS	99.75	cdefghi	100.50	b	.35	def
2 CFQ-01	101.75	bcdefg	82	opq	.20	f
30 KATEPWA	100	cdefghi	99	bc	.65	bc
32 ROBLIN	102.88	abc	81.63	pq	.20	f
28 SINTON	102.50	bcd	95.88	c	.80	b
33 CFQE-01	98.38	fghijk	67.13	s	.20	f
TRA	ns		**		ns	
TRB	**		**		**	
TRA*TRB	ns		**		ns	
C.V.	2.98		3.66		58.44	

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-05 Summary of results from trial Coop-01 Cultivar * Management (cont'd)

	SEP	TAN SP.
1 Conv	2.30 a	1.64 a
2 ICM	1.18 a	.31 a
22 CFQB-08	1.38 a	1.50 a
18 CFQB-04	1.75 a	.88 a
23 CFQB-09	1.63 a	.50 a
24 CFQC-01	1.38 a	1.13 a
15 CFQB-01	1.50 a	1.50 a
10 CFQA-06	1.50 a	.88 a
21 CFQB-07	1.75 a	1 a
1 CASAVANT	1.38 a	1.13 a
12 CFQA-08	1.88 a	.88 a
17 CFQB-03	2.13 a	1.38 a
14 CFQA-10	1.63 a	1.25 a
4 CFQ-03	1.88 a	1.38 a
5 CFQA-01	1.63 a	1.25 a
9 CFQA-05	1.63 a	1.25 a
19 CFQB-05	1.88 a	1.13 a
13 CFQA-09	2 a	.50 a
6 CFQA-02	1.50 a	.38 a
7 CFQA-03	1.88 a	1.50 a
11 CFQA-07	1.63 a	.63 a
3 CFQ-02	1.75 a	1.13 a
20 CFQB-06	1.88 a	.75 a
25 HY-320	2.11 a	1 a
26 CFQD-01	1.88 a	1.50 a
31 MAX	2 a	1.13 a
8 CFQA-04	1.88 a	1.75 a
16 CFQB-02	1.63 a	1.25 a
27 CFQD-02	1.75 a	.88 a
29 COLOMBUS	1 a	.63 a
2 CFQ-01	2.13 a	.88 a
30 KATEPWA	2 a	0 a
32 ROBLIN	1.88 a	.50 a
28 SINTON	2.29 a	0 a
33 CFQE-01	1.50 a	.63 a
TRA	ns	ns
TRB	ns	ns
TRA*TRB	ns	ns
C.V.	35.75	116.52

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

3.1.1.5 Summary

Management had a significant effect on yield of 33 cultivars. The response was limited by a severe water stress during flowering and filling periods. The cultivars had very different characteristics with the european cultivars having higher yields.

3.1.2 Experiment 02 - Population * Fungicide

3.1.2.1 Objective

Determine the effect of fungicides on spring wheat (cv. Max) at different population levels

3.1.2.2 Treatment list

Factor A

1- 300 seeds / square meter
2- 425 seeds / square meter
3- 550 seeds / square meter
4- 675 seeds / square meter

Factor B

1- Check
2- Tilt ZGS 24 / Tilt ZGS 49-55
3- Dithane M-45 ZGS 47 / Dithane M-45, 7 days later
4- Dithane M-45 ZGS 37 / Dithane M-45 ZGS 47 / Dithane M-45, 7 days later
5- Dithane M-45 ZGS 47 / Tilt ZGS 55

3.1.2.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a gleysol of the Ste-Rosalie series. Because these soils may have a deficient drainage, this farm was tile drained.

The field was plowed the preceeding fall and disked two times in the spring, the last disking incorporating the fertilizer that was applied before planting. The soil analysis was:

- water pH	: 6.4	- buffer pH	: 7.0
- P (Bray II)	: 264	- K (Amm.Ac)	: 423
- Mg (Amm.Ac)	: 597	- CEC	: 21.06
- O.M.	: 1.2%		

Fertilizer was applied prior to planting; 210 Kg/ha of 0-45-0 and 167 kg/ha of 0-0-60 were mixed together and applied on the 25th of april and 196 kg/ha of 46-0-0 were applied on the 27th of april using a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil.

Seeding was done on may 4th, using a Kincaid cone seeder at a depth of 2.5 cm. The cultivar Max was used; the number of seeds per envelope was adjusted according to the germinating power and to the thousand kernel weight. The seeding rates used were:

1- 300 seeds / square meter
2- 425 seeds / square meter
3- 550 seeds / square meter
4- 675 seeds / square meter

Plot size was of 1m * 5m and each treatment was replicated four times in a split-plot design.

The plots were sprayed with a mixture of Pardner (Bromoxynil, 336 gr a.i./ha) and Hoe-grass (Diclofop-methyl, 710 gr a.i./ha) in 275 litres/ha of water, on may 26th at ZGS 12 using a conventional farm sprayer (Hardy), at 5.5 km/hr. There was a second application of herbicides (MCPA 300 gr a.i./ha) needed on the 18th of june at ZGS 32 using the conventional farm sprayer.

The plant growth regulator Cycocel extra (Chlormequat chloride, 240 gr a.i./ha) was applied on june 6th at ZGS 30, using the farm sprayer (Hardy), at 5.5 km/hr. The applications were done 48 cm above the crop and the volume of water used was 275 l/ha. Supplemental nitrogen (265 kg/ha of 34-0-0) was applied on the 6th of june at ZGS 30 using the pneumatic spreader.

The fungicides were applied with a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha. Tilt (Propiconazole, 125 gr a.i./ha) was applied on june 6th at ZGS 30 and again on june 27th at ZGS 47 for treatment 2. It was also applied on july 6th at ZGS 59 for treatment 5. Dithane M-45 (Mancozeb, 1.8 kg a.i./ha) was applied on june 22nd at ZGS 37 for treatment 4, on june 28th at ZGS 49 for treatments 3, 4 and 5, and on july 6th at ZGS 59 for treatments 3 and 4.

Plant counts were done three weeks after planting. Height is the average of the straw length (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 20th using a Kincaid plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads), % protein (Total N (Kejdhall method) * 5.7), sedimentation value (SDS method) and ash content (calcination method) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.1.2.4 Results and discussion

Plant Population

Plant population had a significant effect on thousand kernel weight, heads per square meter and plants per square meter. The decrease in thousand kernel weight is explained by the severe water stress that the plants suffered during the flowering and grain filling periods. As the number of plants increased, there was less water available for each of the plants. The number of heads and plants per square meter was expected to increase with the increased seeding rates.

Fungicides

The fungicides had a significant effect on yield, on thousand kernel weight and on tan spot control. Because the yield responses are quite low, due to the very dry grain filling period, it is impossible to differentiate between fungicides. The fungicide programs that provided with a longer protection period (Tilt/Tilt, Dithane/Dithane/Dithane, Dithane/Tilt) seemed to increase the thousand kernel weight significantly over the check. The fungicides also had a significant effect on tan spot, with the fungicide programs containing Tilt having better success.

TABLE Q-07 Summary of results from trial Coop-02 Population * Fungicide (cont'd)

	LODG	SEP	NEL	TAN SP.
1 300 pl/m	.20 a	5.13 a	1 a	3 a
2 425 pl/m	.20 a	5.40 a	1.27 a	3 a
3 550 pl/m	.20 a	5.13 a	2.13 a	4 a
4 675 pl/m	.20 a	5.27 a	1.40 a	2.87 a
1 Check	.20 a	5.25 a	2.08 a	4.42 a
2 T/T	.20 a	5.42 a	1.42 a	2.08 b
3 D/D	.20 a	5.25 a	.92 a	3.67 a
4 D/D/D	.20 a	4.92 a	.83 a	4.17 a
5 D/T	.20 a	5.33 a	2 a	1.75 b
TRA	ns	ns	ns	ns
TRB	ns	ns	ns	**
TRA*TRB	ns	ns	ns	ns
C.V.	0	12.82	114.19	12.45

	HUM	PROT	% ASH	SDS
1 300 pl/m	13.90 a	17.20 a	2.43 a	68.56 a
2 425 pl/m	13.35 a	17.25 a	2.23 a	61.95 a
3 550 pl/m	13.25 a	17.41 a	2.32 a	61.90 a
4 675 pl/m	13.78 a	17.34 a	2.38 a	69.71 a
1 Check	13.74 a	17.26 a	2.35 a	66.82 a
2 T/T	13.21 b	17.39 a	2.13 a	65.20 a
3 D/D	13.40 b	17.24 a	2.50 a	64.57 a
4 D/D/D	13.74 a	17.28 a	2.38 a	65.29 a
5 D/T	13.74 a	17.31 a	2.33 a	65.77 a
TRA	ns	ns	ns	ns
TRB	**	ns	ns	ns
TRA*TRB	ns	ns	ns	ns
C.V.	3.15	1.37	18.03	8.06

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-06 Summary of results from trial Coop-02 Population * Fungicide

Coop - 02

	YIELD	TKW	HDS/M2	PL/M2
1 300 pl/m	3566.64 a	28.33 a	341.25 c	268.10 c
2 425 pl/m	3581.72 a	27.91 ab	386.45 b	330.15 b
3 550 pl/m	3538.84 a	27.47 bc	393.65 b	355.90 b
4 675 pl/m	3566.69 a	27.27 c	486.05 a	459.30 a
1 Check	3420.59 b	27.18 c	418.62 a	374.94 a
2 T/T	3642.95 a	27.96 ab	377.56 a	329.37 a
3 D/D	3641.54 a	27.41 bc	404.50 a	347 a
4 D/D/D	3529.68 ab	27.99 ab	398.62 a	365.12 a
5 D/T	3582.60 a	28.17 a	409.94 a	350.37 a
TRA	ns	**	**	**
TRB	**	**	ns	ns
TRA*TRB	ns	ns	ns	ns
C.V.	5.32	3.32	15.64	24.88

	KGHL	HEADING	MATURITY	HEIGHT
1 300 pl/m	78.87 a	56.90 a	97.90 a	90.40 a
2 425 pl/m	78.85 a	57.15 a	97.75 a	89.80 a
3 550 pl/m	78.44 a	56.85 a	102.15 a	89 a
4 675 pl/m	78.72 a	56.50 a	97.45 a	88.35 a
1 Check	78.52 a	56.94 a	97.75 a	89.88 a
2 T/T	78.68 a	56.75 a	97.94 a	88.38 a
3 D/D	78.76 a	56.69 a	97.56 a	89.56 a
4 D/D/D	78.86 a	57.06 a	98 a	89.88 a
5 D/T	78.78 a	56.81 a	102.81 a	89.25 a
TRA	ns	ns	ns	ns
TRB	ns	ns	ns	ns
TRA*TRB	ns	ns	ns	ns
C.V.	.54	1.32	8.85	2.34

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

3.1.2.5 Summary

Plant population had no significant effect on all parameters except thousand kernel weight, heads/sq.meter and plants/sq.meter. The fungicides increased yield significantly but the lack of water during the grain filling period limited the yield response.

3.1.3 Experiment 03 - Fertility * Fungicide

3.1.3.1 Objective

Determine the effects of fungicide treatments on spring wheat (cv. Max) at different nitrogen levels.

3.1.3.2 Treatment list

Factor A

ZGS / Treatment	0	30	45	Total
1	0	0	0	0
2	36	48	36	120
3	45	60	45	150
4	54	72	54	180
5	63	84	63	210
6	90	90	0	180

Factor B

1- Check
2- Tilt ZGS 24 / Tilt ZGS 49-55
3- Dithane M-45 ZGS 47 / Dithane M-45, 7 days later
4- Dithane M-45 ZGS 37 / Dithane M-45 ZGS 47 / Dithane M-45, 7 days later
5- Dithane M-45 ZGS 47 / Tilt ZGS 55

3.1.3.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a gleysol of the Ste-Rosalie series. Because these soils may have a deficient drainage, this farm was tile drained.

The field was plowed the preceding fall and disked two times in the spring, the last disking incorporating the fertilizer that was applied before planting. The soil analysis was:

- water pH	6.4	- buffer pH	7.0
- P (Bray II)	264	- K (Amm.Ac)	423
- Mg (Amm.Ac)	597	- CEC	21.06
- O.M.	1.2%		

Fertilizer was applied prior to planting; 210 Kg/ha of 0-45-0 and 167 kg/ha of 0-0-60 were mixed together and applied on the 25th of april using a pneumatic fertilizer spreader (Nodet-Gougis DP-112) at 6 km/hr, 70 cm above the soil.

The nitrogen was added to the plots, using a small plastic container. The fertilizer was mixed with filler and the total amount was divided in two equal parts that were applied to the plots perpendicular to each other to insure good coverage. The ZGS 0 application was done on may 2nd, using 46-0-0 for all treatments. The second application was done on june 9th at ZGS 31; 46-0-0 was used for treatments 2, 3, 4 and 5, while 34-0-0 was used for treatment 6. The third application was done on june 28th at ZGS 47 for treatments 2, 3, 4 and 5, using 34-0-0.

The seeding was done on may 4th with a precision planter (Nodet-Gougis) at a depth of 2.5 cm. The seeding rate was adjusted according to the thousand kernel weight and to the germinating power in order to obtain 425 viable seeds / square meter. The row width was 12 cm. The soil was rolled after planting.

The plots were sprayed with a mixture of Pardner (Bromoxynil, 336 gr a.i./ha) and Hoe-grass (Diclofop-methyl, 710 gr a.i./ha) in 275 litres/ha of water, on may 26th at ZGS 12 using a conventional farm sprayer (Hardy), at 5.5 km/hr. There was a second application of herbicides (MCPA 300 gr a.i./ha) needed on the 18th of june at ZGS 32 using the conventional farm sprayer.

The plant growth regulator Cycocel extra (Chlormequat chloride 240 gr a.i./ha) was applied on june 6th at ZGS 30, using the farm sprayer (Hardy), at 5.5 km/hr. The applications were done 48 cm above the crop and the volume of water used was 275 l/ha.

The fungicides were applied with a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha. Tilt (Propiconazole 125 gr a.i./ha) was applied on june 6th at ZGS 30 and again on july 2nd at ZGS 55 for treatment 2. It was also applied on july 6th at ZGS 59 for treatment 5. Dithane M-45 (Mancozeb 1.8 kg a.i./ha) was applied on june 22nd at ZGS 37 for treatment 4, on july 1st at ZGS 53 for treatments 3, 4 and 5, and on july 6th at ZGS 59 for treatments 3 and 4.

Plant counts were done three weeks after planting. Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 21st using a Kincaid plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads), % protein (Total N (Kejdhall method) * 5.7), sedimentation value (SDS method) and ash content (calcination method) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.1.3.4 Results and discussion

Nitrogen fertility

The progressive increase of the nitrogen levels from 0 to 210 kg/ha had a significant effect on yield with the optimum level situated between 150 and 210 kg/ha. The maximum yield was 3312 kg/ha. The number of heads/sq.meter was increased significantly by nitrogen as it was reported by Rohde (1963); the thousand kernel weight obtained with N=0 was significantly lower than at all the other levels of nitrogen. The height was increased with higher levels of nitrogen. The protein level was also affected significantly by the nitrogen level. The optimum level for protein was situated bet5ween 180 and 210 kg/ha.

Fungicides

The fungicides had a significant effect on yield; the maximum yield increase was of approximately 209 kg/ha. The response to the application of fungicides was affected by low water availability during grain filling period and by a poor control of septoria. The thousand kernel weight and the hectoliter weight were increased by the use of fungicides, although not significantly ($.05 < p < .10$). The control of tan spot was improved significantly by the fungicides; the programs including a late application of Tilt or three applications of Dithane were better than the other treatments. Treatment # 4 increased the ash content and the fungicide treatments decreased the sedimentation values.

TABLE Q-08 Summary of results from trial Coop-03 Nitrogen * Fungicide

Coop - 03

		YIELD	PL/M2	HDS/M2	TKW	KGHL
1	N = 0	1477.24 c	324.25 a	309.75 c	23.81 b	76.09 a
2	N = 120	2979.11 b	347.95 a	417.05 a	26.96 a	77.11 a
3	N = 150	3151.03 ab	327.95 a	420.80 a	26.70 a	77.24 a
4	N = 180	3312.62 a	327.95 a	406.35 a	26.72 a	77.67 a
5	N = 210	3270.97 a	336.20 a	366.55 b	26.57 a	77.39 a
6	N = 180	3222.75	322.25 a	389.15 ab	26.79 a	77.28 a
1	Check	2790.60 b	342.67 a	305.62 a	25.53 b	76.86 b
2	T/T	2897.08 ab	327.08 a	389.17 a	26.31 ab	77.13 ab
3	D/D	2891.26 ab	333.92 a	379.25 a	26.45 a	77.31 ab
4	D/D/D	2933.02 ab	318.04 a	379.58 a	26.34 ab	77.12 ab
5	D/T	2999.47 a	333.75 a	391.08 a	26.65 a	77.59 a
	TRA	**	ns	**	**	ns
	TRB	ns	ns	ns	ns	ns
	TRA*TRB	ns	ns	ns	ns	ns
	C.V.	9.87	14.06	12.52	5.13	1.13

		HEADING	MATURITY	HEIGHT	LODG	HUM
1	N = 0	57.40 a	104.10 a	60.05 e	.20 a	11.02 a
2	N = 120	55.90 a	102.60 a	76.65 d	.20 a	11.28 a
3	N = 150	54.80 a	103.85 a	78.80 c	.20 a	11.06 a
4	N = 180	56.35 a	102.80 a	80.80 b	.20 a	11.54 a
5	N = 210	52.25 a	102.85 a	80.70 b	.21 a	11.40 a
6	N = 180	55.45 a	103.40 a	82.70 a	.21 a	11.47 a
1	Check	56.38 a	104.33 a	75.58 a	.20 a	11.02 a
2	T/T	56.38 a	102.54 a	76.75 a	.20 a	11.27 a
3	D/D	56.33 a	104.04 a	77.13 a	.21 a	11.43 a
4	D/D/D	55.75 a	102.38 a	76.54 a	.20 a	11.31 a
5	D/T	55.29 a	103.04 a	77.08 a	.21 a	11.43 a
	TRA	ns	ns	**	ns	ns
	TRB	ns	ns	ns	ns	ns
	TRA*TRB	ns	ns	ns	ns	ns
	C.V.	5.25	3.44	3.85	12.70	5.05

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-09 Summary of results from trial Coop-03 Nitrogen * Fungicide (cont'd)

		SEP	TAN SP.	PROT	% ASH	SDS
1	N = 0	4.67 a	2.07 a	15.33 c	2.44 a	64.25 a
2	N = 120	5.13 a	2.67 a	15.65 c	2.34 a	60.81 a
3	N = 150	4.27 a	2.55 a	16.08 b	2.17 a	61.25 a
4	N = 180	4.87 a	1.87 a	16.52 a	2.22 a	67.99 a
5	N = 210	4.60 a	1.60 a	16.44 a	2.12 a	61.35 a
6	N = 180	4.93 a	1.67 a	16.23 a	2.25 a	63.18 a
1	Check	5.06 a	4.83 a	15.99 a	2.25 b	65.70 a
2	T/T	4.89 a	1.72 b	16.18 a	2.16 b	62.36 b
3	D/D	4.61 a	1.72 b	15.94 a	2.23 b	62.61 b
4	D/D/D	4.56 a	1.44 bc	16.10 a	2.44 a	62.39 b
5	D/T	4.61 a	.61 c	15.98 a	2.20 b	62.55 b
	TRA	ns	ns	*	ns	ns
	TRB	ns	**	ns	*	*
	TRA*TRB	ns	ns	ns	ns	ns
	C.V.	13.24	70.58	12.45	13.01	6.11

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

3.1.3.5 Summary

Increasing nitrogen levels increased yield, thousand kernel weight, height and protein content significantly, the optimum level for yield situated between 150 and 210 kg/ha and the optimum level for protein situated between 180 and 210 kg/ha. The fungicides increased yield, thousand kernel weight and hectoliter weight significantly. The fungicide programs including a late application of Tilt or three application of Dithane were better in controlling tan spot.

3.1.4 Experiment 04 Population * Fertility

3.1.4.1 Objective

Determine the effect of different levels of nitrogen, using different nitrogen sources and different timing of applications, at different plant populations.

3.1.4.2 Treatment list

Factor A

1- 300 seeds / square meter
2- 425 seeds / square meter
3- 550 seeds / square meter

Factor B

ZGS / Treatment	0	30	45	Total	Source
1	40	80	0	0	
2	36	48	36	120	Urea
3	36	48	36	120	Nitrate
4	84	36	0	120	Urea
5	84	36	0	120	Nitrate
6	120	0	0	120	Urea
7	120	0	0	120	Nitrate
8	45	60	45	150	Urea
9	45	60	45	150	Nitrate
10	105	45	0	150	Urea
11	105	45	0	150	Nitrate
12	150	0	0	150	Urea
13	150	0	0	150	Nitrate
14	54	72	54	180	Urea
15	54	72	54	180	Nitrate
16	126	54	0	180	Urea
17	126	54	0	180	Nitrate
18	180	0	0	180	Urea
19	180	0	0	180	Nitrate
20	63	84	63	210	Urea
21	63	84	63	210	Nitrate
22	147	63	0	210	Urea
23	147	63	0	210	Nitrate
24	210	0	0	210	Urea
25	210	0	0	210	Nitrate
26	75 (u)	75 (n)	0	150	
27	75 (u)	75 (u)	0	150	

3.1.4.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a gleysol of the Ste-Rosalie series. Because these soils may have a deficient drainage, this farm was tile drained.

The field was plowed the preceeding fall and disked two times in the spring, the last disking incorporating the fertilizer that was applied before planting. The soil analysis was:

- water pH	: 6.4	- buffer pH	: 7.0
- P (Bray II)	: 264	- K (Amm.Ac)	: 423
- Mg (Amm.Ac)	: 597	- CEC	: 21.06
- O.M.	: 1.2%		

Fertilizer was applied prior to planting; 210 Kg/ha of 0-45-0 and 167 kg/ha of 0-0-60 were mixed together and applied on the 25th of april and 196 kg/ha of 46-0-0 were applied on the 27th of april using a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil.

Seeding was done on may 4th, using a Kincaid cone seeder at a depth of 2.5 cm. The cultivar Max was used; the number of seeds per envelope was adjusted according to the germinating power and to the thousand kernel weight. The seeding rates used were:

1- 300 seeds / square meter
2- 425 seeds / square meter
3- 550 seeds / square meter

Plot size was of 1m * 5m and each treatment was replicated four times in a split-plot design.

The nitrogen was applied manually using a small plastic container. The fertilizer was mixed with filler and the total amount was divided in two equal parts that were applied to the plots perpendicular to each other to insure good coverage. The levels of nitrogen were 0, 120, 150, 180 and 210 kg/ha. The applications were split in one, two or three applications, at ZGS 0, ZGS 30 and ZGS 45, using either ammonium nitrate (34-0-0) or urea (46-0-0). The ZGS 0 application was done on april 26th, 27th and 28th, The second application was done on june 10th at ZGS 31. The third application was done on june 26th at ZGS 45.

The plots were sprayed with a mixture of Pardner (Bromoxynil 336 gr a.i./ha) and Hoe-grass (Diclofop-methyl 710 gr a.i./ha) in 275 litres/ha of water, on may 26th at ZGS 12 using a conventional farm sprayer (Hardy, TJet 8002, 30 lbs/sq.in. 5.5 km/hr). There was a second application of herbicides (MCPA 300 gr a.i./ha) needed on the 18th of june at ZGS 32 using the conventional farm sprayer.

The plant growth regulator Cycocel extra (Chlormequat chloride 240 gr a.i./ha) was applied on june 6th at ZGS 30. The fungicide Tilt (Propiconazole 125 gr a.i./ha) was applied on june 6th at ZGS 30 and again on july 1st at ZGS 49. using the farm sprayer (Hardy). The applications were done 60 cm above the crop and the volume of water used was 275 l/ha.

Plant counts were done three weeks after planting. Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 20th using a Kincaid plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads), % protein (Total N (Kejdhall method) * 5.7), sedimentation value (SDS method) and ash content (calcination method) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.1.4.4 Results and discussion

Plant population

The plant population had a significant effect on yield. The yield response was small; it was limited by severe water stress. Increasing plant population also decreased significantly the number of kernels per head. The hectoliter weight was affected by the plant population.

Nitrogen fertility

Increasing the nitrogen fertility from 0 to 210 kg/ha increased the yield from 1494 kg/ha to a maximum of 3809 kg/ha, with the optimum level between 180 and 210 kg/ha. Nitrogen also increased height and protein level significantly, with the optimum level at 210 kg/ha. Nitrogen did not have any effect on any other parameter measured.

Timing of application

The timing of the applications of nitrogen had a significant effect on yield, thousand kernel weight, height and protein level. The last application of treatment 3 was done (ZGS 45) in the middle of a very important water stress; this last application was therefore not as efficient as the others. The plots receiving this treatment did not yield as much as the others. This also explains why the number of kernels per head and the height were reduced with this treatment. The thousand kernel weight and the protein level were increased with this late application; as reported in many publications, a late application of nitrogen will increase the thousand kernel weight and the protein level without increasing the yield.

Source of applied nitrogen

The source of the applied nitrogen had a significant effect on number of heads/sq.meter, hectoliter weight, heading date and level of septoria infection. The decrease in the number of heads/sq.meter with the ammonium nitrate may be explained by increased losses of nitrogen during may and the early days of june. This may also explain the difference in heading date and the lower level of septoria.

TABLE Q-10 Summary of results from trial Coop-04 Population * Nitrogen

Coop - 04

	YIELD	PL/M2	HDS/M2	KER/HEAD
1 300 pl/m	3524.39 b	229.99 c	378.90 c	39.16 a
2 425 pl/m	3673.26 a	310.29 b	438.42 b	37.93 b
3 550 pl/m	3663.07 a	377.70 a	481.54 a	36.24 c
1 120 N	3416.48 c	318.51 a	425.32 a	37.36 a
2 150 N	3560.59 b	305.78 a	440.42 a	37.78 a
3 180 N	3702.05 a	304.48 a	431.77 a	37.39 a
4 210 N	3806.79 a	297.47 a	435.68 a	38.58 a
1 1 Appl	3748.09 a	310.70 a	432.52 a	38.31 a
2 2 Appl	3713.09 a	307.46 a	435.71 a	38.33 a
3 3 Appl	3403.24 b	301.28 a	431.78 a	36.68 b
1 46-0-0	3632.11 a	310.23 a	443.23 a	38.19 a
2 34-0-0	3611.72 a	302.82 a	423.43 b	37.37 a
TRA	*	**	**	*
TRB	**	ns	ns	ns
TRC	**	ns	ns	**
TRD	ns	ns	*	ns
TRB*TRC	ns	ns	*	ns
TRB*TRD	ns	ns	ns	ns
TRC*TRD	ns	ns	ns	ns
TRA*TRB	ns	ns	ns	ns
TRA*TRC	ns	ns	ns	ns
TRA*TRD	ns	ns	ns	ns
TRB*TRC*TRD	ns	ns	ns	ns
TRA*TRB*TRC	ns	ns	ns	ns
TRA*TRB*TRD	ns	ns	*	ns
TRA*TRC*TRD	ns	ns	ns	ns
TRA*TRB*TRC*TRD	ns	ns	*	*
C.V.	9.79	16.33	16.76	10.40

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-11 Summary of results from trial Coop-04 Population * Nitrogen (cont'd)

	TKW	KGHL	HEADING	MATURITY
1 300 pl/m	28.02 a	79.10 b	58.18 a	98.25 a
2 425 pl/m	28.29 a	79.32 a	57.67 a	98.67 a
3 550 pl/m	27.31 a	78.79 c	57.34 a	98.33 a
1 120 N	27.80 a	79.13 a	57.69 a	98.11 a
2 150 N	27.93 a	79.00 a	57.68 a	98.28 a
3 180 N	27.78 a	79.06 a	57.78 a	99.35 a
4 210 N	27.99 a	79.08 a	57.77 a	97.93 a
1 1 Appl	27.69 b	79.13 a	57.67 a	98.38 a
2 2 Appl	27.82 b	79 a	57.71 a	97.86 a
3 3 Appl	28.11 a	79.08 a	57.81 a	99 a
1 46-0-0	27.90 a	78.95 b	57.49 a	98.77 a
2 34-0-0	27.85 a	79.18 a	57.97 b	98.06 a
TRA	ns	*	ns	ns
TRB	ns	ns	ns	ns
TRC	**	ns	ns	ns
TRD	ns	**	**	ns
TRB*TRC	ns	ns	ns	ns
TRB*TRD	ns	ns	**	ns
TRC*TRD	ns	ns	ns	ns
TRA*TRB	ns	ns	ns	ns
TRA*TRC	ns	ns	ns	ns
TRA*TRD	*	ns	ns	ns
TRB*TRC*TRD	ns	ns	ns	ns
TRA*TRB*TRC	ns	ns	ns	ns
TRA*TRB*TRD	ns	ns	ns	ns
TRA*TRC*TRD	ns	ns	ns	ns
TRA*TRB*TRC*TRD	ns	ns	ns	ns
C.V.	3.20	.78	1.16	4.77

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-12 Summary of results from trial Coop-04 Population * Nitrogen (cont'd)

	HEIGHT	LODG	HUM	SEP	TAN SP.
1 300 pl/m	84.37 a	.20 a	12.54 a	1.92 a	3.04 a
2 425 pl/m	84.66 a	.20 a	12.44 a	2.15 a	3.31 a
3 550 pl/m	84.02 a	.20 a	12.20 a	2.04 a	3.38 a
1 120 N	81.76 d	.20 a	12.41 a	2.36 a	3.17 a
2 150 N	84.03 c	.20 a	12.34 a	2 a	3.31 a
3 180 N	85.29 b	.20 a	12.45 a	1.89 a	3.19 a
4 210 N	86.31 a	.20 a	12.38 a	1.89 a	3.31 a
1 1 Appl	86.18 a	.20 a	12.33 a	2.13 a	3.19 a
2 2 Appl	85.53 a	.20 a	12.33 a	2.06 a	3.15 a
3 3 Appl	81.38 b	.20 a	12.52 a	1.92 a	3.40 a
1 46-0-0	84.54 a	.20 a	12.39 a	2.28 a	3.28 a
2 34-0-0	84.16 a	.20 a	12.40 a	1.79 b	3.21 a
TRA	ns	ns	ns	ns	ns
TRB	**	ns	ns	ns	ns
TRC	**	ns	ns	ns	ns
TRD	ns	ns	ns	*	ns
TRB*TRC	ns	ns	ns	ns	ns
TRB*TRD	ns	ns	ns	ns	ns
TRC*TRD	ns	ns	ns	ns	ns
TRA*TRB	ns	ns	ns	ns	ns
TRA*TRC	ns	ns	ns	ns	ns
TRA*TRD	ns	ns	ns	ns	ns
TRB*TRC*TRD	*	ns	ns	ns	ns
TRA*TRB*TRC	ns	ns	ns	ns	ns
TRA*TRB*TRD	ns	ns	ns	*	ns
TRA*TRC*TRD	ns	ns	ns	**	ns
TRA*TRB*TRC*TRD	ns	ns	ns	ns	ns
C.V.	3.44	0	7.99	58.61	40.18

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-13 Summary of results from trial Coop-04 Population * Nitrogen (cont'd)

	PROT	% ASH	SDS
1 300 pl/m	15.56 a	2.18 a	64.71 a
2 425 pl/m	15.04 a	2.21 a	57.43 a
3 550 pl/m	15.38 a	2.24 a	61.22 a
1 120 N	14.97 c	2.19 a	60.83 a
2 150 N	15.18 b	2.29 a	61.12 a
3 180 N	15.36 b	2.23 a	61.24 a
4 210 N	15.74 a	2.16 a	61.26 a
1 1 Appl	15.05 c	2.25 a	60.74 a
2 2 Appl	15.22 b	2.19 a	60.80 a
3 3 Appl	15.71 a	2.19 a	61.84 a
1 46-0-0	15.38 a	2.21 a	61.01 a
2 34-0-0	15.27 a	2.21 a	61.24 a
TRA	ns	ns	ns
TRB	**	ns	ns
TRC	**	ns	ns
TRD	ns	ns	ns
TRB*TRC	**	ns	ns
TRB*TRD	ns	ns	ns
TRC*TRD	ns	ns	ns
TRA*TRB	ns	ns	ns
TRA*TRC	ns	ns	ns
TRA*TRD	ns	ns	ns
TRB*TRC*TRD	ns	ns	ns
TRA*TRB*TRC	ns	ns	ns
TRA*TRB*TRD	ns	ns	ns
TRA*TRC*TRD	ns	ns	ns
TRA*TRB*TRC*TRD	ns	ns	ns
C.V.	3.60	18.66	8.39

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-14 Summary of results from trial Coop 04 Population * Fertility

Coop - 04

		YIELD		PL/M2		HDS/M2	
1	300 pl/m	3463.43	a	229.87	c	376.27	c
2	425 pl/m	3577.27	a	310.64	b	434.22	b
3	550 pl/m	3590.74	a	374.46	a	474.59	a
1	N = 0	1494.20	h	291.64	a	304.36	d
2	N120/S3/U	3201.30	fg	318.42	a	455.50	abc
3	N120/S3/N	3153.70	g	309.25	a	406.25	abc
4	N120/S2/U	3561.70	cde	314.67	a	459	abc
5	N120/S2/N	3584.50	cde	322.83	a	444.75	abc
6	N120/S1/U	3527.90	cdef	312.08	a	387.83	c
7	N120/S1/N	3458	defg	328.08	a	398.92	bc
8	N150/S3/U	3468.80	cdefg	296.33	a	416.33	abc
9	N150/S3/N	3296.30	efg	270.42	a	421.92	abc
10	N150/S2/U	3600.10	bcde	328.33	a	464.17	ab
11	N150/S2/N	3610.70	bcde	301.58	a	414.50	abc
12	N150/S1/U	3705.80	bcd	336.17	a	476.25	a
13	N150/S1/N	3681.90	bcd	301.83	a	449.33	abc
14	N180/S3/U	3550.10	cde	307.55	a	465.18	ab
15	N180/S3/N	3313.70	efg	310.33	a	410.58	abc
16	N180/S2/U	3764.90	abcd	293.33	a	416.17	abc
17	N180/S2/N	3819.30	abc	307.45	a	439.36	abc
18	N180/S1/U	3940.90	ab	302.08	a	431.92	abc
19	N180/S1/N	3755.90	abcd	289.77	a	429.69	abc
20	N210/S3/U	3676.70	bcd	301.67	a	459.08	abc
21	N210/S3/N	3577.60	cde	288.50	a	422.17	abc
22	N210/S2/U	3773.90	abcd	297	a	437.08	abc
23	N210/S2/N	3933.70	ab	288.92	a	414.42	abc
24	N210/S1/U	3806.30	abcd	306.58	a	452.08	abc
25	N210/S1/N	4072.50	a	302.17	a	429.25	abc
26	N150/M/UN	3505.60	cdef	308.67	a	431.50	abc
27	N150/M/UU	3685.80	bcd	305.42	a	425.58	abc
	TRA	ns		**		**	
	TRB	**		ns		**	
	TRA*TRB	ns		ns		ns	
	C.V.	10.03		16.64		16.61	

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-15 Summary of results from trial Coop 04 Population * Fertility

Coop 04

		TKW	KGHL	HEADING	MATURITY
1	300 pl/m	27.87 b	79.03 a	58.30 a	98.26 a
2	425 pl/m	28.20 a	79.21 a	57.78 b	98.69 a
3	550 pl/m	27.21 c	78.64 b	57.49 c	98.35 a
1	N = 0	25.25 b	76.49 c	61.17 a	99.33 a
2	N120/S3/U	27.83 a	79.13 ab	57.50 cdefg	98.17 a
3	N120/S3/N	27.78 a	78.95 ab	58 bcde	98.17 a
4	N120/S2/U	27.99 a	79.22 ab	58 bcde	98 a
5	N120/S2/N	27.65 a	79.28 ab	57.58 cdefg	98 a
6	N120/S1/U	27.73 a	79.03 ab	57.50 cdefg	98.17 a
7	N120/S1/N	27.83 a	79.20 ab	57.58 cdefg	98.17 a
8	N150/S3/U	28.21 a	78.74 ab	57.58 cdefg	98.17 a
9	N150/S3/N	28.17 a	79.40 ab	58.17 bc	98.17 a
10	N150/S2/U	27.73 a	78.73 ab	57.08 g	98.33 a
11	N150/S2/N	27.68 a	78.89 ab	57.67 cdefg	98.33 a
12	N150/S1/U	28.07 a	79.08 ab	57.50 cdefg	98.33 a
13	N150/S1/N	27.73 a	79.18 ab	58.15 bcd	98.33 a
14	N180/S3/U	27.90 a	78.93 ab	57.91 bcde	105 a
15	N180/S3/N	28.19 a	79.25 ab	57.75 bcdef	98.33 a
16	N180/S2/U	27.66 a	78.73 ab	57.42 defg	98 a
17	N180/S2/N	27.68 a	78.97 ab	58 bcde	98.33 a
18	N180/S1/U	27.57 a	79.14 ab	57.42 defg	98.17 a
19	N180/S1/N	27.69 a	79.32 ab	58.15 bc	98.77 a
20	N210/S3/U	28.32 a	79.12 ab	57.33 efg	98.33 a
21	N210/S3/N	28.30 a	79.47 a	58.33 b	98.17 a
22	N210/S2/U	28.04 a	78.95 ab	57.50 cdefg	98.33 a
23	N210/S2/N	28.20 a	79.22 ab	58.33 b	95.58 a
24	N210/S1/U	27.61 a	78.56 ab	57.17 fg	98.67 a
25	N210/S1/N	27.49 a	79.18 ab	57.92 bcde	98.50 a
26	N150/M/UN	27.67 a	78.48 b	57.42 defg	98.33 a
27	N150/M/UU	27.69 a	79.23 ab	58 bcde	98 a
	TRA	&	&	&	ns
	TRB	**	**	**	ns
	TRA*TRB	ns	ns	ns	ns
	C.V.	3.41	1.19	1.16	4.49

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

3.1.4.5 Summary

The population had a significant effect on yield and number of kernels per head. Nitrogen increased yield and protein content significantly. The timing of application had a negative effect on yield and a positive effect on thousand kernel weight and protein level. The source had no significant effect on yield but decreased the number of heads/sq.meter, the degree of infection from septoria and delayed heading date.

3.1.5 Experiment 05 Fertility * PGR

3.1.5.1 Objective

To determine the effect of plant growth regulators on spring wheat Max at different nitrogen levels.

3.1.5.2 Treatment list

Factor A

ZGS / Treatment	0	30	45	Total
1	45	60	45	150
2	54	72	54	180
3	63	84	63	210

Factor B

1- Check
2- Cycocel ZGS 30
3- Terpal C ZGS 32-37
4- Cerone ZGS 37-45

3.1.5.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a gleysol of the Ste-Rosalie series. Because these soils may have a deficient drainage, this farm was tile drained.

The field was plowed the preceeding fall and disked two times in the spring, the last disking incorporating the fertilizer that was applied before planting. The soil analysis was:

- water pH	6.4	- buffer pH	7.0
- P (Bray II)	264	- K (Amm.Ac)	423
- Mg (Amm.Ac)	597	- CEC	21.06
- O.M.	1.2%		

Fertilizer was applied prior to planting; 210 Kg/ha of 0-45-0 and 167 kg/ha of 0-0-60 were mixed together and applied on the 25th of april using a pneumatic fertilizer spreader (Nodet-Gougis DP-112) at 6 km/hr, 70 cm above the soil.

The nitrogen was added to the plots, using a small plastic container. The fertilizer was mixed with filler and the total amount was divided in two equal parts that were applied to the plots perpendicular to each other to insure good coverage. The ZGS 0 application was done on may 2nd, using 46-0-0 for all treatments. The second application was done on june 7th at ZGS

3i; 46-0-0 was used for all treatments. The third application was done on june 27th at ZGS 47, using ammonium nitrate for all treatments.

The seeding was done on may 4th with a precision planter (Nodet-Gougis) at a depth of 2.5 cm. The seeding rate was adjusted according to the thousand kernel weight and to the germinating power in order to obtain 425 viable seeds / square meter. The row width was 12 cm. The soil was rolled after planting.

The plots were sprayed with a mixture of Pardner (Bromoxynil 336 gr a.i./ha) and Hoe-grass (Diclofop-methyl 710 gr a.i./ha) in 275 litres/ha of water, on may 26th at ZGS 12 using a conventional farm sprayer (Hardy), at 5.5 km/hr. There was a second application of herbicides (MCPA 300 gr a.i./ha) needed on the 18th of june at ZGS 32 using the conventional farm sprayer.

The fungicide Tilt (Propiconazole 125 gr a.i./ha) was applied at ZGS 30 on june 6th and at ZGS 49-50 on july 1st, using a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha.

The plant growth regulators were applied with a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha. Cycocel extra (Chlormequat chloride 360 gr a.i./ha) was applied on june 6th at ZGS 30 on plots receiving treatment 2; Terpal C (Chlormequat chloride 345 gr a.i./ha & Etephon 172.5 gr a.i./ha) was applied at ZGS 37 on plots receiving treatment 3 and Cerone (Etephon 360 gr a.i./ha) was applied at ZGS 39 on june 22nd on plots receiving treatment 4.

Plant counts were done three weeks after planting. Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 21st using a Kincaid plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads), % protein (Total N (Kejdhall method) * 5.7), sedimentation value (SDS method) and ash content (calcination method) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.1.5.4 Results and discussion

Nitrogen level

Increasing the nitrogen levels from 150 to 210 kg/ha had a significant effect on heading date. All the other parameters measured did not change with the nitrogen levels. This is explained by the very important drought sufferd by the crop during flowering and grain filling periods.

Plant growth regulator

The plant growth regulators had a significant effect on the thousand kernel weight, the hectoliter weight, the heading date, the maturity date and the height of the plants. Terpal C decreased the thousand kernel weight; Terpal C and Cycocel both reduced the hectoliter weight. Cerone was significantly different from the other treatments and did not decrease the hectoliter weight or the thousand kernel weight. Terpal C reduced the height of the plants the most.

TABLE Q-16 Summary of results from trial Coop-05 Nitrogen * PGR

Coop - 05

	YIELD	PL/M2	HDS/M2	TKW	KGHL
1 N = 150	2910.29 a	383.44 a	423.81 a	28.63 a	79.65 a
2 N = 180	3007.31 a	392.37 a	443.94 a	27.81 a	79.63 a
3 N = 210	2951.71 a	388.69 a	432.06 a	27.86 a	79.81 a
1 Check	2910.78 a	391.42 a	424.08 a	28.61 a	79.84 ab
2 CCC	3038.21 a	384.25 a	449.25 a	28.23 a	79.59 bc
3 Terpal C	2949.62 a	394.67 a	429.83 a	26.78 b	79.18 bc
4 Cerone	2927.15 a	382.33 a	429.92 a	28.78 a	80.16 a
TRA	ns	ns	ns	ns	ns
TRB	ns	ns	ns	**	**
TRA*TRB	ns	ns	ns	ns	ns
C.V.	5.70	7.82	11.14	4.67	.75

	HEADING	MATURITY	HEIGHT	LODG	HUM
1 N = 150	57.33 b	97.17 a	79.50 a	.20 a	13.13 a
2 N = 180	57.58 ab	97.67 a	79.75 a	.20 a	12.89 a
3 N = 210	57.92 a	97.92 a	81.08 a	.28 a	12.94 a
1 Check	57 b	97.38 ab	85.63 a	.20 a	13.29 a
2 CCC	57.63 a	98.13 a	80.63 b	.20 a	12.94 a
3 Terpal C	57.90 a	98.20 a	74.40 c	.30 a	12.73 a
4 Cerone	57.80 a	96.70 b	81 b	.20 a	13.04 a
TRA	ns	ns	ns	ns	ns
TRB	*	**	**	ns	ns
TRA*TRB	ns	ns	ns	ns	ns
C.V.	1.00	.93	2.08	56.68	4.23

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

TABLE Q-17 Summary of results from trial Coop-05 Nitrogen * PGR (cont'd)

	PROT	% ASH	SDS
1 N = 150	15.58 a	2.10 a	59.13 a
2 N = 180	15.81 a	1.95 a	57.79 a
3 N = 210	16.08 a	2.25 a	59.98 a
1 Check	15.76 a	2.11 a	58.18 b
2 CCC	15.80 a	2.08 a	59.93 ab
3 Terpal C	15.83 a	2.15 a	60.34 a
4 Cerone	15.90 a	2.08 a	57.84 b
TRA	ns	ns	ns
TRB	ns	ns	*
TRA*TRB	ns	ns	ns
C.V.	1.37	9.13	3.43

(Means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

3.1.5.5 Summary

Nitrogen levels had no significant effect on all parameters measured. The severe water stresses reduced the possible differences between treatments. The plant growth regulators had, except for Cerone, negative effects on thousand kernel weight and hectoliter weight. As expected, the plant growth regulators delayed the heading date but not the maturity date. Height was significantly reduced but there was no lodging.

3.2 Winter wheat

3.2.1 Experiment 11 Cultivar * Management

3.2.1.1 Objective

Determine the effect of management (conventional vs intensive) on different cultivars of winter wheat.

3.2.1.2 Treatment list

Factor A

1- Conventional management

```
- population density ==> 325 viable seeds / m2
- row width          ==> 12 cm
- fertility          ==> 18-90-90 à ZGS 0
                         85-0-0   à ZGS 13
- herbicides         ==> Buctril M à ZGS 31
```

2- Intensive management

```
- population density ==> 450 viable seeds / m2
- row width          ==> 12 cm
- fertility          ==> 18-90-90 à ZGS 0
                         85-0-0   à ZGS 13
                         55-0-0   à ZGS 30
                         55-0-0   à ZGS 49

- herbicides         ==> Buctril M à ZGS 31
- fungicides         ==> Bayleton à ZGS 30
                         Tilt à ZGS 49
- PGR                ==> Cycocel extra à ZGS 30
```

Factor B

1 Dolomite	9 Absolvent	17 Odessa
2 Tukan	10 Monopol	18 CFQ87-G1
3 Disponent	11 CFQ87-H4	19 CFQ87-G2
4 Perlo	12 CFQ87-H5	20 CFQ87-G3
5 Karat	13 CFQ87-H6	21 CFQ87-G4
6 CFQ87-H1	14 CFQ87-H7	22 Danko
7 CFQ87-H2	15 CFQ87-H8	23 Norstar
8 CFQ87-H3	16 CFQ87-H9	

3.2.1.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a clay-loam of the Bedford series. These soils have a good to very good drainage; the topography is undulating and there are some rocks present, but not enough to affect the agriculture. The field where the trials were held was not tile drained but had a very good surface drainage; the field is also surrounded by woods on two sides.

The field was disked two times, the last disking incorporating the fertilizer that was applied before planting. The fertilizer applied prior to planting was 300 Kg/ha of 6-30-30 on the 15th of september using a conventional fertilizer spreader. The previous crop was barley.

Twenty three winter wheat cultivars were seeded on september 18th 1986, using a Kincaid cone seeder at a depth of 2.5 cm. The row width was 12 cm. The number of seeds per envelope was adjusted according to the thousand kernel weight and to the germinating power of each cultivar. The seeding rate were 325 viable seeds and 450 viable seeds per square meter for the conventional and the intensive management respectively. Plot size was of 1m * 5m and each treatment was replicated four times in a split-block design.

All the plots received an additional 85 kg/ha of nitrogen (186 kg/ha 46-0-0) on april 15th at ZGS 13, using a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil. They were also sprayed with Buctril M (Bromoxynil 280 gr a.i./ha & MCPA 280 gr a.i./ha) in 275 litres/ha of water, on may 4th at ZGS 31 using a conventional farm sprayer (Hardy), at 5.5 km/hr.

The ICM plots received supplemental treatments of nitrogen and were sprayed with fungicides and plant growth regulators. The supplemental nitrogen was applied on two occasions, the first consisting of 81 kg/ha of nitrogen at ZGS 30 (120 kg/ha of 46-0-0) on the 25th of april, and the second consisting of 55 kg/ha of nitrogen at ZGS 49 (162 kg/ha of 34-0-0) on the 5th of june, using the pneumatic spreader.

Two applications of fungicides were necessary. The first fungicide applied was Bayleton 50W (Triadimefon 175 gr a.i./ha) at ZGS 30 on april 25th. The second fungicide was Tilt (Propiconazole 125 gr a.i./ha) and it was applied at ZGS 49 on june 5th. The fungicides were applied in 275 l/ha of water 60 cm above the crop with a conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr).

The plant growth regulator Cycocel extra (Chlormequat chloride 1200 gr a.i./ha) was applied on april 25th at ZGS 30, using the conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr).

Plant counts were done in early may; only one plot was winterkilled. Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between may 1st and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between may 1st and ZGS 90 for 80% of the grains.

The plots were harvested on august 14th using a cutter and a stationnery plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.2.1.4 Results and discussion

Management

Management had a significant effect on yield, thousand kernel weight, height and mildew infection. The increase in yield is explained by a higher nitrogen fertility and by the use of fungicides and plant growth regulators. The increase in thousand kernel weight and hectoliter weight can be explained by added nitrogen and also by a late application of nitrogen which may increase these two parameters. The decrease in mildew infection is explained by the utilization of fungicides. The fungicides used were not able to significantly reduce the levels of the other diseases present.

Cultivars

There were significant differences in all parameters measured, except tan spot. The top wheat yield of 6414 kg/ha, was obtained with the cultivar Odessa, an unlicensed cultivar from Europe. The top yield of 8439 kg/ha was obtained with the rye cultivar Danko. The cultivars responded differently to management with the best response to management obtained with the cultivar CFQ87-G1 at 2567 kg/ha and the lowest with the cultivar CFQ87-H7 at -135 kg/ha. The earliest cultivars were from Europe; the cultivar

Norstar was in the latest group. The differences in maturity were significant but minimal. The height varied with the cultivar Norstar being the tallest at 110 cm and the cultivar CFQ87-G3 being the shortest. Lodging and susceptibility to diseases varied with the genetic material.

TABLE Q-18 Summary of results from trial Coop-11 Cultivar * Management

Coop 11

	YIELD		TKW		KGHL	
1 CONV	4797.50	a	31.01	a	69.02	a
2 ICM	5806.70	b	33.11	b	70.88	a
22 DANKO	8438.60	a	31.94	efgh	72.05	cde
17 FR-ODESSA	6413.70	b	38.90	a	76.03	a
16 CFQ87-H9	6403.20	b	33.85	bcde	73.71	abcd
7 CFQ87-H2	6269.10	bc	36.33	ab	74.51	abc
3 Disponent	6147.80	bcd	31.20	efghi	68.65	fg
5 Karat	5848.70	bcde	33.41	cdef	75.21	ab
9 Absolvent	5739.60	bcdef	36.42	ab	74.06	abc
4 Perlo	5732.60	bcdef	31.88	efgh	70.90	def
6 CFQ87-H1	5660.40	bcdef	34.94	bcd	69.73	efg
2 Tukan	5493.20	cdef	33.74	bcdef	70.81	ef
12 CFQ87-H5	5436.60	defg	32.11	efg	72.39	bcde
8 CFQ87-H3	5242.30	efgh	32.34	defg	71.14	def
1 Dolomite	5054.80	fghi	29.11	hi	68.33	fg
15 CFQ87-H8	5034.10	fghi	29.13	hi	64.15	h
21 CFQ87-B4	4695.80	ghij	31.69	efgh	64.31	h
13 CFQ87-H6	4576	hij	30.96	efghi	70.38	ef
14 CFQ87-H7	4556.40	hij	31.58	efgh	67.34	g
10 Monopol	4427.60	ij	30.86	fghi	70.55	ef
11 CFQ87-H4	4396.60	ij	35.19	bc	69.44	efg
19 CFQ87-B2	4201	j	30.19	ghi	64.61	h
20 CFQ87-B3	4182.30	j	27		63.15	h
23 NORSTAR	4069.30	j	28.45	i	75.73	a
18 CFQ87-B1	4013	j	26.54		61.88	h
TRA	**		*		ns	
TRB	**		**		**	
TRA*TRB	*		ns		**	
C.V.	12.89		7.77		3.64	

TABLE Q-19 Effect of management on yield response of cultivars

Coop 11

	Average		Conv	ICM
22 DANKO	8438.60	a	8371.52	8505.70
17 FR-ODESSA	6413.70	b	5888.35	7114.06
16 CFQ87-H9	6403.20	b	6134.40	6671.92
7 CFQ87-H2	6269.10	bc	5430.77	7107.35
3 Disponent	6147.80	bcd	5902.77	6392.80
5 Karat	5848.70	bcde	4951.92	6745.37
9 Absolvent	5739.60	bcdef	4972.70	6353.06
4 Perlo	5732.60	bcdef	5253.55	6211.70
6 CFQ87-H1	5660.40	bcdef	5330.17	5990.55
2 Tukan	5493.20	cdef	5335.60	5650.80
12 CFQ87-H5	5436.60	defg	5145.47	5727.70
8 CFQ87-H3	5242.30	efgh	4737.62	5746.97
1 Dolomite	5054.80	fghi	4472.62	5637.00
15 CFQ87-H8	5034.10	fghi	4551.97	5516.12
21 CFQ87-G4	4695.80	ghij	3935.85	5455.75
13 CFQ87-H6	4576	hij	4330.40	4821.60
14 CFQ87-H7	4556.40	hij	4632.45	4480.37
10 Monopol	4427.60	ij	3806.72	5048.37
11 CFQ87-H4	4396.60	ij	3496.92	5296.20
19 CFQ87-G2	4201	j	3928.32	4473.72
20 CFQ87-G3	4182.30	j	3753.57	4611.02
23 NORSTAR	4069.30	j	3249.72	4888.80
18 CFQ87-G1	4013	j	2729.10	5296.95

TABLE Q-20 Summary of results from trial Coop-11 Cultivar * Management (cont'd)

	HEADING		MATURITY		HEIGHT	
1 CONV	35.20	a	84.45	a	93.55	a
2 ICM	35.29	a	84.47	a	88.10	b
22 DANKO	30.38	i	82	g	117.63	a
17 FR-ODESSA	32.86	fghi	84	ef	93.86	d
16 CFQ87-H9	35.75	bcdef	84.88	bc	90.63	def
7 CFQ87-H2	34.50	defgh	84.38	de	100.13	c
3 Disponent	36.75	bcde	84.75	cd	86.75	fgh
5 Karat	34	defgh	84.13	e	102.38	c
9 Absolvent	35.44	ghi	84.11	e	86.89	fgh
4 Perlo	34.13	defgh	84.25	e	99.63	c
6 CFQ87-H1	36.63	bcde	84.75	cd	80.63	ij
2 Tukan	37.75	abc	85.13	bc	91.88	de
12 CFQ87-H5	37	bcd	84.75	cd	84	hij
8 CFQ87-H3	33.38	fgh	84	ef	90	def
1 Dolomite	34.88	cdefg	84.38	de	84.88	ghi
15 CFQ87-H8	37.50	abc	85	bc	86.88	fgh
21 CFQ87-G4	33.50	fgh	84.13	e	81.88	ij
13 CFQ87-H6	36.88	bcde	85	bc	93.75	d
14 CFQ87-H7	40.25	a	86	a	89.13	efg
10 Monopol	38.38	ab	85.25	b	90.13	def
11 CFQ87-H4	36.88	bcde	84.88	bc	92.63	de
19 CFQ87-G2	33.38	fgh	84.13	e	79.75	j
20 CFQ87-G3	31.88	hi	83.63	f	74	k
23 NORSTAR	38.25	ab	85	bc	110	b
18 CFQ87-G1	33.38	fgh	84	ef	82.50	hij
TRA	ns		ns		**	
TRB	**		**		**	
TRA*TRB	ns		ns		ns	
C.V.	7.07		.41		4.40	

TABLE Q-21 Summary of results from trial Coop-11 Cultivar * Management (cont'd)

	LODG		MILDEW		SEPT	
1 CONV	3.75	a	3.57	a	4.85	a
2 ICM	3.46	a	.48	b	3.33	a
22 DANKO	3.28	efgh	0	i	3.25	bcde
17 FR-ODESSA	3.86	cdefg	0	i	3.75	abcde
16 CFQ87-H9	2.70	ghi	2.25	def	2.75	de
7 CFQ87-H2	3.20	efgh	.25	hi	4	abcde
3 Disponent	3.08	efgh	.75	ghi	3	cde
5 Karat	3.75	cdefg	.75	ghi	5.50	ab
9 Absolvent	4.76	bc	3.75	bc	5.25	abc
4 Perlo	3.30	efgh	2.25	def	4.75	abcde
6 CFQ87-H1	2.25	hi	1.50	fgh	2.50	e
2 Tukan	2.75	ghi	2.50	cdef	3.50	abcde
12 CFQ87-H5	1.50	i	3.25	bcd	3.50	abcde
8 CFQ87-H3	4.30	cdef	0	i	5.75	a
1 Dolomite	2.80	ghi	3	bcde	4	abcde
15 CFQ87-H8	3.35	defgh	1.75	efg	3.25	bcde
21 CFQ87-G4	5.83	b	0	i	4	abcde
13 CFQ87-H6	2.63	ghi	3.25	bcd	4.25	abcde
14 CFQ87-H7	1.45	i	0	i	3.25	bcde
10 Monopol	2.83	ghi	4	ab	4.50	abcde
11 CFQ87-H4	2.98	fgh	3	bcde	4.50	abcde
19 CFQ87-G2	4.98	bc	2.50	cdef	4.50	abcde
20 CFQ87-G3	8.15	a	3	bcde	4.75	abcde
23 NORSTAR	4.43	cde	5.25	a	4.50	abcde
18 CFQ87-G1	4.70	bcd	3.50	bcd	5	abcd
TRA	ns		**		ns	
TRB	**		**		*	
TRA*TRB	*		**		ns	
C.V.	33.56		42.78		33.87	

TABLE Q-22 Summary of results from trial Coop-11 Cultivar * Management (cont'd)

	HEL	TAN SP.
1 CONV	2.22 a	2.48 a
2 ICM	1.33 a	.46 a
22 DANKO	3.25 ab	2.25 ab
17 FR-ODESSA	2.50 ab	0 b
16 CFQ87-H9	1.50 ab	0 b
7 CFQ87-H2	1 ab	1.25 ab
3 Disponent	2.50 ab	2.50 ab
5 Karat	.75 ab	0 b
9 Absolvent	.50 ab	1.50 ab
4 Perlo	0 b	1.50 ab
6 CFQ87-H1	3.25 ab	2.50 ab
2 Tukan	2.50 ab	1.25 ab
12 CFQ87-H5	.25 ab	1.75 ab
8 CFQ87-H3	0 b	1 ab
1 Dolomite	.25 b	1.50 ab
15 CFQ87-H8	2 ab	2.75 ab
21 CFQ87-G4	0 b	2.50 ab
13 CFQ87-H6	2.75 ab	0 b
14 CFQ87-H7	3 ab	3.50 a
10 Monopol	4 a	.75 ab
11 CFQ87-H4	1.75 ab	1.25 ab
19 CFQ87-G2	1.50 ab	2.50 ab
20 CFQ87-G3	3.25 ab	1.50 ab
23 NORSTAR	3.25 ab	.50 b
18 CFQ87-G1	1 ab	1.50 ab
TRA	ns	ns
TRB	**	ns
TRA*TRB	ns	ns
C.V.	120.58	112.95

3.2.1.5 Summary

Management had a significant effect on yield of winter wheat cultivars. The yield responses varied from -135 kg/ha to 2567 kg/ha. The cultivars were very different in all parameters measured except tan spot.

3.2.2 Experiment 12 Fungicides * Population

3.2.2.1 Objective

To determine the effect of different fungicide programs on winter wheat (cv. Monopol) at three population levels.

3.2.2.2 Treatment list

Factor A

1- 300 seeds / square meter
2- 425 seeds / square meter
3- 550 seeds / square meter

Factor B

1- Check
2- Bayleton ZGS 30
3- Bayleton ZGS 30 / Tilt + Bravo ZGS 45
4- Dithane M-45 ZGS 45 / Dithane M-45, 7 days later
5- Bayleton ZGS 30 / Dithane M-45 ZGS 47 / Dithane M-45, 7 days later

3.2.2.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a clay-loam of the Bedford series. These soils have a good to very good drainage; the topography is undulating and there are some rocks present, but not enough to affect the agriculture. The field where the trials were held was not tile drained but had a very good surface drainage; the field is also surrounded by woods on two sides.

The field was disked two times, the last disking incorporating the fertilizer that was applied before planting. The fertilizer applied prior to planting was 300 Kg/ha of 6-30-30 on the 15th of september using a conventional fertilizer spreader. The previous crop was barley.

The winter wheat cultivar Monopol was seeded on september 18th with a precision planter (Nodet-Gougis) at a depth of 2.5 cm. The seeding rate was adjusted according to the thousand kernel weight and to the germinating power in order to obtain 300, 425 and 550 viable seeds / square meter. The row width was 12 cm. The soil was rolled after planting. Plot size was of 1m * 5m and each treatment was replicated four times in a split-block design.

All the plots received an additional 81 kg/ha of nitrogen (176 kg/ha 46-0-0) on april 15th at ZGS 13, 55 kg/ha of nitrogen at ZGS 30 (120 kg/ha of 46-0-0) on the 25th of april, and another 55 kg/ha of nitrogen at ZGS 49 (162 kg/ha of 34-0-0) on the 5th of june, using a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil. They were also sprayed with Buctril M (Bromoxynil 280 gr a.i./ha & MCPA 280 gr a.i./ha) in 275 litres/ha of water, on may 4th at ZGS 31 using a conventional farm sprayer (Hardy), at 5.5 km/hr.

The plant growth regulator Cycocel extra (Chlormequat chloride 1200 gr a.i./ha) was applied on april 25th at ZGS 30, using the conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr).

The first fungicide applied was Bayleton 50W (Triadimefon 175 gr a.i./ha) at ZGS 30 on april 25th, for all plots receiving treatments 2, 3 and 5. Dithane M-45 (Mancozeb 1,800 gr a.i./ha) was applied at ZGS 59 on june 10th for plots receiving treatments 4 and 5. The fungicide Tilt (Propiconazole 125 gr a.i./ha) was applied at ZGS 59 mixed with Bravo (Chlorothalonil 875 gr a.i./ha) on june 10th for the plots receiving treatment 3. The last application of Dithane M-45 (Mancozeb 1,800 gr a.i./ha) was done at ZGS 65 on june 15th for plots receiving treatments 4 and 5. The fungicides were applied in 275 l/ha of water 60 cm above the crop with a conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr).

Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 12th using a cutter and a stationnery plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.2.2.4 Results and discussion

Plant population

Plant population had no significant effect on all parameters measured except on lodging. The increase in population increased lodging. This can be explained by higher disease pressure in the canopy, causing higher lodging.

Fungicide

The fungicide programs had a significant effect on thousand kernel weight, lodging and mildew and septoria ratings. The fungicide programs including a product which has an effect on head diseases had better results than the other fungicide programs on the thousand kernel weight. The lodging ratings were reduced with an application of Bayleton followed by another application of fungicides as in treatments 3 and 5. Mildew was reduced with those treatments containing Bayleton and septoria was reduced with the treatments containing Tilt.

TABLE Q-23 Summary of results from trial Coop-12 Population * Fungicide

Coop 12

	YIELD	TKW	KGHL	HEADING	MATURITY
1 300 PL/M2	2784.90 a	29.99 a	72.01 a	40.05 a	85 a
2 425 PL/M2	2853.70 a	31.16 a	71.69 a	39.75 a	85 a
3 550 PL/M2	3413.80 a	32.04 a	73.75 a	38.55 b	85 a
1 CHECK	2834.40 a	29.95 c	71.43 a	39.58 a	85 a
2 B	2789.60 a	29.77 c	70.68 a	39.67 a	85 a
3 B/ T-B	3590.30 a	33.04 a	74.46 a	38.17 a	85 a
4 D/D + D	3011.70 a	31.79 ab	73.68 a	39.17 a	85 a
5 B/D + D	2861.40 a	30.80 bc	72.17 a	40.67 a	85 a
TRA	ns	ns	ns	*	ns
TRB	ns	*	ns	ns	ns
TRA*TRB	ns	ns	ns	ns	ns
C.V.	17.49	6.32	1.87	2.77	0

	HEIGHT	LODG	HUM	MILDEW	SEP	SPOT BL.
1 300 PL/M2	84.45 a	5.41 b	13.10 a	5.95 a	4.70 a	3.65 a
2 425 PL/M2	85.65 a	6.43 a	13.31 a	6.15 a	4.75 a	3.65 a
3 550 PL/M2	84.80 a	6.91 a	12.77 a	5.40 a	4.75 a	3.75 a
1 CHECK	84.50 a	7.30 a	12.30 a	6.25 a	5.17 a	3.92 a
2 B	85.25 a	7 ab	12.98 a	5.33 b	4.42 bc	3.42 a
3 B/ T-B	85.33 a	4.98 d	12.96 a	4.50 c	4.17 c	3.75 a
4 D/D + D	85.50 a	6.25 bc	13.33 a	6.50 a	5.17 a	3.58 a
5 B/D + D	84.25 a	5.72 cd	13.75 a	6.58 a	4.75 b	3.75 a
TRA	ns	*	ns	ns	ns	ns
TRB	ns	**	ns	**	**	ns
TRA*TRB	ns	ns	ns	ns	ns	ns
C.V.	2.13	15.63	12.98	16.89	9.87	17.14

(Means followed by the same letter are not significantly different)
(* and ** significant at p= .05 and .01 respectively)

TABLE Q-24 Summary of results of trial Coop 13 PGR * Nitrogen fertility

Coop 13

	YIELD		TKW	KGHL	HEADING	MATURITY
1 TEMOIN	3798.94	a	36.84 a	74.44 a	40.45 a	85 a
2 CYCOCEL ZGS 30	3650.96	a	36.01 a	76.06 a	41.58 a	85 a
1 40/80/0/0 U	4217.20	ab	38.05 a	75.39 a	40 a	85 a
2 40/80/0/0 N	3560.60	cd	36 a	75.98 a	42 a	85 a
3 40/80/25/25 U	4444.20	a	36.49 a	77.43 a	41 a	85 a
4 40/80/50/50 U	3947.90	abc	36.90 a	76.66 a	41.25 a	85 a
5 40/80/25/25 N	3394.90	d	35.74 a	75.46 a	42.38 a	85 a
6 40/80/50/50 N	3710	cd	35.05 a	75.24 a	41.50 a	85 a
7 40/130/0/0 U	4276	ab	37.18 a	68.65 a	40.38 a	85 a
8 40/130/0/0 N	3507	cd	35.48 a	74.88 a	40.25 a	85 a
9 0	2326.90	e	36.60 a	75.63 a	40.25 a	85 a
10 0/90/80 U	3864.60	bcd	36.78 a	77.18 a	41.13 a	85 a
TRA	ns		ns	ns	ns	ns
TRB	**		ns	ns	ns	ns
TRA*TRB	ns		ns	ns	ns	ns
C.V.	11.98		4.48	10.87	2.95	0

(Means followed by the same letter are not significantly different)
(* and ** significant at p= .05 and .01 respectively)

3.2.2.5 Summary

The population had no significant effect on parameters measured except heading date and lodging. The fungicides had a significant effect on thousand kernel weight and on lodging. The fungicides also reduced mildew and septoria pressure significantly.

3.2.3 Experiment 13 Fertility * PGR

3.2.3.1 Objective

To determine the effect of different nitrogen levels on winter wheat (cv. Monopol) with and without plant growth regulators.

3.2.3.2 Treatment list

Factor A

1- Check
2- Cycocel ZGS 30

Factor B

ZGS Treatment	0	20	30	45	Total
1	40	80 (u)	0	0	120
2	40	80 (n)	0	0	120
3	40	80 (u)	25 (u)	25 (n)	170
4	40	80 (u)	50 (u)	50 (n)	220
5	40	80 (n)	25 (n)	25 (n)	170
6	40	80 (n)	50 (n)	50 (n)	220
7	40	130 (u)	0	0	170
8	40	130 (n)	0	0	170
9	0	0	0	0	0
10	0	90 (u)	80 (u)	0	170

(u) = urea
(n) = ammonium nitrate

3.2.3.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a clay-loam of the Bedford series. These soils have a good to very good drainage; the topography is undulating and there are some rocks present, but not enough to affect the agriculture. The field where the trials were held was not tile drained but had a very good surface drainage; the field is also surrounded by woods on two sides.

The field was disked two times, the last disking incorporating the fertilizer that was applied before planting. The fertilizer applied prior to planting was 300 Kg/ha of 0-30-30 on the 15th of september using a conventional fertilizer spreader. The previous crop was barley.

The winter wheat cultivar Monopol was seeded on september 18th with a precision planter (Nodet-Gougis) at a depth of 2.5 cm. The seeding rate was adjusted according to the thousand kernel weight and to the germinating power in order to obtain 425 viable seeds / square meter. The row width was 12 cm. The soil was rolled after planting. Plot size was of 1m * 5m and each treatment was replicated four times in a split-block design.

All the plots were sprayed with Buctril M (Bromoxynil 280 gr a.i./ha & MCPA 280 gr a.i./ha), on may 4th at ZGS 31. They also received an application of the fungicide Bayleton 50W (Triadimefon 175 gr a.i./ha) at ZGS 30 on april 25th and of the fungicide Tilt (Propiconazole 125 gr a.i./ha) at ZGS 49 on june 5th. These products were applied in 275 litres/ha of water using a conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr).

The plant growth regulator Cycocel extra (Chlormequat chloride 1200 gr a.i./ha) was applied on april 25th at ZGS 30, using the conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr), on the plots receiving treatment 2.

The nitrogen was applied with a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil. The levels of nitrogen were 0, 120, 170, 220 kg/ha. The applications were split in two, three or four applications, at ZGS 0, ZGS 20, ZGS 30 and ZGS 45, using either ammonium nitrate (34-0-0) or urea (46-0-0). The ZGS 0 application was done on september 15th and the second application was done on april 15th at ZGS 21 for all plots receiving treatments 1 to 8. The third application was done on may 1st at ZGS 31, for all plots receiving treatments 3, 4, 5, 6 and 10. The last application was done on june 4th at ZGS 49 for all plots receiving treatments 3, 4, 5 and 6.

Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described in "L'inventaire des maladies des plantes au Canada" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 12th using a cutter and a stationnery plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.2.3.4 Results and discussion

Plant growth regulator

The plant growth regulator had a significant effect on height. The application of Cycocel reduced the height of the plants by a factor of 5.1%. The plant growth regulator did not have a significant effect on lodging.

Nitrogen fertility

Nitrogen increased yield from 2327 kg/ha to 4444 kg/ha as the level of nitrogen went from 0 to 170 kg/ha with the optimum level between 120 and 220. The use of the 46-0-0 had a significant advantage over 34-0-0 by 627.82 kg/ha. Spliting the nitrogen in multiple applications did not show any significant advanyage on yield. The fertility levels influenced significantly the height of the plants, with the 0 level being the lowest. Lodging was also affected significantly by the nitrogen levels, with the highest levels causing more lodging. Humidity before harvest was affected significantly, with the 0 level beng the more humid. Heads/sq.meter was also affected with the N=0 level giving the lowest value of heads.

TABLE Q-25 Summary of results of trial Coop 13 PGR * Nitrogen fertility (cont'd)

Coop 13

	HEIGHT	LODG	HUM	HDS/M2
1 TEMOIN	90.85 a	1.37 a	14.04 a	592.35 a
2 CYCOCEL

ZGG 30 | 86.23 b | 1.84 a | 12.71 a | 579.70 a |
1 40/80/0/0 U	89.13 ab	.70 de	14.24 ab	544.25 ab
2 40/80/0/0 N	88.38 b	1.25 bc	13.29 cd	638.50 a
3 40/80/25/25 U	91.75 a	1.73 b	13.33 cd	544 ab
4 40/80/50/50 U	91.88 a	2.45 a	12.81 d	636.50 a
5 40/80/25/25 N	89.38 ab	2.30 a	12.96 cd	595.25 ab
6 40/80/50/50 N	90 ab	2.33 a	12.69 d	556.25 ab
7 40/130/0/0 U	90.38 ab	1.48 bc	13.06 cd	657.25 a
8 40/130/0/0 N	89.63 ab	2.55 a	12.46 d	602 ab
9 0	75.88 c	.25 e	15.06 a	492.25 b
10 0/90/80 U	89 ab	1 cd	13.88 bc	594 ab
TRA	**	ns	ns	ns
TRB	**	**	*	*
TRA*TRB	ns	ns	ns	ns
C.V.	2.38	29.09	6.23	12.92

TABLE Q-26 Summary of results of trial Coop 13 PGR * Nitrogen fertility (cont'd)

	TKW	MILDEW	SEPT	SPOT BL.
1 TEMOIN	36 a	3.75 a	5.35 a	3.85 a
2 CYCOCEL ZGS 30	36.10 a	5.25 a	5.55 a	4.10 a
1 40/80/0/0 U	34.38 a	3.75 a	5.50 a	4 a
2 40/80/0/0 N	39.73 a	5.25 a	5.50 a	3.50 a
3 40/80/25/25 U	37.65 a	4.50 a	5.50 a	4 a
4 40/80/50/50 U	36.48 a	5.50 a	5.75 a	4.25 a
5 40/80/25/25 N	38.68 a	4.75 a	5.25 a	4 a
6 40/80/50/50 N	34.30 a	4.75 a	5.25 a	4.25 a
7 40/130/0/0 U	32.38 a	4 a	5.75 a	4.50 a
8 40/130/0/0 N	36.55 a	3.50 a	5.25 a	4 a
9 0	35.90 a	2 a	4.75 a	3.25 a
10 0/90/80 U	34.45 a	3.50 a	5.50 a	4 a
TRA	ns	ns	ns	ns
TRB	ns	ns	ns	ns
TRA*TRB	ns	ns	ns	ns
C.V.	8.82	33.02	16.86	13.84

3.2.3.5 Summary

The use of a plant growth regulator did not affect any of the parameters measured except height. The optimum nitrogen fertility level is between 120 and 220. When the fertilizer used is 46-0-0 there is a yield advantage of over 627 kg/ha.

3.2.4 Experiment 14 PGR * Fertility

3.2.4.1 Objective

To determine the effect of plant growth regulators on winter wheat (cv. Monopol) at different nitrogen levels.

3.2.4.2 Treatment list

Factor A

ZGS Treatment	0	20	30	45	Total
1	40	80	0	0	120
2	40	80	25	25	170
3	40	80	50	50	220

Factor B

1- Check
2- Cycocel ZGS 30
3- Cycocel ZGS 30 / Cycocel ZGS 31
4- Cerone ZGS 38
5- Cycocel ZGS 31 / Cerone ZGS 38

3.2.4.3 Materials and methods

The experiment was done on a farm located in Ste-Rosalie, Quebec, approximately 80 kilometers east of Montreal. The soil on the farm is a clay-loam of the Bedford series. These soils have a good to very good drainage; the topography is undulating and there are some rocks present, but not enough to affect the agriculture. The field where the trials were held was not tile drained but had a very good surface drainage; the field is also surrounded by woods on two sides.

The field was disked two times, the last disking incorporating the fertilizer that was applied before planting. The fertilizer applied prior to planting was 300 Kg/ha of 0-30-30 on the 15th of september using a conventional fertilizer spreader. The previous crop was barley.

The winter wheat cultivar Monopol was seeded on september 18th with a precision planter (Nodet-Gougis) at a depth of 2.5 cm. The seeding rate was adjusted according to the thousand kernel weight and to the germinating power in order to obtain 425 viable seeds / square meter. The row width was 12 cm. The soil was rolled after planting. Plot size was of 1m * 5m and each treatment was replicated four times in a split-block design.

All the plots were sprayed with Buctril M (Bromoxynil 280 gr a.i./ha & MCPA 280 gr a.i./ha), on may 4th at ZGS 31. They also received an application of the fungicide Bayleton 50W (Triadimefon 175 gr a.i./ha) at ZGS 30 on april 25th and of the fungicide Tilt (Propiconazole 125 gr a.i./ha) at ZGS 49 on june 5th. These products were applied in 275 litres/ha of water using a conventional farm sprayer (Hardy, TJets 8002, 30 lbs/sq.in. at 5.5 km/hr).

The nitrogen was applied with a pneumatic fertilizer spreader (Nodet-Gougis DP 112) at 6 km/hr, 70 cm above the soil. The levels of nitrogen were 120, 170, 220 kg/ha. The applications were split in four applications, at ZGS 0, ZGS 20, ZGS 30 and ZGS 45, using urea (46-0-0) for applications at ZGS 0, 20 and 30, and ammonium nitrate (34-0-0) for the application at ZGS 45. The 120 kg/ha rate of nitrogen was split in two applications (ZGS 0 and ZGS 20). The ZGS 0 application was done on september 15th and the second application was done on april 15th at ZGS 21 for all plots. The third application was done manually using a small plastic container. The fertilizer was mixed with filler and the total amount was divided in two equal parts that were applied to the plots perpendicular to each other to insure good coverage. The application was done on may 1st at ZGS 31, for plots receiving treatments 2 and 3. The last application was also done manually on june 4th at ZGS 49 for plots receiving treatments 2 and 3.

The plant growth regulators were applied with a hand-held CO2 sprayer. The pressure was 30 lbs/sq.in. and the speed was 3.6 km/hr. The applications were done 48 cm above the crop and the volume of water used was 200 l/ha. Cycocel extra (Chlormequat chloride 1800 gr a.i./ha) was applied on april 25th at ZGS 30 on plots receiving treatment 2, 3 and 5. Cycocel extra (Chlormequat chloride 240 gr a.i./ha) was again applied at ZGS 31 on may 3rd. Cerone (Etephon 360 gr a.i./ha) was applied at ZGS 39 on june 1st on plots receiving treatment 4 and 5.

Height is the average of the straw lenght (from the soil to the top of the head without the awns) of six plants randomly chosen in the plot, measured four weeks after heading. Disease ratings were taken at ZGS 75-80 using the method described by Couture in "Canadian Plant Disease Survey" (Annex 1). Lodging was evaluated prior to harvest using the "Belgian lodging rating system for cereal crops" (Annex 2). Heading data corresponds to the number of days between seeding and ZGS 50 for 50% of the plants in the plot and maturity data corresponds to the number of days between seeding and ZGS 90 for 80% of the grains.

The plots were harvested on august 12th using a cutter and a stationnery plot combine. The harvested samples were cleaned and dried; yield per plot, hectolitre weight, thousand kernel weight, number of kernels per head (average of ten heads) were determined.

The results were analysed and standard analysis of variance was done using the SAS system. Means were compared using the Duncan new multiple range test.

3.2.4.4 Results and discussion

Plant growth regulators

The plant growth regulators had significant effects on hectoliter weight, heading date and height. The plant growth regulator treatments containing Cycocel decreased hectoliter weight. Heading date was also delayed by all pgr treatments except Cycocel alone. The reduction in height was the highest with treatment 5 (Cycocel/Cerone). There was no significant difference in lodging.

Nitrogen level

The nitrogen levels had a significant effect on yield and height. The yield increased as the nitrogen level went from 120 to 170 and 220 kg/ha. Height increased with all three levels of nitrogen going from 83.40 cm to 87.40 cm.

TABLE Q-27 Summary of results from trial Coop-14 PGR * Nitrogen

Coop 14

	YIELD	TKW	KGHL	HEADING	MATURITY
1 CHECK	3825.80 a	35.29 a	78.53 ab	38.17 bc	85 a
2 CCC	3915.60 a	33.93 a	76.73 d	37.58 c	85 a
3 CCC/CCC	3833.30 a	32.65 a	77.70 bc	38.75 ab	85 a
4 CER	3871.50 a	35 a	78.80 a	39.17 a	85 a
5 CCC/CER	3606.10 a	33.48 a	77.58 cd	38.83 ab	85 a
1 N=120	3332.90 a	34.45 a	77.49 a	38.70 a	85 a
2 N=170	4047.40 b	34.89 a	78.12 a	37.90 a	85 a
3 N=220	4051.10 b	34.27 a	78 a	38.90 a	85 a
TRA	ns	ns	**	*	ns
TRB	*	ns	ns	ns	ns
TRA*TRB	ns	ns	ns	ns	ns
C.V.	13.09	102.14	1.33	2.43	0

	MILDEW	SEP	SPOT BL	HEIGHT	LODG
1 CHECK	2.83 a	3.83 a	3.67 a	91.67 a	.82 a
2 CCC	2.50 a	4 a	3.50 a	85.08 b	1.30 a
3 CCC/CCC	2.33 a	4 a	3.83 a	86.67 b	1.25 a
4 CER	3 a	4 a	3.83 a	85.92 b	.28 a
5 CCC/CER	3 a	4 a	3.50 a	77.42 c	.32 a
1 N=120	2.90 a	4 a	3.40 a	83.40 a	.63 a
2 N=170	2.50 a	4 a	3.90 a	85.52 b	.53 a
3 N=220	2.80 a	3.90 a	3.70 a	87.40 c	1.22 a
TRA	ns	ns	ns	**	ns
TRB	ns	ns	ns	*	ns
TRA*TRB	ns	ns	ns	ns	ns
C.V.	15.30	4.60	14.51	2.69	89.95

(means followed by the same letter are not significantly different)
(* and ** significant at p=.05 and .01 respectively)

3.2.4.5 Summary

Plant growth regulators reduced plant height but there was no difference in lodging. They also reduced hectoliter weight and delayed heading date. The nitrogen increased yield and height of the plants.

4 Large scale trials

4.1 Spring wheat

4.1.1 Objectives

The objective of these trials was to determine the effectiveness of making late applications of fungicides on spring wheat (cv. Max) and to demonstrate the economic returns associated with the use of fungicides in large scale field trials

4.1.2 Materials and methods

4.1.2.1 Treatment list

Treatment list

1- Check
2- Dithane M-45 ZGS 47 / Dithane M-45 ZGS 47 + 7 days
3- Tilt ZGS 45-55
4- Dithane M-45 ZGS 37-45 / Tilt ZGS 45-55

4.1.2.2 Materials and methods

Spring wheat Max was planted in the spring of 1987, at varying dates, depending on the farm. The seeding rate used was 200 kg/ha, and tramlines were used. The plots were 11 meters wide (one tramline width) and 100 meters long. The plots were replicated four times in a randomized complete block design.

The nitrogen fertility was the same on all farms. The total amount of 190 kg/ha of nitrogen, applied as urea (46-0-0), was split in two applications (ZGS 0 and ZGS 30). The fertilizers were applied with conventional spreaders.

The fungicides were applied at different dates, depending on the farm. The application stages were generally respected. The treatments were 10 meters wide; the harvest was made on the left side of the right tramline and was of one combine width. Each of the plots was weighed with a mobile weighing station.

4.1.3 Results

4.1.3.1 Results and discussion

The increase in yields varied from farm to farm. At the Louis-Hebert farm, the fungicides caused an increase in yields og 166 kg. As it is the case for the farms Bousquet and Pelletier, this increase in yield is not sufficient to cover the costs of the application of fungicides (table Q-). The minimum yield increase needed to cover the costs is 331 kg/ha, supposing a price of $150 / mt. The quality of the crop was not improved by the use of fungicides.

These poor results can be partly explained by improper timing of applications for the Bousquet farm (treatment 3 at ZGS 55-57) and by low disease pressure for the other two farms which are located outside of the wheat growing area of Quebec.

The other three farms obtained good results. The increases in yield obtained covered the costs of applying the fungicides. The fungicides also improved the quality of the crop on the Lussier and Hoka farms. These two farms were the most affected by diseases. There were no significant differences between fungicides.

TABLE Q-28 Summary of results from large scale trials

	Tr 1	Tr 2	Tr3	Tr4	prob	C.V.
Louis Hebert	3238	3452	3448	3314	ns	
Lefebvre	3500	3942	4059	3729	ns	
Bousquet	5420	5515	5259	5766	ns	
Pelletier	5172	5152	5431	5038	ns	
Lussier	3957 a	4872 bc	4911 b	4981 c	**	3.34
Ferme Hoka	4846 a	5570 c	5260 b	5327 bc	**	2.18
Average	4355	4750	4728	4692		

TABLE Q-29 Summary of quality results from large scale trials

Louis Hebert	Kg/hl	TKW	% Ash	% Prot
Tr 1	75.30	25.40		
Tr 2	75.50	26.50		
Tr 3	76	25.90		
Tr 4	75.50	26.80		
prob	ns	ns		

Lefebvre	Kg/hl	TKW	% Ash	% Prot
Tr 1	75.80	31.20	1.98	16
Tr 2	72.80	31.30	2.02	15.60
Tr 3	73.80	30.90	1.84	15.90
Tr 4	74.30	31	1.74	15.90
prob	ns	ns	ns	ns

Bousquet	Kg/hl	TKW	% Ash	% Prot
Tr 1	78.50	32	1.80	14.30
Tr 2	78.90	32.90	1.80	14.10
Tr 3	78.60	32.70	1.80	14.40
Tr 4	78.70	32.80	1.80	13.90
prob	ns	ns	ns	ns

Pelletier	Kg/hl	TKW	% Ash	% Prot
Tr 1	80.60	37.80		
Tr 2	80.70	36.40		
Tr 3	80	35.60		
Tr 4	80.10	36.10		
prob	ns	ns		

Lussier	Kg/hl	TKW	% Ash	% Prot
Tr 1	74.70 a	26.50	1.80	14.70
Tr 2	77.90 b	29.90	1.80	14.20
Tr 3	76.50 b	28.60	1.70	14.70
Tr 4	78 b	30.40	1.90	14.70
prob	**	ns	ns	ns

Ferme Hoka	Kg/hl	TKW	% Ash	% Prot
Tr 1	74.70 a	25.90 a	1.70	16.30
Tr 2	76.20 b	27.60 b	1.80	16.10
Tr 3	76.30 b	27.50 b	1.80	16.20
Tr 4	76.90 b	28.70 b	1.80	16.10
prob	**	*	ns	ns

Table Q-30 Summary of dates and corresponding Zadoks growth stages at our six locations

ZGS	Lussier	Ferme Hoka	Bousquet	Pelletier	Lefebvre	Ls Hebert
0	Apr 14	Apr 14	Apr 20	Apr 22	Apr 19	Apr 25
10	Apr 22			May 15		
13		- May 21		May 28	May 10	
20	May 6					
21	May 21		May 21	June 1	May 20	June 7
31	May 22	May 25				June 12
33		June 8		June 17		
37	June 8		June 17			
39	June 15	June 16				
40	June 16		June 18	June 26		
45		June 18				June 25
47	June 18					
55	June 21					July 11
57	June 25					
63	June 26	July 7		Aug 12		
75						
80			July 21			
90	Aug 12	Aug 11	Aug 17		Aug 14	

Cooperating farmers

M. Sylvain Lavoie
Ferme Louis Hebert
1475 Chemin Royal
Ile d'Orleans, Que
G0A 3W0

M. Gaetan Pelletier
Rang 5 ouest
St-Donat, Que.
G0K 1L0

M. Germain Lefebvre
1316 Chemin des Patriotes
St-Denis-sur-Richelieu, Que
J0H 1K0

Ferme Hoka
135 Haute Riviere Sud
St-Cesaire, Que
J0L 1T0

M. Laurent Bousquet
Ferme Grand Rang
739 Grand Rang
La Presentation, Que
J0H 1B0

M. Jean Paul Lussier
100 Beaudry
St-Damase, Que
J0H 1J0

5 Meteorological information

The meteorological information presented here was gathered at the St-Hyacinthe research station, which is located approximately 2 miles from the Ste-Rosalie site. This site is situated in a mild temperate zone where the vegetative period is of approximately 200 to 240 days and where the accumulation of degree-days (above 5C) usually reaches 1720 to 2220. Soil temperatures are usually above 15C between 120 and 180 days per year. Table Q-31 gives the 10 year average of some meteorological data.

The year 1987 was characterized by unequal rainfall and high temperatures. Rainfall was above average in may, june and september but below average in april, july and august. Water stresses were evident between the second week of june and the second week of september.

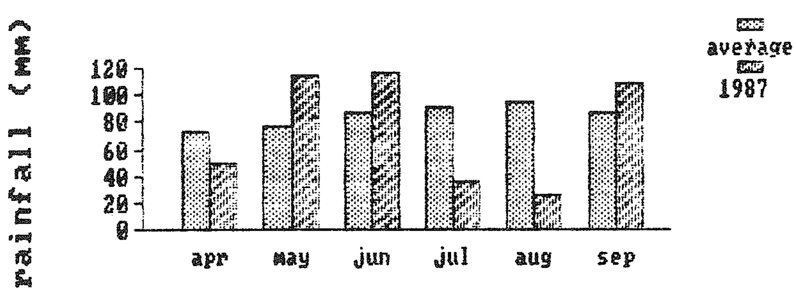
Temperatures were above average from april to july with august and september just below average. Table Q-32 summarizes the data for the St-Hyacinthe station in 1987.

Table Q-31

Month	Average daily temp	Average minimum temp	Total precip (mm)	Days with precipitation
Apr	5.60	0.60	73.70	13
May	12.90	6.70	76.20	13
June	18.50	12.30	86.40	12
July	20.70	15.10	91.40	13
Aug	19.60	14.00	94.00	12
Sep	15.10	9.00	86.40	12

Table Q-32

Month	Average daily temp	Average minimum temp	Total precip (mm)	Days with precipitation
Apr	10.00	3.90	49.80	11
May	13.50	7.40	113.30	16
June	19.40	13.80	116.30	17
July	21.80	15.80	34.50	12
Aug	18.60	13.10	25.30	10
Sep	14.70	10.90	108.00	16



List of visitors

Date	Name	# of visitors
07-02	David Rourke, Ag-Quest	1
07-13	J D Cameron, C&M Seeds	2
07-14	ITAA St-Hyacinthe (Anne Vanasse)	7
07-15	Dr MacKenzie & Smith, MacDonald Coll.	2
07-15	CPVQ Weed Committee	60
07-16	Hackney, Pro-Grain	1
07-16	Dr Dubuc, Ag Can	3
07-16	Dagenais J L, & farmers	50
07-22	Peill J	4
07-24	Chemagro	18
07-25	CFQ Field day (agr. & technicians	200
07-27	Farmer (Coop Purdel)	45
07-28 to 07-30	Farmer tours	925
08-07	Ciba-Geigy	2
08-13	CPVQ (Richard Morin)	1
08-28	ITAA St-Hyacinthe (J M Milord)	35
	Total	1356

Annex 1

Disease rating system

	0	1	2	3	4	5	6	7	8	9
Top leaves	*abs*	*abs*	*abs*	*abs*	*abs*	*abs*	*peu*	*pre*	*mod*	*sev*
Middle leaves	*abs*	*abs*	*abs*	*abs*	*peu*	*pre*	*mod*	*sev*	*sev*	*sev*
Bottom leaves	*abs*	*iso*	*peu*	*pre*	*mod*	*sev*	*sev*	*sev*	*sev*	*sev*

abs (absent)	0%	pre (present)	10%
iso (isolated)	1%	mod (moderate)	25%
peu (little)	5%	sev (severe)	50%

Couture L. 1980. Assessment of severity of foliage diseases of cereals in cooperative evaluation tests. Can. Plant Dis. Surv. 60: 8-10.

Annex 2 Belgian lodging index

LODGING INDEX = S * I * 0.2

where

S = area of surface lodged (1-9 scale)

1= no lodging 9= total lodging

I = the intensity of lodging (1-5 scale)

1= completely upright 5= completely flat