EFFECT OF MANAGEMENT PRACTICES ON STUBBLE YIELDS OF WHEAT

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In recent years, most farmers in Western Canada have been made aware of the detrimental effects of summerfallow on soil productivity. Many agree that the problem is one that we cannot afford to ignore any longer and are changing their cropping practices to reduce summerfallow acreage. However, for many producers the alternatives to summerfallow don't appear financially attractive. Research work on extended cropping is quite limited and usually examines only single factors rather than interactions of factors such as fertilizer and weed control practices.

The major reason for producers to continue to practice summerfallowing is the limited amount of moisture available to stubble-grown crops. Thus to make stubble cropping more attractive, practices need to be developed to increase the amounts of soil moisture available to stubble grown crops. In addition, we need to make more efficient use of the limited amounts of soil moisture available for stubble crop production.

These studies were initiated to determine the effects of fertilizer and weed control practices used in combination with some cultural treatments, on wheat yields in an extended cropping system. These tests were established at the Scott Experimental Farm, as well as the associated project farm locations at Kindersley, Lashburn, Mervin and Loon Lake. A brief description of these sites is given in Table 1. Each of the soil zones is represented by one of these sites, which encompass a wide range of soil and climatic conditions.

Table 1. Description of sites where stubble wheat tests were conducted, 1983.

	Kindersley	Scott	Lashburn	Glaslyn	Loon Lake
Soil zone	Brown	Dk. Brown	Black	Gray-Black	Gray-wooded
Soil type	Sceptre Hu-Cl	Elstow Cl-L	Waseca L	Whitewood L	Loon River L
Organic matter (% at 0-15 cm)	2.4	3.5	3.6	3.9	2.6
Av. ann. precip. (mm)	282	350	-	456	434

The test was a randomized complete block using a split-split plot design. The stubble treatments were applied to the main plots and herbicide treatments to the sub plots. Each herbicide treatment was split into three sub-sub plots which were either unfertilized or received N and P_2O_5 as indicated in Table 2. The treatments were replicated four times at each location. This test was designed to be continued for a minimum of 5 year with wheat cropped

continuously and the same treatments applied to the same plots repeatedly. The tests were initiated in 1982 on fallow and the 1983 crop was the first produced on stubble. The results presented here are preliminary, however with 5 locations some definite trends appear to be developing.

Table 2 Description of treatments used in stubble wheat tests.

Main Plots (stubble treatments)	Sub Plots (weed control treatments)	Sub-Sub Plots (fertilizer treatments)
1. Fall Tillage flattened stubble	check - no herbicide Hoegrass - Glean Hoegrass - Torch Avadex-2,4-D	check - no fertilizer 45 kg N + 22 kg P_2O_5/ha 90 kg N + 45 kg P_2O_5/ha applied with each herbicide treatment
2. Regular height standing stubble	check - no herbicide Hoegrass - Glean Hoegrass - Torch Hoegrass - Burctril M	↓
3. Tall standing stubble	check - no herbicide Hoegrass - Glean Hoegrass - Torch Hoegrass - Buctril M	↓
Plot sizes at Scott 12 m x 44 m	12 m x 11 m	12 m x 3.6 m
Plot sizes at Project Farms 5.5 m x 22 m	5.5 m x 5.5 m	5.5 m x 1.8 m

Weed numbers

The numbers of weeds did not differ significantly between stubble treatments when averaged over the five locations (Table 3). It is expected that weed numbers may change over time due to the stubble treatments. For example the fall tillage treatment may encourage more weeds to grow prior to seeding and they may be reduced by pre-seeding tillage. If the standing stubble treatments result in more soil moisture, they may enhance weed germination. However, such differences have not appeared to date.

The effect of herbicide treatments on weed numbers is quite apparent. All herbicide treatments resulted in significantly reduced weed numbers compared to the check treatment. The Hoegrass-Glean and Hoegrass-Buctril M treatments resulted in significantly fewer weeds present than Hoegrass-Torch or Avadex-2,4-D treatments. Glean and Buctril M were applied a week after the Hoegrass treatment, whereas Torch was applied as a tank mix with Hoegrass. This may have accounted for some of the differences in weed control,as some late-geermin-ating broadleaf weeds may have escaped treatment. Glean and Buctril M control a wider range of weed species than Torch or 2,4-D which may also account for some of the difference. At one location where wild buckwheat numbers were high,

control was not as good with 2,4-D as with the other herbicides. At 2 locations, control of stinkweeds with Torch was not as effective as with Glean or Buctril M. At Kindersley where wild oat numbers were high, Hoegrass treatments reduced their numbers more than the Avadex treatments.

Table 3 Effect of stubble treatments, herbicides and fertilizer treatments on numbers of weeds present in a stubble wheat crop and grain protein content (5 location average 1983).

Stubble	Weeds/m^2	Grain protein (%)
Fall tillage	15.8 a*	14.9 a
Regular stubble	15.4 a	15.1 a
Tall stubble	19.5 a	15.1 a
Herbicide treatment		
Check	54.1 a	14.9 a
Hoegrass-Glean	1.6 c	14.9 a
Hoegrass-Torch	7.1 b	15.1 a
Hoegrass-Buctril M	2.6 c	15.1 a
Avadex-2,4-D	8.9 b	15.0 a
Fertilizer treatment		
Check	15.8 a	14.2 c
45 kg N + 22 kg P_2O_5/ha	16.4 a	14.9 b
90 kg N + 45 kg P_2O_5/ha	18.7 a	16.0 a

* Values followed by the same letter within a treatment group do not differ significantly.

Fertilizer treatments did not significantly affect weed numbers averaged over the five locations. However at individual locations fertilizer treatments did have an effect. At Kindersley where crop stands were light, weed numbers increased as the rates of N and P_2O_5 were increased. At Lashburn, where crop stands were much heavier, weed numbers declined as rates of N and P_2O_5 were increased. At other locations, no definite trend appeared. The effect of fertilizers on weed numbers is probably related to their effect on competitiveness of the crop with weeds. Where the crop stand is heavy and very competitive with weeds, supplying adequate nutrients can increase the competitiveness of the crop. Where the crop stand was light, there was probably enough space for additional weed development to occur in addition to crop development in response to the fertilizer treatment.

Weed numbers in 1983 were low at the loon lake and Glaslyn locations and high at Kindersley, Scott and Lashburn.

The stubble treatments and herbicide treatments did not affect grain protein levels. It was anticipated that if these treatments had an effect on protein

levels it would probably be due to the dilution effect of higher yields. However this did not occur in 1983. Fertilizer rates did affect protein content of the wheat produced. As the rates of N and P_2O_5 were increased, so also were the protein contents. This was expected since the protein content of a wheat crop is usually related to the amount of available N in the soil.

Stubble treatments had very little effect on yields at most locations (Table 4). Standing stubble cut at a normal swathing height resulted in a small yield increase at all locations, compared to the fall tillage treatments. The tall standing stubble treatment did not give as consistent a response. Average yields for the five locations did not differ significantly between stubble treatments. Soil moisture levels were determined at Scott only and indicated that the normal stubble height or tall stubble resulted in approximately 1 cm. more soil moisture being available to the wheat crop at seeding time compared with the fall tillage treatment.

Table 4 Wheat yields (kg/ha) on stubble as affected by stubble treatments.

	Stubble treatment		
Location	Fall tillage	Normal height stubble	Tall stubble
Kindersley	1303	1365	1469
Scott	1162	1349	1195
Lashburn	1626	1739	1885
Glaslyn	2101	2196	2027
Loon Lake	969	1111	1041
5 location avg.	1433 a*	1552 a	1523 a

* Values followed by the same letter are not significantly different.

At Kindersley, Scott and Lashburn where weed numbers were high, herbicide treatments resulted in significantly higher yields compared to the untreated check treatment (Table 5). Yields from the Hoegrass plus Glean, Torch or Buctril M treatments were generally higher than from the Avadex plus 2,4-D treatments at these locations. At Glaslyn and Loon Lake where weed numbers were low, herbicide treatments gave only small yield responses.

Table 5 Effect of herbicide treatments on stubble wheat yields (kg/ha).

	Herbicide Treatment				
Location	Check no herbicide	Hoegrass Glean	Hoegrass Torch	Hoegrass Buctril M	Avadex 2,4-D
Kindersley	1171	1384	1511	1509	1332
Scott	937	1327	1338	1380	1350
Lashburn	1614	1799	1820	1834	1638
Glaslyn	2037	2138	2198	2056	2076
Loon Lake	971	1098	1049	1064	1012
5 location Avg.	1346 c*	1549 a	1583 a	1569 a	1482 b

* Values followed by the same letter are not significantly different.

Applications of N and P_2O_5 fertilizers resulted in increased yields at all locations (Table 6). Application of N and P_2O_5 at the higher rates used gave yields that were equal to or greater than yields where the lower rates were used at all locations except one. At Glaslyn, the high rate of fertilizer gave yields that were lower than the lower fertilizer rate. At this location the yields from the high fertilizer rate were still higher than for the non-fertilized check treatment.

Table 6 Effect of fertilizer treatments on stubble yields of wheat (kg/ha).

	Fertilizer rates (kg/ha)		
Location	0-N, 0-P_2O_5	45 N, 22 P_2O_5	90 N, 45 P_2O_5
Kindersley	772	1519	1846
Scott	1093	1253	1371
Lashburn	1160	2018	2072
Glaslyn	1844	2317	2072
Loon Lake	901	1098	1123
5 location avg.	1154 a*	1641 b	1716 c

* Values followed by the same letter are not significantly different.

Summary

Some definite trends in terms of weed numbers in response to herbicide treatments have already begun to develop. Changes in weed numbers due to stubble treatments or fertilizer rates may also occur in future, and will require monitoring. It is anticipated that changes in weed species may also occur over time in response to those treatments although no real trends have developed as yet.

Leaving the stubble standing, either as stubble cut at a normal swathing height or as tall stubble resulted in yields that were 7% higher than where fall tillage was used. An application of Hoegrass with either Glean, Torch or Buctril M for weed control resulted in yields that were 16% higher than where herbicides were not used. Application of N at 90 kg/ha and P_2O_5 at 45 kg/ha increased yields by 49% over the non fertilized check treatment.

If these individual treatment effects are totalled together the effect is 7 + 16 + 49 = 72% increase in yields. In these studies average yields of 1823 kg/ha were obtained where normal or tall stubble was combined with Hoegrass plus Glean, Torch or Buctril M and 90 kg/ha of N plus 45 kg/ha of P_2O_5. Yields were 1012 kg/ha for the fall tillage, herbicide check, fertilizer check treatment. Thus the combined yield response was 80%.

Plans are to continue these studies for at least an additional 4 years. Additional data should be useful in determining whether; fertilizer responses may be enhanced by increasing soil moisture levels with snow trapping; weed control is affected by rates of fertilizer application; weed populations will build up with adequate weed control and whether fertilizer responses will change over time.