A SIMPLISTIC ANALYSIS OF STUBBLE AND SUMMERFALLOW YIELDS IN EASTERN SASKATCHEWAN FOR 1957-71

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Crop district #5 in east-central Saskatchewan extends from the Qu'Appelle River north to the top of township 39 and from the Manitoba border to the west side of range 18 west of the 2nd Meridan. The summerfallow - frequency map for Saskatchewan Fertilizer and Cropping Practices suggests a 3-5 year rotation for the western portion of this district and a 5 year + rotation for the eastern portion.

In common with all parts of Saskatchewan the area represented by Crop District 5 is subject to recurring dry years, occurring in a rather random 2 to 3 year cycle. Reduction in summerfallow acreage for this crop district would reduce the erosion hazard, reduce the encroachment of salts on additional acres, and improve farm returns. There are, however, problems in development of cropping programs to use summerfallow mainly as a management input rather than as part of the standard 2 or 3 year rotation.

Yields of wheat on summerfallow and stubble are available for 1957 to 1971 from D.B.S. and S.D.A. statistics. These yields are shown in table 1, arranged in order of increasing annual precipitation for Sub-Crop District 5A.

TABLE 1

Year	Annual Precipitation	Wheat Yield Stubble Bu./Acre	Wheat Yield Summerfallow Bu./Acre
1961	9.34	4.6	6.6
1960	11.85	16.7	25.6
1967	12.80	13.3	20.1
1968	13.10	15.8	22.1
1958	13.24	10.3	18.2
1957	13.49	10.9	18.7
1966	16.09	24.0	32.4
1964	16.27	18.4	25.1
1959	16.79	14.4	24.4
1962	16.83	17.5	24.8
1971	17.36	22.9	31.9
1963	17.40	23.4	32.4
1969	17.43	23.5	34.5
1965	19.57	22.0	27.8
1970	19.57	19.2	26.9

It should be pointed out that the yield data is based on harvested acreage. It could be suggested, therefore, that the yield data for stubble could be considered as generous in relation to the acreage seeded. In most dry years some acreage of stubble is not harvested.

For the 15 year period, the average yield of wheat on stubble is 17.1 bushels per acre compared to 24.8 bushels on summerfallow. The stubble yield is, therefore, 68.9 per cent of that on summerfallow. To use this average, however, to indicate that some upgrading of stubble crop management is all that is necessary, would be misleading.

Table 2 shows the yield relationships for the total period, the six dry years and the nine wet years.

TABLE 2

	Summerfallow Wheat Yield	Stubble Wheat Yield	$\frac{\text{Stubble}}{\text{Summerfallow}}$ %
15 - Year	24.8	17.1	68.9
6 - Dry Years	18.5	11.9	64.3
9 - Wet Years	27.8	20.6	74.1

It is difficult to generalize as to the percentage yield required on stubble in relation to summerfallow, which makes stubble cropping economic. It would be, however, reasonably safe to assume that anything less than 65 per cent will frequently be unsatisfactory and over 70 per cent would be potentially sound.

One can not make too many conclusions from fertilizer use data on the effect of fertilizer on the relative yields in dry years. It can be noted that fertilizer use in Saskatchewan for 1967 was almost four times that for 1963. For Sub-Crop District 5A, the stubble yields of wheat as a percentage of summerfallow were 74.3 in 1963 and 66.2 in 1967. In 1967, for 5A, 55 per cent of wheat on summerfallow, was fertilized and 68 per cent of the wheat on stubble was fertilized. The average nitrogen rate was below that recommended, but the use on summerfallow was well below optimum with only 55 per cent of the acreage fertilized. The pattern for 1968 tends to show the same trend. 1968 was the peak fertilizer use year for the period, but stubble wheat yields were only 70.1 per cent of summerfallow, well below the 74.1 per cent shown for the 9 wet years.

Barley yield data is quite similar. Table 3 shows the yields and percentage yields for the 15-year period and the wet and dry years.

TABLE 3

	Barley Yield Stubble Bu./Acre	Barley Yield Summerfallow Bu./Acre	Stubble / Summerfallow %
15 - Year	25.6	37.9	67.5
6 - Dry Years	16.8	27.3	61.4
9 - Wet Years	31.6	45.0	70.2

The barley yields show that the percentage yield on stubble is slightly below that for wheat. Although this may be partly due to higher nitrogen requirements for barley, barley shows greater effects of moisture stress.

One major problem with the weather pattern is that dry years are frequently succeeded by dry years. In the 6 dry years there are three 2 - year dry periods, 1957-58, 1960-61, and 1967-68. As far as stubble crop is concerned the three - year period 1957-59 was dry since there was only 6.23 inches of precipitation for April - July in 1959 and the previous fall was dry.

It becomes fairly obvious that management of the cropping system to take advantage of the potential reduction in summerfallow can become rather complex. If a decision is made to use optimum production inputs on stubble, based on probability of seasonal precipitation, the average result may be satisfactory. It is reasonably certain, however, that a major percentage of the return on optimum fertilizer use, for example, would be obtained in 9 out of the 15 years considered here. The other 6 years would range from a possible break-even to a net loss.

There are difficulties in delaying cropping decisions until spring. Availability of fertilizer, weed chemicals, and even seed may be a problem. There appears to be some potential for cropping decisions to be made for this region by late October or early November.

In table 4 yields of wheat on stubble are shown for three categories of precipitation in September - October of the previous year.

TABLE 4

WHEAT YIELDS ON STUBBLE

September - October Precipitation, Previous Year	No. of Years	Bu./Acre
> 3.0 Inches	5	19.7
2 - 3 Inches	5	18.7
< 2.0 Inches	5	12.9

The data in Table 4 would suggest that fall precipitation could be used with fair confidence in making cropping decisions. In the years with more than 3 inches of precipitation in September - October, generally optimum inputs could be used. In the 2 - 3 inch category some adjustment of inputs and close monitoring of weed problems would be advisable. In the dry category less than 2 inches, summer-fallow might be advisable, particularly on perennial weed problem areas, and minimum inputs would be warranted if land is to be cropped. There are two years in which the decision would have been questionable. 1957 was one of the lowest yielding years for stubble and 1962 was relatively good after a dry fall in 1961. May - June was dry in 1957 with total rainfall of only 2.40 inches and was relatively wet in 1960 with total rainfall of 5.25 inches.

SUMMARY

The analysis of yield data for sub-crop district 5A demonstrates a large variation in potential crop returns on stubble land in eastern Saskatchewan with variations in moisture supply. In addition to optimum management and production inputs for crops grown on stubble, there is a major need to assess the system each year for the balance in cropping program and inputs. Analysis of fall moisture supplies suggest that cropping decisions can be made with reasonable confidence based on fall moisture supplies in eastern Saskatchewan.

MAGNETIZED SEED IN SASKATCHEWAN

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I wish to acknowledge the assistance of Dave Warnock, Research Station, Melfort and Roy McIver, Experimental Farm, Indian Head for supplying data; and Dr. Austenson, Crop Science Department, University of Saskatchewan, Saskatoon for supplying information regarding their tests. I want to thank Mr. Wayne Bird for the material he supplied from the test he conducted.

Work on magnetized seed is not new. It has been reported in literature back to 1963. The present method of treatment consists of passing the seed through a magnetic field. The time required in the magnetic field is very short--simply dropping the seed between two magnets can give results. The strength of the magnet is not too critical; results have been obtained from magnetic fields with a wide range of strengths.

In the last two years interest in magnetic seed treatment has increased, with the result that many types of equipment for treating seed have appeared on the market. Tests on the effectiveness of several of these machines have been conducted by at least four research institutions in the last two years to see if we could get results similar to those obtained elsewhere.

I would like to pause here and point out that this paper is not intended to discredit the results obtained in the Lethbridge area by Mr. Pittman. My question is why are the Saskatchewan results different than his. In discussion with Mr. Pittman I find that this is of major concern to him also.

Now to deal with the work that has been done in Saskatchewan. Unless otherwise mentioned, all tests reported were replicated, and unless indicated, all the differences mentioned are statistically significant.

Research Station, Melfort. Dave Warnock used two machines, Pittman's permanent magnets and the Zapper, an electro-magnetic machine, on two varieties each of wheat, barley, oats, and rape. There were no significant differences in yield on any of the varieties due to magnetic treatment. To see if there was any difference between machines the actual increase (or decrease) for yield, weight per bushel, and 1000 kernel weight were examined. As shown in Table 1, both machines gave approximately the same number of increases or decreases for the different measurements.

Summary from Melfort - No advantage to magnetic treatment - possible disadvantage.

Research Station, Indian Head. Roy McIver. Tests were conducted at seven locations in 1975 comparing treated and nontreated seed of Neepawa wheat, Kelsey oats, Bonanza barley and Norland flax (at six locations). There were no significant differences in yield at any location for wheat or flax, a decrease at one location for oats and one increase and one decrease for barley. No statistical analysis was carried out on the other factors measured.

To compare the variations obtained between the different crops, the number of locations where there was an increase (+) or decrease (-)(not necessarily statistically significant) is shown in Table 2. From these data it would appear that maybe the different crops behave differently for different measurements.

Summary for Indian Head - No advantage in yield on any of the four crops - possible slight disadvantage for oats.

Crop Science Department, University of Saskatchewan, Saskatoon. Dr. H. Austenson. In 1975 they used a split-split plot design with several cultivars for each of six crops. Seeding west gave consistently higher yields than seeding north; significantly different for wheat, barley and oats (Table 4). There were minor increases or decreases in yield from the three magnetic seed treatments over the yield from the untreated seed, but none of these differences were significant (Table 5). There was no trend for one treater to be better than the others.

In the analysis of data for each crop, the interaction between direction of seeding and cultivars, direction of seeding and magnetic treatment, and cultivars and magnetic treatment was calaulated (Table 6). There were only three of the eighteen interactions that were significant.

Earlier emergence of the magnetically treated barley was observed but could not be seen three days later.

Summary for Crop Science Department, University of Saskatchewan, Saskatoon - No yield advantage from magnetically treated seed on any of six crops.

Research Station, Swift Current. D. Read and J. McElgunn. Tests were conducted at seven locations in 1974 and at nine locations in 1975 using Neepawa wheat, Conquest barley, Wascana durum and Sioux oats. The seed was passed through the seed energizer that Pittman uses (Agrotronics), half with no power to the coils and half with the coils energized. The tests were arranged in a replicated split plot design with crops as the main plots and treatments as the subplots. The measurements that were analyzed statistically were total sheaf wt, grain wt, weight per bushel, weight for 1000 kernels, and for 1974, the percent N and P in the grain.

Although the plots were observed several times during the year, there were never any distinct differences in appearance noted between the adjacent plots where magnetized and nonmagnetized seed had been planted. At some locations slight differences could be observed.

Table 3 shows the number of tests where there were statistically significant increases (+) or decreases (-) over the untreated for the various measurements. As far as yield is concerned there is no advantage and only in three or less tests out of the 15 or 16 were there any differences. There is a bit more significance for the yield of grain plus straw and when you look at the number of differences there are for 1000 kernel wt and weight per bushel it looks like magnetism is doing something. With these measurements there are 9 or 10 significant differences out of the 15 or 16 tests. These differences were not all beneficial but the number of beneficial ones varies with the crop.

Another test conducted at Swift Current in 1975 consisted of different varieties of grain with the seed from different sources and passed through different treaters. There were eight varieties from four seed sources and five treaters. The test did <u>not</u> include all combinations of these but did consist of 21 main treatments, each of which were split into treated and untreated. When the results for each variety were grouped together there was no significant difference between treated and untreated plots for total plant production, grain yield, 1000 kernel wt, weight per bushel, or maturity. The treaters used ranged from permanent magnets, the Agrotronics, another electro magnetic system, and a $\frac{1}{4}$ H.P. electric motor with the armature removed and a piece of plastic fitted inside the coils.

<u>Summary for Swift Current</u> - No advantage on yield but may be having some effect on 1000 kernel wt and weight per bushel.

One other test that I want to report on was conducted by Mr. Wayne Bird from Matador. He used Neepawa wheat and took paired plot square yard samples which were threshed and analyzed at Swift Current. He used magnetically treated and untreated seed on fertilized and unfertilized strips. There was no significant difference in yield or total plant material between magnetized and nonmagnetized seed or between fertilizer and no fertilizer. There was a significant interaction. The magnetic treatment decreased the yield on the unfertilized strip but increased the yield on the fertilized strip.

What does this all add up to? In looking at all the data I am convinced that magnetic treatment does something, as indicated by the number of significant differences in bushel and kernel weight. In the tests in Saskatchewan these differences do not carry through to influence the yield. The effect of magnetism is not always beneficial, and there is no way of predicting when and where the effect will be beneficial. From the results I can not recommend the magnetic treatment of seed in Saskatchewan. This leaves us with another unanswered question. Why do we get results that differ from those obtained elsewhere?

Table 1. Number of variations from results obtained from untreated seed of eight varieties at Melfort - 1975 (not necessarily statistically significant)

Treater	Yield of grain		Bushel weight		1000 Kernel weight	
Pittman	3(+)*	5(-)**	1(+)	5(-)	3(+)	3(-)
Zapper	2(+)	6(-)	2(+)	3(-)	3(+)	2(-)

* (+) Indicates the number of varieties on which there were increases over untreated.

**(-) Indicates the number of varieties on which there were decreases over untreated.

Table 2. Number of variations from the results obtained from untreated seed at seven locations near Indian Head - 1975 (not necessarily statistically significant)

Measurement	Wheat		Oats		Barley		Flax (6 locations)	
Yield of grain	1(+)*	6(-)**	2(+)	5(-)	6(+)	1(-)	2(+)	4(-)
Yield (significant)	0		1(-)		1(+)	1(-)	0	
Days to mature	1(+)		5(-)		3(+)	2(-)	2(+)	1(-)
Lodging	3(+)		2(+)	1(-)	0		0	
Height	4(+)	1(-)	4(+)	1(-)	3(+)	2(-)	2(+)	2(-)

* Number of locations where there were increases.

** Number of locations where there were decreases.

Table 3. Statistically significant increases (+) or decreases (-) due to magnetic treatment in 16 tests in Southwestern Saskatchewan - 1974-1975

Measurement No. of tests	Wheat 16	Oats 15	Barley 15	Durum 16
Yield of grain	1(+) 2(-)	1(+) 1(-)	1(+)	2(+) 1(-)
Yield of grain & straw	2(-)	2(+) 2(-)	3(+)	3(+)
Weight per bushel	3(+) 2(-)	7(+) 3(-)	6(+) 2(-)	3(+) 1(-)
1000 Kernel weight	3(+) 6(-)	4(+) 2(-)	7(+) 2(-)	5(+) 3(-)
% N in grain (7 tests)	1(+) 3(-)	2(+) 1(-)	2(+)	1(+) 1(-)
% P in grain (7 tests)	3(-)	2(+) 1(-)	1(+) 1(-)	1(+) 3(-)

Table 4. Yield increase from plots seeded west over yield from plots seeded north. Crop Science Dept.

Crop	Cultivars	Yield increase
Wheat	4	19*
Barley	3	215*
Oats	3	95*
Rape	2	8
Faba beans	2	36
Field peas	2	19

*Statistically significant.

Table 5. Yield increase from magnetic seed treatment over check yield. Crop Science Dept.

Crop	Zapper	Senstek	Enagizer
Wheat	2	-2	-6
Barley	111	97	-3
Oats	16	84	88
Rape	3	1	-10
Faba beans	-2	-19	-8
Field peas	82	42	49

Table 6. Significance of interactions. Crop Science Dept.

Crop	Direction X cultivar	Direction X treatment	Cultivar X treatment
Wheat	N.S.	N.S.	N.S.
Barley	*	N.S.	**
Oats	N.S.	N.S.	N.S.
Rape	N.S.	N.S.	N.S.
Faba beans	*	N.S.	N.S.
Field peas	N.S.	N.S.	N.S.