

# Effects of summerfallow flax and mustard barrier strips on the subsequent crop.

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## Introduction and Objectives

Oilseed barrier strips on summerfallow are an effective method for reducing wind erosion on land having low residue coverage. Oilseed barrier strips may be needed routinely when land previously cropped to legumes and oilseeds is fallowed using conventional tillage.

The objectives of this study were to 1) determine the agronomic effects of flax and mustard barrier strips on the subsequent crop, 2) determine any benefit from applying fertilizer with the strips, and 3) determine any benefit from applying trifluralin with the strips.

## Methods

The experiment was conducted at the Swift Current Research Station on a Swinton loam, an Orthic Brown Chernozem. Barriers were grown on conventional-tillage summerfallow following wheat during 1989-92 and the agronomic effect on subsequently-grown spring wheat determined for 1990-93. Oriental mustard ('Cutlass') and flax ('Dufferin') barrier strips were seeded in late July in a north-south direction with a strip spacing of 10.7 m. The oilseed strips were seeded with a prototype barrier seeder which had three hoe openers on a 0.2 m row spacing. The seeder was mounted on the frame of a heavy-duty cultivator after the last rank of sweeps. These barrier treatments were compared with conventional open fallow in a randomized complete block design with two (2) replicates. Barrier plots were approximately 90 x 90 m.

Within each barrier plot, there were three soil additive treatments: 1) Fertilizer: applied with the seed: 28 kg P (as  $P_2O_5$ ) per ha as monammonium phosphate and 34 kg N (actual) per ha as ammonium nitrate plus monammonium phosphate, 2) Trifluralin: 0.65 kg granular trifluralin (active ingredient) per ha applied during oilseed seeding in a 1.2 m band centred on the strip applied before the first rank of cultivator sweeps with a conventional granular herbicide applicator, and 3) Check: no fertilizer or trifluralin. A 1.2 m wide section of spike tooth harrows, chained to the cultivator, was dragged behind the barrier seeder to pack and smooth the seedbed as well as to provide additional incorporation of the trifluralin. Each additive subplot consisted of two adjacent strips.

In the crop year, hard red spring wheat ('Lancer') was seeded at 66 kg ha<sup>-1</sup> with a commercial hoe-press drill during the first half of May after one preseeding tillage operation which was at an angle to the barrier. N and P were applied with the seed based on soil-test

recommendations considering mean fall  $\text{NaHCO}_3$ - extractable nitrate and P sampled midway between the strips.

Gravimetric soil moisture, nitrates, and P were determined from soil cores to 1.2 m in the strip and midway between the strips. Sampling was done in late fall and early spring in the same general location. Wheat grain yields were determined from plant samples taken over a 0.5 m<sup>2</sup> area at the soil sampling locations. In 1993, additional 0.5 m<sup>2</sup> samples were taken 1 and 2 m both east and west of the barriers to quantify the extent of wheat growth effect from the strip. During the winter, snow depth and density were measured at the same general locations as soil sampling.

### Results and Discussion

Oilseed seeding date varied each year so that it could be done in conjunction with normal summerfallow tillage for weed control (Table 1). Surface soil moisture at time of barrier seeding was excellent in all years leading to good barrier establishment. The mustard barriers produced tall, sturdy barriers in all years whereas the height of the flax strips was variable.

The flax froze after overnight air temperatures dropped below 0°C whereas the mustard appeared unaffected by any early frosts. The flax barriers partially lodged following frost on August 26, 1992. In southern Saskatchewan, flax barriers should be seeded before the end of July to avoid frost but mustard barriers appear suitable for seeding during the first and, possibly, the second week of August; these seeding dates are the same as those recommended for northern North Dakota (Dodds, 1972).

In 1992, grasshoppers damaged the flax plants but only a few grasshoppers were observed on the mustard strips. Nicholaichuk (1992) noticed similar grasshopper behaviour during a earlier annual barrier study at Swift Current.

The gain of soil water between fall and spring was greater on the barrier strip than the open fallow (Figure 1) due to snow trapping (Figure 2). Greater on-strip gains in soil water are possible since fall and winter precipitation were average to below average in all years compared to long-term normals for Swift Current. Spring soil water was not significantly different on the oilseed strips compared to open fallow, although the trend was for lower soil water on the mustard strips. The oilseed strips slightly increased snow water midway between the strips but the amount of extra snow did not affect soil water contents (data not shown). Snow drifts extended about 1-5 m eastward of the flax strips while they extended 2-7 m eastward of the mustard strips.

Soil nitrates on the oilseed strips were lower than open fallow (Figure 3). There were no apparent differences between  $\text{NaHCO}_3$ - extractable P among barrier or additive treatments (data not shown).

In all years, the wheat was stunted and chlorotic directly where the oilseed strips had been located compared to elsewhere. The growth effects of the strips in the subsequent wheat crop appeared confined to the immediate strip; this was confirmed by measured 1993 yields near the barriers (Figure 4). Wheat grown on oilseed strips, especially mustard, yielded less than on open fallow (Figure 5). Wheat yields between the strips were not different than open fallow (data not shown).

Since the oilseed barriers did not strongly affect soil water, we attributed the wheat yield depression over the strips primarily to a N deficiency caused by soil N taken up and fixed in the oilseed residue. Wheat yields on fertilized oilseed strips were greater than the unfertilized strips. Fertilizing oilseed strips with N fertilizer alone, using an opener which separates seed from fertilizer, warrants further investigation.

Weeds were not judged to be a major problem either within the barriers or in the wheat crop so that strip-applied trifluralin had no important agronomic effects.

### Conclusions

In low residue situations on summerfallow, mustard or flax barrier strips are a low-cost wind erosion control practice. When seeded in conjunction with normal summerfallow tillage, the cost of establishing oilseed strips is less than \$2 ha<sup>-1</sup>. Wheat yields over the entire field after using oilseed strips were more than 98% of open fallow yields.

Although they depressed subsequent on-strip wheat yields more than flax, mustard is better suited for summerfallow barrier strips due to its greater height, tolerance to grasshoppers, and suitability for later seeding.

### References

- Dodds, D.L. 1972. Wind erosion control on summerfallow, continuous cropland. Coop. Extension Service Circ. SC-572. North Dakota State Univ., Fargo, ND.  
 Nicholaichuk, W. 1983. How can snow be managed? pp 13-14 /N 1982 Research Hi-Lites. Agriculture Canada Research Station, Swift Current, SK.

Table 1. Seeding dates and final barrier strip heights

| <u>Year</u> | <u>Seeding Date</u> | <u>Height (cm)</u> |                |
|-------------|---------------------|--------------------|----------------|
|             |                     | <u>Flax</u>        | <u>Mustard</u> |
| 1989        | July 19             | 37                 | 77             |
| 1990        | July 26             | 49                 | 74             |
| 1991        | July 16             | 47                 | 77             |
| 1992        | July 28             | 17                 | 72             |

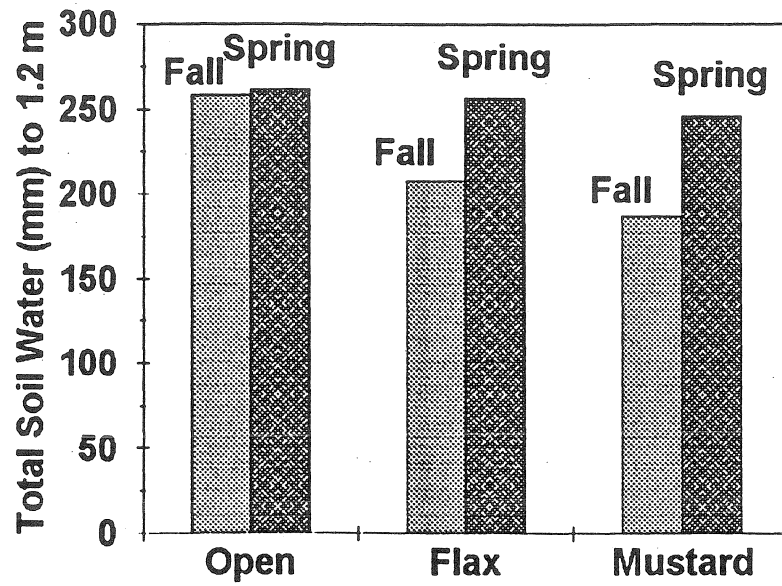


Figure 1. Mean 4-yr on-strip fall and spring soil water to 1.2 m.

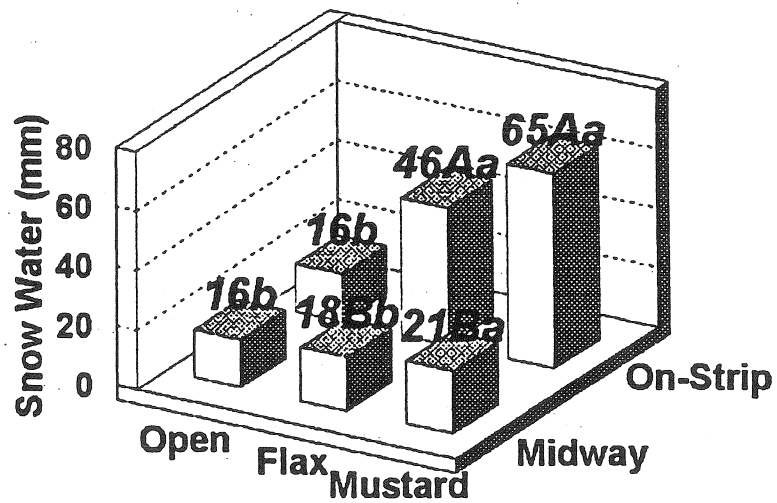


Figure 2. Mean 1990-93 maximum winter snow water equivalent on the strip and midway between strips (different lower case letters indicate differences among barriers, different upper case letters indicate differences among positions, by least significant difference at the 5% level).

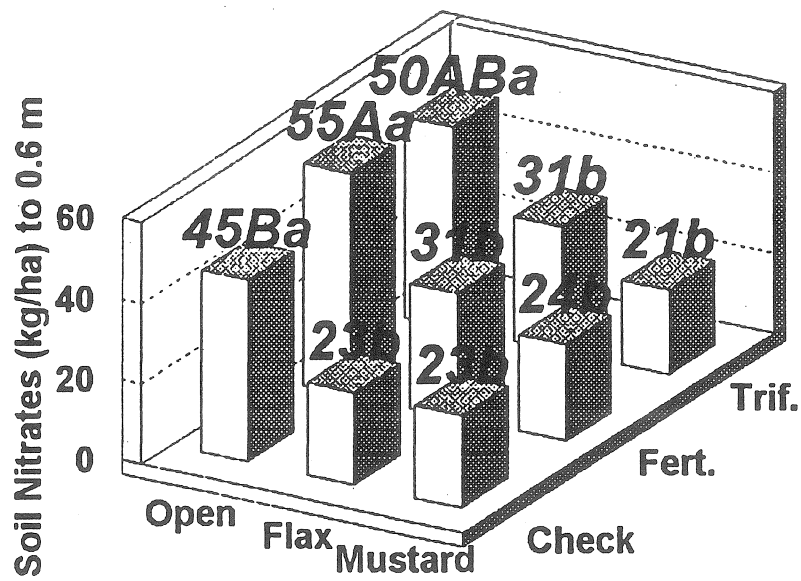


Figure 3. Mean 1990-93 on-strip spring soil nitrates to 60 cm (different lower case letters indicate differences among barriers, different upper case letters indicate differences among additives, by least significant difference at the 5% level).

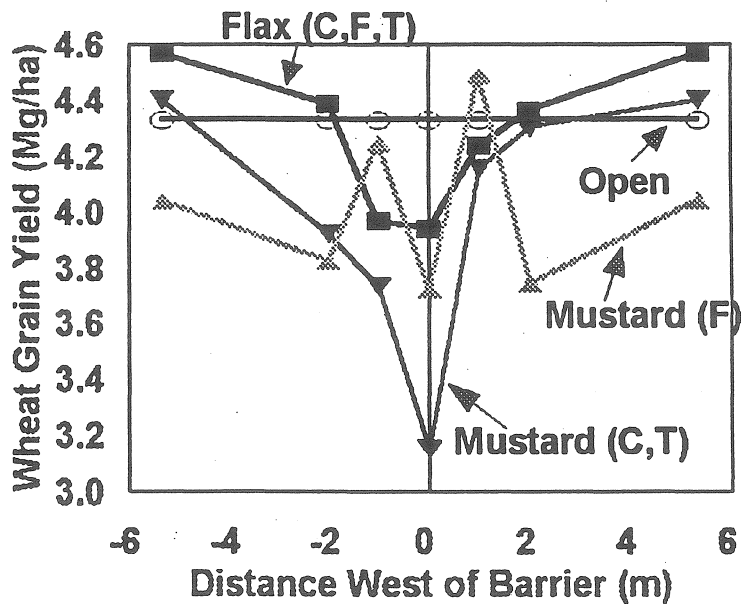


Figure 4. Wheat grain yields in 1993 with perpendicular distance from barriers for open fallow, for check, fertilized, and trifluralin-treated flax strips (C, F, T), for check and trifluralin-treated mustard strips (C,T) and for fertilized mustard strips (F).

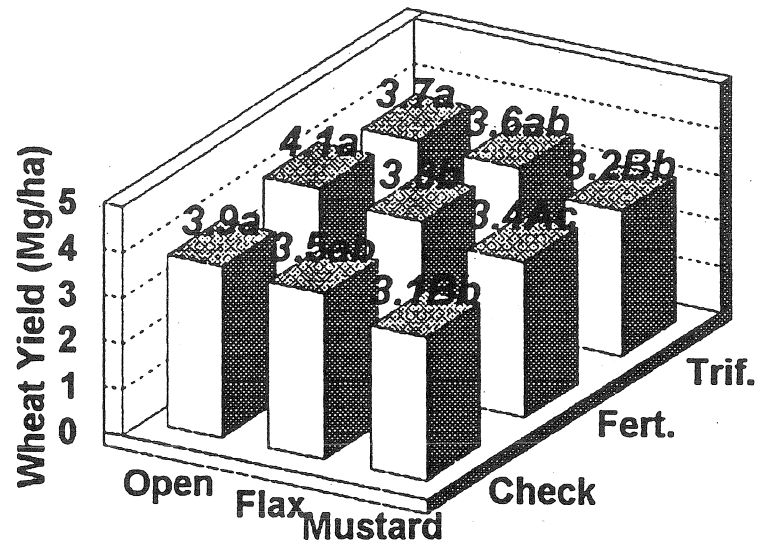


Figure 5. Mean 1990-93 on-strip wheat grain yields as affected by barrier and additive treatments (different lower case letters indicate differences among barriers, different upper case letters indicate differences among additives, by least significant difference at the 5% level).