UNIVERSITY OF ALBERTA

DEPARTMENT OF RURAL ECONOMY

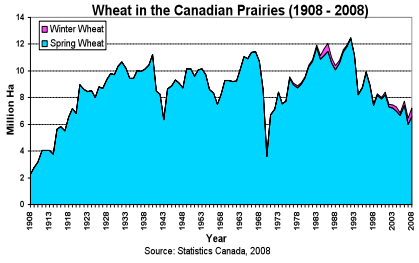
An Economic Analysis of the Influences of Incorporating Winter Wheat into Crop Rotations in the Canadian Prairies

D Yang, J Unterschultz, and S Jeffrey

Introduction

Winter wheat in prairie crop rotations may have many agronomic, environmental, and economic benefits. If winter wheat successfully overwinters, it usually out-yields spring wheat; production costs are lower because of less herbicides and pesticides required; environmental benefits include providing nesting habitats for wildlife, helping to control soil erosion, and more efficient use of early spring moisture (Fowler, 2002). Moreover, there is reduced potential risk of grade loss due to earlier maturity (Salmon and McLelland, 1999).

Figure 1: Seeded Area of Spring Wheat and Winter Wheat in the Canadian Prairies (1908 - 2008)



Source: Statistics Canada, 2008

However, winter wheat area is insignificant compared to spring wheat (Figure 1). This is due to problems related to winter hardiness, weather, crop diseases, farm management, world wheat market, and quality issues (Fowler, 2002). Genomic research programs are ongoing in Western Canada to improve winter wheat cold tolerance, yield, and field management.

Objectives

This study examines scenarios under which it may be beneficial for Western Canadian farmers to switch from spring wheat to winter wheat. The objectives of this study are to evaluate the economics of incorporating winter wheat into crop rotations under different price, yield, and cold tolerance scenarios. The preliminary results from the black soil zones in Alberta, Saskatchewan, and Manitoba are presented here.

Methods and Data

Farm cash flow models of crop production, combined with Net Present Value (NPV), are developed to compare two scenarios: growing no winter wheat, and a scenario where 50% of spring wheat acres are converted to winter wheat.

Table 1: Comparison between Winter Wheat and Spring Wheat for Each Province

	Price ($/bu)		Yield (bu/ac)		Cost ($/ac)	
	Winter	Spring	Winter	Spring	Winter	Spring
AB	5.82	6.18	56.57	55	189.6	206.4
SK	4.5	5.38	44.9	36.95	154.4	157.6
MB	4.08	5.08	65.3	41.5	178.4	173.8

Source: Provincial Crop Budget Estimates, 2007 and 2008.

The representative farms are 2000 acres in size and follow a five year rotation of spring wheat, feed barley, canola, spring wheat, and oats. In the alternative rotation scenario the second occurrence of spring wheat is replaced with winter wheat. The level of winterkill in winter wheat is stochastic. Model data are based on an average of 2007 and 2008 provincial crop budget estimates. Provincial winter and spring wheat prices, yields, and costs are listed in Table 1. Software @RISK5.0 is utilized to analyze the models.

Results

Scenarios compare the NPV with no winter wheat to the NPV with winter wheat in the rotation.

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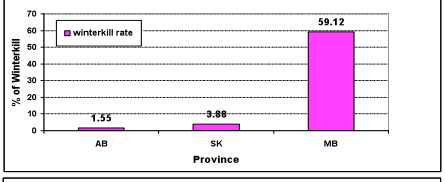
Define: - Price Difference = price of winter wheat – price of spring wheat
- Yield Difference = yield of winter wheat – yield of spring wheat
- NPV Difference = NPV with winter wheat – NPV without winter wheat (i.e. farmers should be indifferent to including winter wheat in the rotation if NPV Difference = 0; referred to as the breakeven point)
- Winterkill is defined as percentage of years there is a complete loss of winter wheat and the field is reseeded to feed barley in the spring.

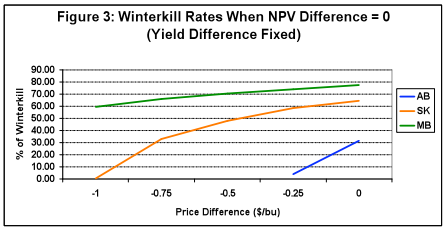
(1) If price and yield difference are fixed, breakeven winterkill rates differ among the three provinces (Figure 2). Due to higher estimated yields for winter wheat, a much higher incidence of winterkill can be tolerated in Manitoba (i.e. research improves cold hardiness).

Figure 2: Winterkill Rates When NPV Difference = 0 (Price Difference and Yield Difference Fixed)



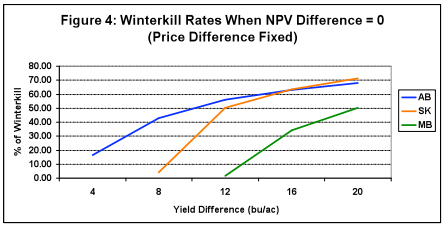
(2) If yield difference is fixed, as the winter wheat prices rise relative to spring wheat, breakeven winterkill rates rise as well (Figure 3) (i.e., research improves quality).

Figure 3: Winterkill Rates When NPV Difference = 0 (Yield Difference Fixed)



(3) If price difference is fixed, breakeven winterkill rates rise as winter wheat increases its yield advantage (Figure 4) (i.e. research improves yield).

Figure 4: Winterkill Rates When NPV Difference = 0 (Price Difference Fixed)



Conclusions

These results provide targets for winter wheat research on improved quality, yields, and cold tolerance. If these traits can be improved, farmers may switch between spring wheat and winter wheat. In real life, it may require more benefits for a switch to winter wheat to happen.

Through research, incorporating winter wheat into crop rotations in the Canadian Prairies may become more viable in the future. However, further analysis is required to refine the results presented here.

Reference

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For further information contact:
danyi@ualberta.ca

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