Economic feasibility of organic, reduced-till cropping systems in the Palouse

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Introduction

The Palouse region of the Inland Pacific Northwest (IPNW) is recognized for its hilly landscape, deep loess soils, and record high wheat yields. To preserve the highly productive soils, many farmers have adopted conservation tillage practices. The vast majority of the 8 million acres planted to dryland crops throughout WA and ID are grown with synthetic fertilizers and pesticides, with <0.1% estimated to be grown using organic management methods. Recent research that integrates reduced-tillage practices with organic management suggests benefits to soil health and potential economic viability. The current study follows a previous investigation of the transition to organic, reduced-tillage (ORT) in eastern WA. Here we analyzed the cost and returns in years 3-7 after organic certification was achieved.

Objectives

1. Determine potential economic viability of ORT cropping systems analyzed through a scenario that would allow integration into a typical Palouse dryland grain farm.
2. Compare ORT returns per acre to returns from non-organic, no-till production practices.

Photo: Organic wheat grown in Pullman, WA.

Study site and cropping systems

Four ORT cropping systems (CS1, CS2, CS3, CS4, see Fig. 1) were compared in terms of average machine operations, input costs, and yield from cropping system plots located near Pullman, WA. The cropping systems were in place for six years (2008-2013), though the plots had been organically managed for five years prior. Plots were located on a uniform 5% southwest facing slope where the main soil type is Palouse silt loam (Fine-silty, mixed, superactive, mesic Pachic Ultic Haploxerolls). The climate is Mediterranean with 38 cm of average annual precipitation during the study years, slightly lower than the 30-year average (43 cm yr^{-1}).

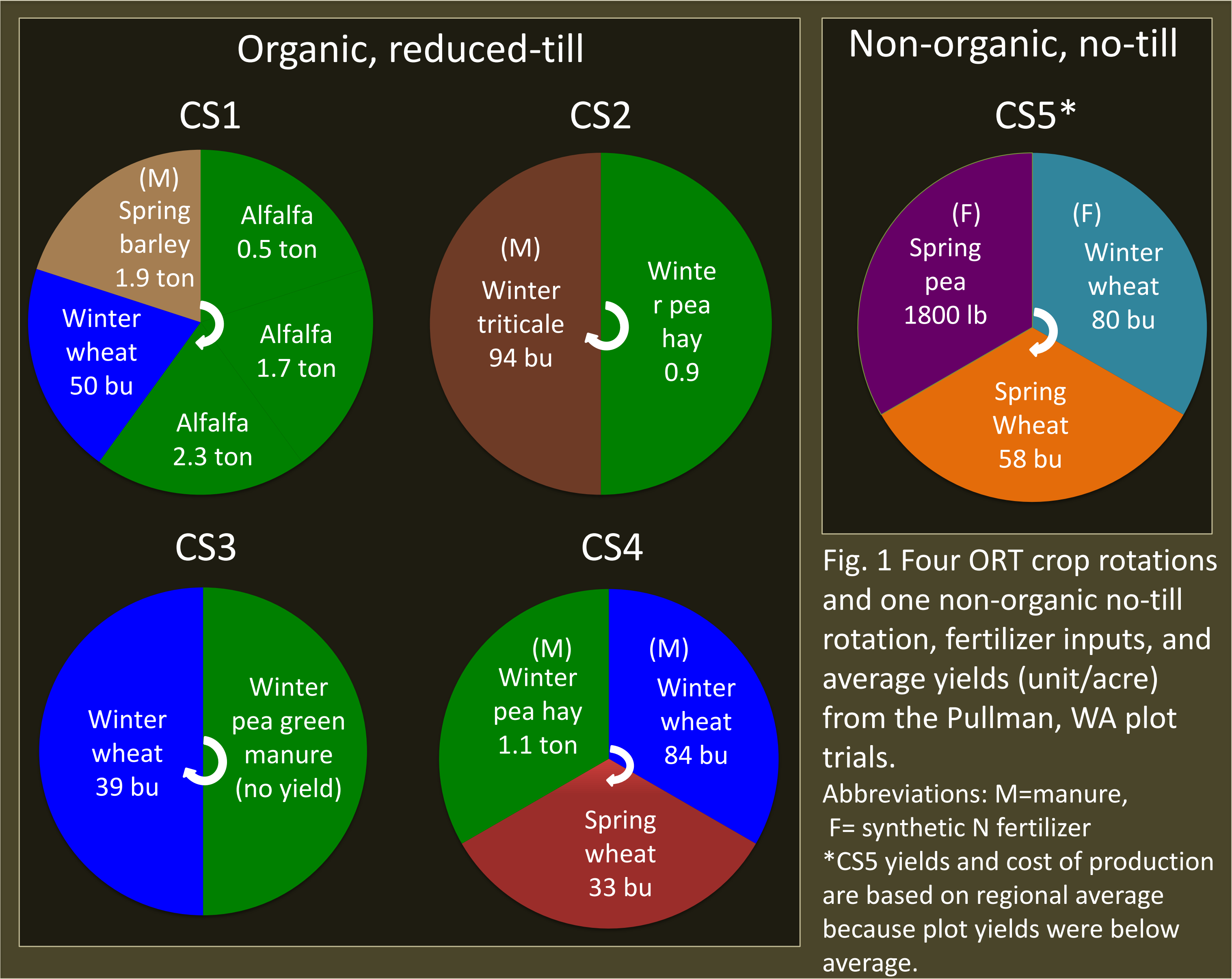


Fig. 1 Four ORT crop rotations and one non-organic no-till rotation, fertilizer inputs, and average yields (unit/acre) from the Pullman, WA plot trials.
Abbreviations: M=manure, F= synthetic N fertilizer
*CS5 yields and cost of production are based on regional average because plot yields were below average.

Methods

Agronomic practices

A rotary harrow and/or undercutter were used in the fall (post-harvest) and spring for weed control. Plots were rotary hoed in the spring between 3-5 times for early, in-crop weed control. Mowing was used post-harvest for weed control in grain and forage crops in most years. All plots were seeded with a no-till drill. Poultry manure was applied to select grain crops (Fig. 1) at rates ranging from 1 ton ac^{-1} (CS1) to 2 ton ac^{-1} (CS2, CS4). No manure was applied to CS2, which relied completely on a green manure crop for nutrient inputs.

Fig. 2 Machine costs associated with weed control in ORT and non-organic, no-till cropping systems

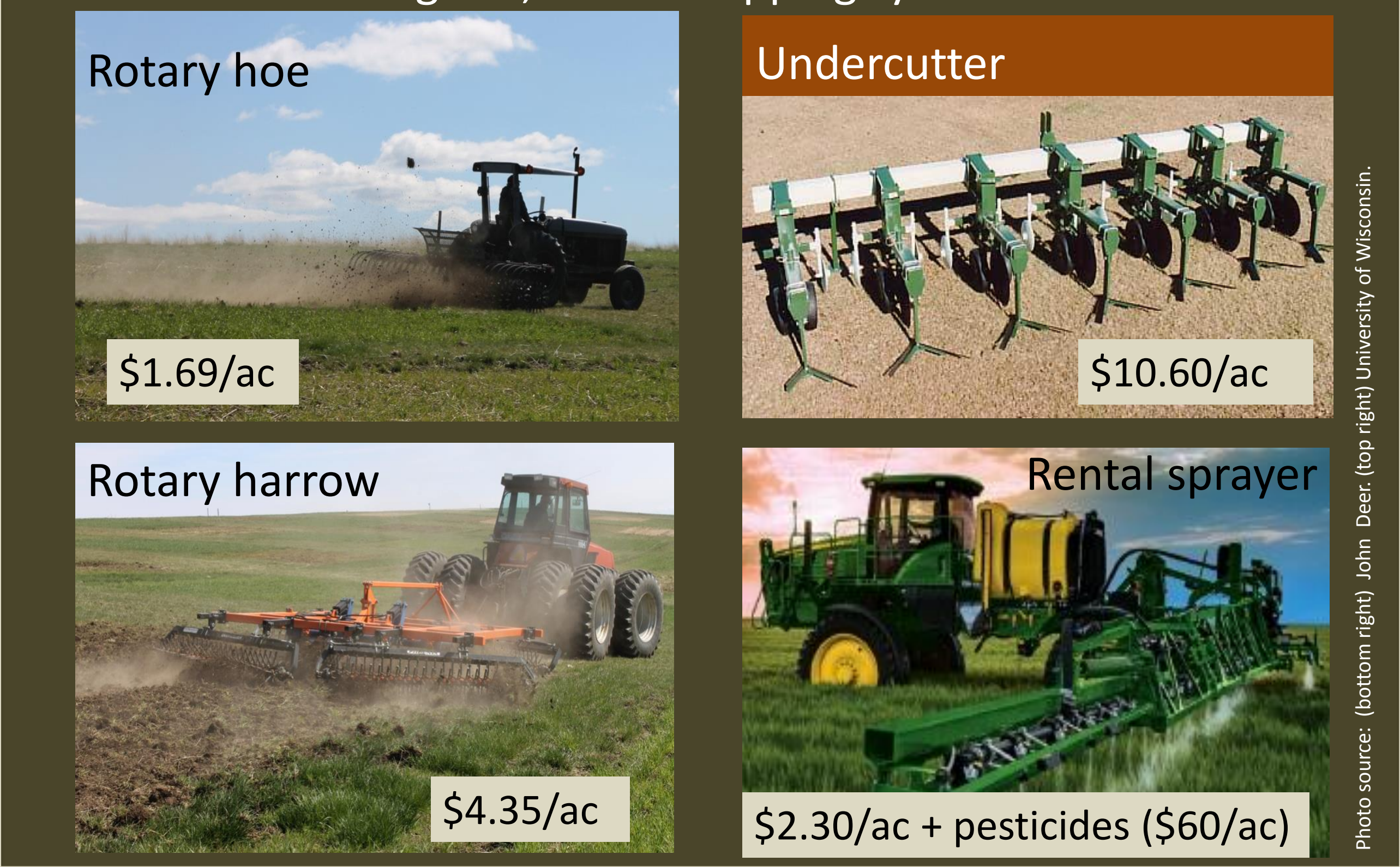


Photo source: (bottom right) John Deer. (top right) University of Wisconsin.

Farm-scale analysis under three market scenarios

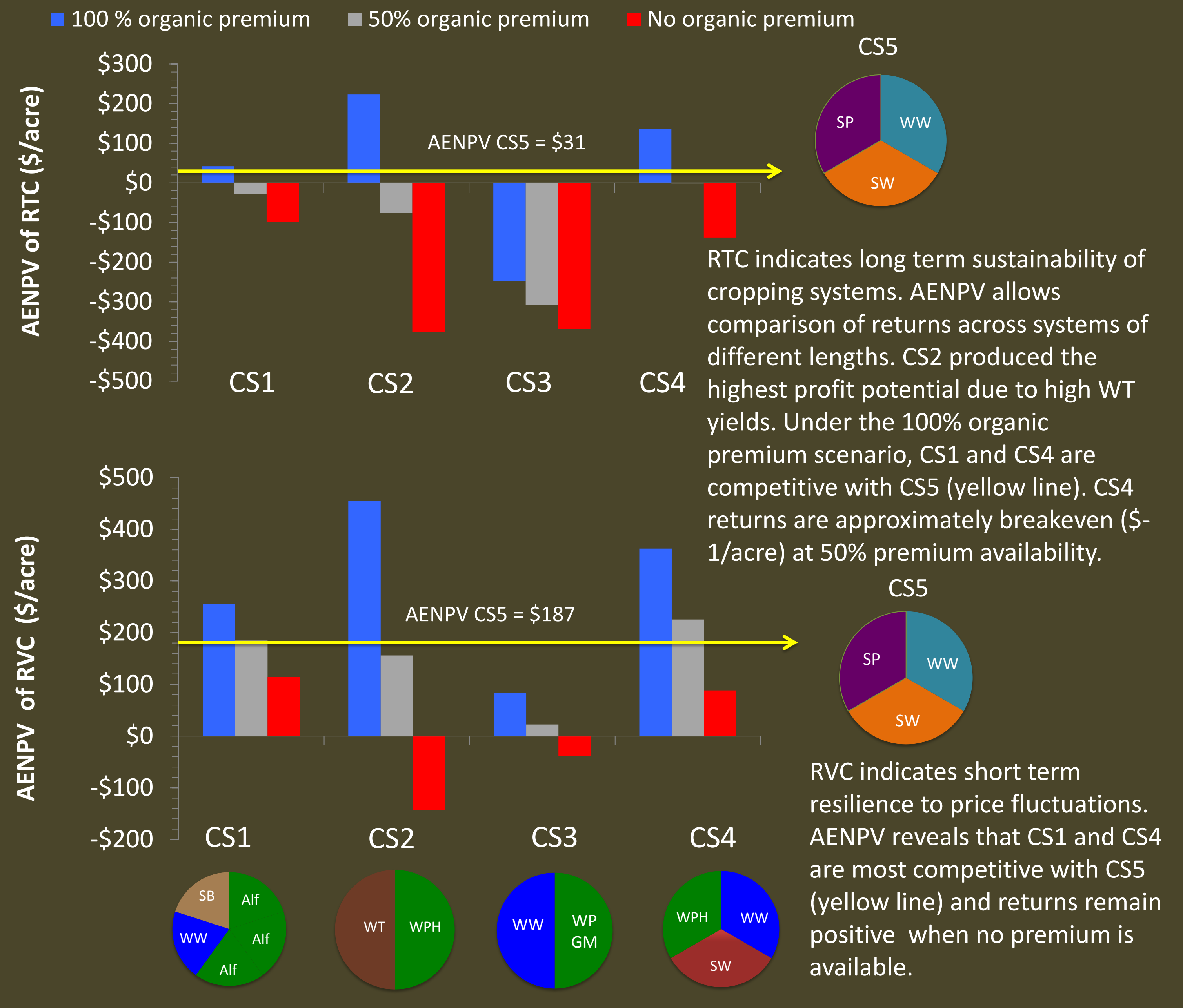
To manage the risk of adopting organic production, we assumed a scenario of a typical Palouse non-organic, no-till farm (2,000 acres) converting 100 acres to certified organic production. This limits organic production to 5% of the total farm capacity, and distributes investment costs of machinery between the organic and conventional components of the farm. Machinery is assumed to be used by both production systems. Machinery costs for weed control methods are displayed in Fig. 2 above.

Obtaining organic prices is not always possible, and organic prices fluctuate. Therefore, we analyzed profit under scenarios where 100%, 50% and 0% of organic crop yields were sold with organic premiums. The net present value (NPV) of returns over total costs (RTC) and variable costs (RVC) were calculated to compare the cropping systems. To compare crop rotations of different lengths, standard amortization factors for an 8% interest rate were applied to the NPV to generate an annual equivalent NPV (AENPV; Fig. 3). Organic systems were compared to a no-till, 3-year rotation typical in this region (CS5). Crop prices (2013-2014 average) are listed below.

Crop	Unit	$/unit
Organic soft white winter wheat, food grade	bu	$13
Organic hard red spring wheat, feed grade	bu	$16
Organic barley, feed grade	ton	$333
Organic winter triticale, feed grade	bu	$12
Organic alfalfa-orchardgrass	ton	$215
Organic winter pea hay	ton	$200
Conventional soft white wheat	bu	$6.50
Conventional hard red spring wheat (DNSW)	bu	$8
Conventional Spring Pea	ton	$280

Results

Fig. 3 Annual net present value (AENPV) of returns over total costs (RTC—top) and variable costs (RVC—bottom)

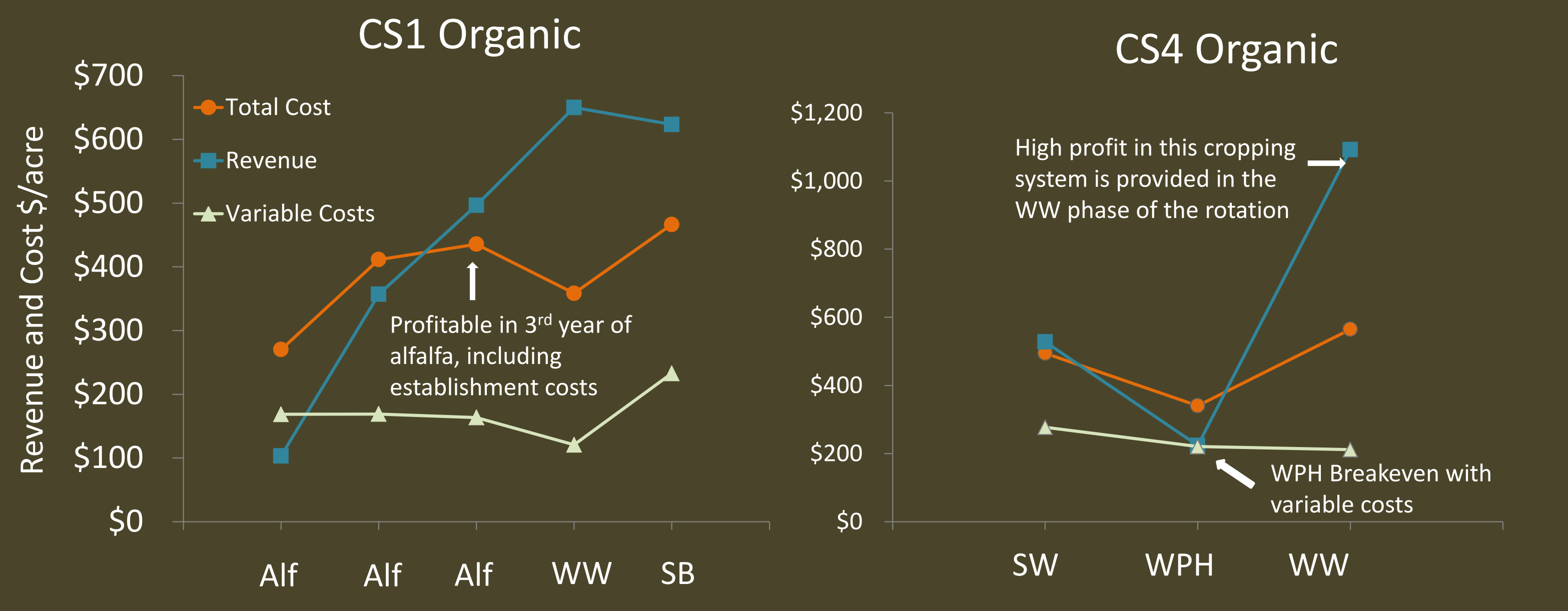


RTC indicates long term sustainability of cropping systems. AENPV allows comparison of returns across systems of different lengths. CS2 produced the highest profit potential due to high WT yields. Under the 100% organic premium scenario, CS1 and CS4 are competitive with CS5 (yellow line). CS4 returns are approximately breakeven ($-1/acre) at 50% premium availability.

RVC indicates short term resilience to price fluctuations. AENPV reveals that CS1 and CS4 are most competitive with CS5 (yellow line) and returns remain positive when no premium is available.

Alf=alfalfa, WW=winter wheat, SW=spring wheat, WPH = winter pea hay, SB=spring barley, SP=spring pea, WT= winter triticale

Fig. 4 Annual costs and returns within cropping systems

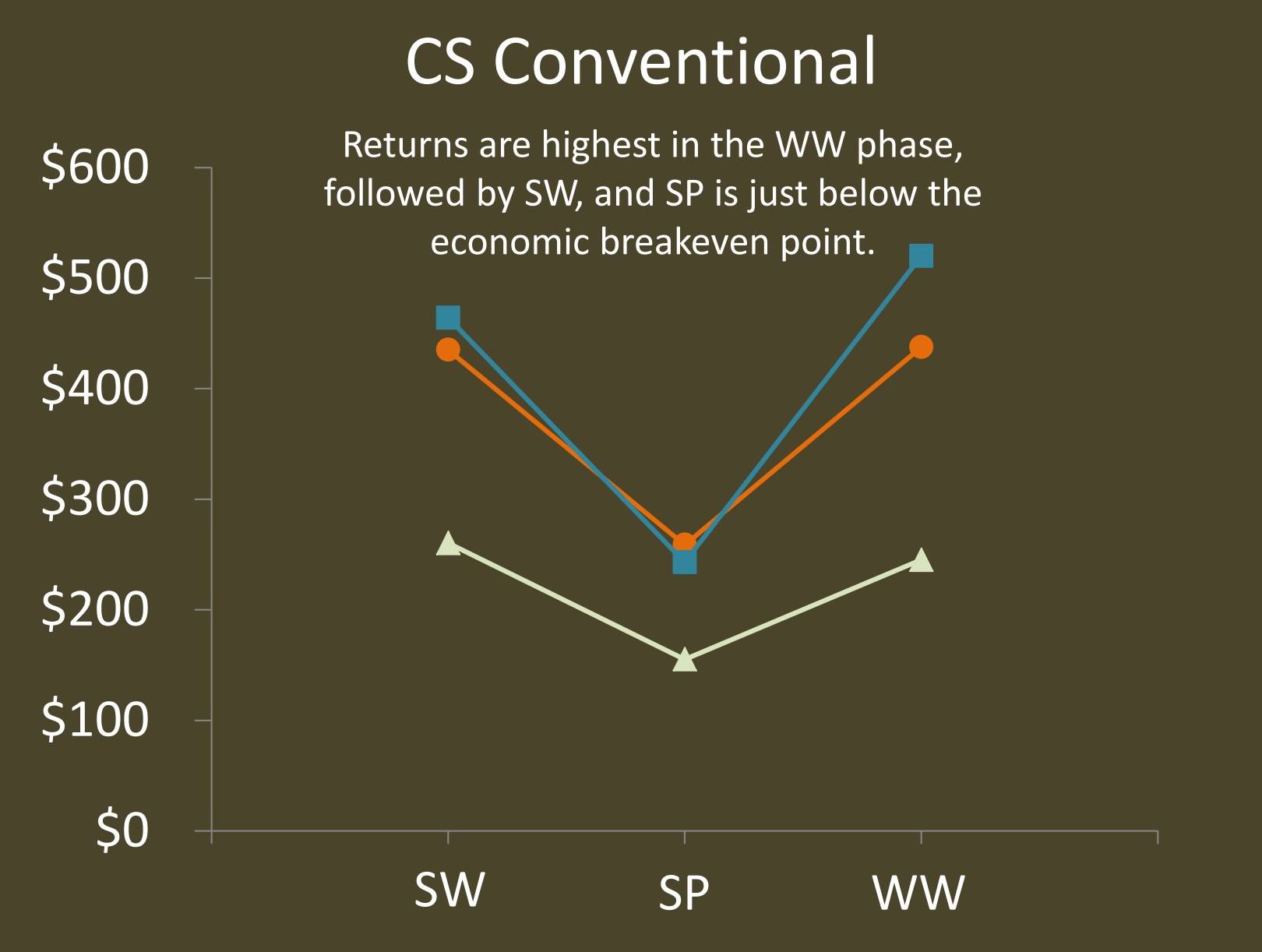


Profitable in 3rd year of alfalfa, including establishment costs

High profit in this cropping system is provided in the WW phase of the rotation

WPH Breakeven with variable costs

Photo: Multiple opportunities for mowing throughout the season made winter pea hay an important crop for weed control in the ORT crop rotations.



Returns are highest in the WW phase, followed by SW, and SP is just below the economic breakeven point.

Conclusions

- CS1 and CS4 show the highest profit potential when organic premiums were available for 100% of production and have the greatest resilience when prices are low. They also have agronomic benefits of longer, more diverse crop rotations.
- While economic returns in CS2 are high due to the triticale, a longer, rotation is suggested for agronomic benefits, such as breaking weed and disease cycles.
- Overall, our study shows promising economic potential of select ORT cropping systems. Additional field-scale trials are suggested.

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