Transitioning from Conventional to Organic Production for the Corn, Soybean, Wheat (CSW) Cropping System: Transition Period Economics

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Summary

- A multiyear agronomic study of conventional and organic CSW cropping systems, including transition period agronomics, provided data for an economic analysis designed to identify the optimal crop sequence for the conventional to organic transition period.
- Net Present Value (NPV) analysis of a feasible set of crop sequences for the CSW cropping system, rotation during the transition period yielded the following optimal sequence, where acres are allocated equally among corn, soybean, wheat annually
    - Conventional corn as an entry crop for the transition period precedes organic red clover which precedes organic corn
    - Conventional soybean as an entry crop for the transition period precedes organic corn which precedes organic soybean
    - Conventional small grain, barley as an entry crop for the transition period precedes organic soybean which precedes organic wheat/red clover
- Growing conditions to date for the multiyear agronomic study comparing a conventional to an organic CSW cropping system affected results.

Background

Farm business owners producing corn, soybean and wheat may look to the production and sale of organic grains as means to improve results. Operators evaluate expected profits under alternative conventional and organic scenarios to aid decision making. If economic analysis yields favorable results, and the owner concludes that organic production is a good fit for the business based upon other considerations, then the decision to transition tillable acres from conventional to organic production is made. Some owners, after making the decision to transition to organic production, ask, "Is there an optimal crop sequence for the 36 month transition period that positions the business for the first year of organic production with organic prices?"

An economic analysis sought to identify the optimal crop sequence for the transition period from a set of feasible transition period crop sequences.

Description of the Economic Analysis

The economic analysis developed to answer the above question required agronomic data including yields, input levels and other information by crop for the transition period. A study designed to provide research based knowledge on the transition period provided needed data. Retired Cornell University Agronomist, Professor Emeritus Bill Cox, and his group initiated a 3-

year study at the Aurora Research Farm in 2015 to compare different sequences of the corn, soybean, and wheat/red clover (CSW) rotation in conventional and organic cropping systems under recommended and high input management during the 36-month transition period (2014-2017) from conventional to an organic cropping system. Please see Cornell University's "What's Cropping Up? Newsletter" website for reports by Professor Cox on the multiyear study <https://scs.cals.cornell.edu/extension-outreach/whats-cropping-up>.

Selected assumptions for the economic analysis follow.

- The conventional CSW cropping system splits acreage equally among corn, soybean and wheat annually, and follows a CSW cropping sequence, rotation year to year.
- The decision to produce organic corn, soybean, and wheat has been made.
- The owner has decided upon the number of tillable acres to transition from conventional to organic production.
- Organic acres will be split equally among corn, soybean and wheat annually beginning with transition and in future years, while following a CSW cropping sequence, rotation year to year.

The design and implementation of the Cox study, selected assumptions, and organic certification requirements during the transition period, including those related to crop rotations, combined to determine the feasible set of crop sequences. We determined the feasible set from the set of alternative entry crop sequences given the design, implementation of the study. The design and implementation of the study centered on a corn, soybean, wheat rotation (Table 1).

Table 1. Crop combination and sequence for transition years 2015 and 2016.

2015	Red Clover	Corn	Soybean
2016	Corn	Soybean	Wheat/Red Clover

Note: In 2015, due to growing season conditions, the Cox study included only red clover as a cover crop where the planned design would have included wheat/red clover.

Given three entry year, 2014 crops from the study, six possible crop combinations for the entry year, A, B, C, … E, result (Table 2).

Table 2. Alternative crop combinations for the entry year, 2014.

A	Barley	Corn	Soybean
B	Barley	Soybean	Corn
C	Corn	Barley	Soybean
D	Corn	Soybean	Barley
E	Soybean	Barley	Corn
F	Soybean	Corn	Barley

There are six possible crop sequences given the design, implementation of the study. However, given crop rotation related requirements per conventional to organic transition guidelines where soil building crop rotations must be implemented, the possible combinations in Table 2 reduce to three feasible crop entry year combinations and three overall crop sequences (Table 3).

Table 3. Feasible crop sequences given the study design, conventional to organic transition period requirements regarding rotations, and other assumptions.

Sequence 1			
2014	Barley	Soybean	Corn
2015	Red Clover (RC)	Corn	Soybean
2016	Corn	Soybean	Wheat/Red Clover
Sequence 2			
2014	Corn	Soybean	Barley
2015	Red Clover (RC)	Corn	Soybean
2016	Corn	Soybean	Wheat/Red Clover
Sequence 3			
2014	Soybean	Barley	Corn
2015	Red Clover (RC)	Corn	Soybean
2016	Corn	Soybean	Wheat/Red Clover

The optimal sequence is the one that maximizes Net Present Value (NPV) for years 2015 and 2016 of the transition period of the study (Kay. 1981. Farm Management: Planning, Control and Implementation. McGraw-Hill Book Co.: New York, NY). Researchers used NPV analysis to calculate NPVs for years 2015 and 2016 of the transition period for each feasible sequence. For this research, net present value of a scenario is the sum of the present values for two years, 2015 and 2016, of cash income above selected cash variable costs. Initial capital investments in a tine weeder, and rotary hoe to facilitate organic production are omitted from the analysis, because the investments are fixed, constant among sequences. Based upon costs and returns analyses, organic, high input scenarios were omitted, because organic, recommended inputs treatments out performed high inputs treatments in all instances based upon the return above selected costs.

Results

NPVs for 1 acre of the organic corn, soybean, wheat rotation for the 2015, 2016 transition years range from $215.24 for Sequence 3 to $233.83 for Sequence 2 (Table 4). The optimal sequence, the one that maximizes NPV for the transition years 2015, 2016, is Sequence 2. For complete crop sequences please see Table 3.

Table 4. NPV by sequence.

Sequence	NPV for the years 2015 and 2016 from 1 acre
1	$216.88
2	$233.83
3	$215.24

Notes: 1) for sequence descriptions, please see Table 3; 2) detailed cost and returns analyses upon which the NPVs are based are available upon request from John Hanchar, Cornell University, jjh6@cornell.edu; 3) 8 percent nominal discount rate.

Analysis to this point suggests crop combinations and sequences for the organic CSW cropping system, rotation (Table 5).

Table 5. Optimal crop combination, sequence suggested by economic analysis, entry year, two transition years, CSW cropping system, rotation.

Time Period		Crop	
Last year of conventional production, transition to organic begins	Conventional Corn	Conventional Soybean	Conventional Small Grain, Barley
First year of organic CSW production, production sold at conventional prices, not yet certified, in transition	Organic Red Clover	Organic Corn	Organic Soybean
Second year of organic CSW production, production sold at conventional prices, not yet certified, still in transition	Organic Corn	Organic Soybean	Organic Wheat/Red Clover

The optimal sequence, and final crop combination in Table 5 position the organic CSW cropping system for the third year of organic CSW when the transition, certification is complete and organic production is sold at organic prices.

- Organic soybean would follow organic corn, column 2
- Organic wheat/red clover would follow organic soybean, column 3
- Organic corn would follow organic wheat/red clover, column 4