PURDUE UNIVERSITY

Purdue Agricultural Economics Report

June 2014

In This Issue…

Weighing Crop Program Alternatives in the 2014 Farm Bill

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Farmers will have to make a **decision regarding their** participation in the new farm program which will cover the 2014 to 2018 crops. There are three main alternatives to select from and in the previous edition of PAER, we examined two of those: PLC (Price Loss Coverage) and ARC-C (Agricultural Risk Coverage-County). That article can be located at http://www.agecon.purdue.edu/extension/pubs/paer/pdf/PAER04_2014.pdf

Here, we continue by explaining the third alternative which is a whole farm alternative we designate as ARC-I (Agricultural Risk Management-Individual Farm). Then we will discuss some of the key decision points producers must evaluate to make a well informed decision.

Introducing the Agricultural Risk Coverage-Individual (ARC-I) Option

Perhaps the easiest way to introduce the ARC-I option is to compare and contrast it with the other two alternatives; PLC (Price Loss Coverage) and ARC-C County).

Table 1. Feature comparison of Agricultural Act Crop Programs

Feature	PLC	ARC-C	ARC-I
Payment Trigger	Statutory reference price	86% of 5 year average revenue*	86% of 5 year average revenue*
Payment Yields	90% of 2008-2012 yields for crop**	5 year Olympic average of county yields	Individual farm yields
Payment Cap	Payments made until loan rate reached	10% of County Benchmark revenue	10% of Whole Farm Benchmark Revenue
Enrollment flexibility	Commodity basis	Commodity basis	Whole farm basis
Coverage	85% of base acres	85% of base acres	65% of base acres
Payment Allocation	Historical base acre allocation	Historical base acre allocation	Current planted acreage allocation

Table 1 provides a list of five features of the three programs offered in the 2014 farm bill. What triggers a payment? PLC is distinguished from the ARC programs by using a reference price as opposed to benchmark revenue for triggering payments. The reference prices are set in the law (by statute). Payments would be made to farmers under the PLC option when the U.S. market year farm price drops below the statutory reference price of $3.70 a bushel for corn, $8.40 a bushel for soybeans, and $5.50 for wheat. Each commodity is independent, so in any given year, payments might be triggered on one of the commodities but not the others. The PLC program effectively guards against price drops between the statutory reference price and the loan rate that

Table 2. ARC-C and ARC-I Calculations for a Wheat and Corn Farm

	Wheat		Corn	
	Price	Yield	Price	Yield
Year 1	$ 4.87*	55*	$ 3.55*	155
Year 2	$ 5.70	57	$ 5.18	174
Year 3	$ 7.24	60	$ 6.22	185**
Year 4	$ 7.77**	61	$ 6.89**	125*
Year 5	$ 6.80	65**	$ 4.50	184
Olympic Averages	$6.58	59	$ 5.30	171
Benchmark Revenue	$ 390.41		$ 906.30	
ARC-C Revenue Guarantee	$ 335.75		$ 779.42	
Planted Acres Shared in Year 6	20%		80%	
ARC-I Guarantee	$ 67.15		$ 623.54	
Per acre ARC-I Whole Farm Guarantee	$ 690.69			

Notes:
* Dropped from average calculation as the lowest value.
**Dropped from average calculation as the highest value.

guarantees a minimum price for the crop.

The two ARC programs function quite differently and bear more resemblance to revenue based crop insurance. In both instances of ARC, payments begin when actual revenue in a given year for that crop falls below 86% of the benchmark revenue which is determined by the most recent 5 years of yields and U.S. marketing year prices. These payments cease however after an amount equal to 10% of the benchmark is paid. ARC-C uses county yields and ARC-I uses the individual farm's yields to determine the benchmark revenue. The ARC programs can thus be thought of as a government support payment to offset a portion of the deductible from a crop insurance contract at 75% coverage.

Similar to county insurance products, the ARC-C works as a group or pooled coverage plan while the ARC-I works on an individual farm basis. The county yield basis of the ARC-C means that a farm will have its payments triggered and calculated based on the countywide performance for the crop. The individual basis of the ARC-I uses only yield information of the covered farm for determining payout amounts. In the last three rows of Table 1 we see that moving to this individual type of coverage comes at a cost as farmers have to forego both enrollment flexibility and the amount of base acres covered. Farms that enroll in ARC-I will have 20% less of their base acres used in calculating their payments. ARC-I farms also lose the commodity by commodity flexibility in enrollment and must instead enroll all base acres on the covered farm in the ARC-I option. The ARC-I option also uses this year's planted acres in determining the acreage base rather than the FSA fixed acreage allocation that is present in the PLC and ARC-C programs.

Calculating an ARC-I Payment

To demonstrate an ARC-I payment we should first review the ARC-C calculation, previously presented in the April edition of PAER. In Table 2, we have five years of data on prices and yields for wheat and corn crops. In calculating the average price and yield for each crop, we use an Olympic formula that drops the lowest and highest value. Multiplying the Olympic average price and yield for each crop yields a benchmark revenue for each crop. The ARC-C revenue guarantee is 86% of that benchmark.

Assuming these are the county average yields for each year, a farmer who enrolled both wheat and corn crops in the ARC-C option would begin receiving payments when actual revenue (county yield multiplied by U.S. marketing year average price) fell below these values. Those payments may increase up to a limit of 10% of the benchmark revenue (approximately $39 for wheat and $90 for corn) and would be paid out on 85% of historical base acres. Continuing with Table 2, the three rows at the bottom demonstrate the primary difference in the ARC-I and ARC-C options. The Planted Acres Share row shows that 20% of acres are in wheat this year while the remaining 80% are in corn this year. This year's planted acres provide the weights used to calculate the ARC-I benchmark revenue for the farm, using the farm's actual yield history in calculating the Olympic average yield for the past five years. For simplicity here, we have assumed that the farm has identical yields to the county. This gives an ARC-I guarantee for covered acres on the farm of $691. ARC-I will vary versus ARC-C due to differences in yields (individual farm versus county yields) and due to the use of acre bases in which the ARC-I uses this year's actual planted acres and ARC-C uses the historical FSA acreage bases. Payments under ARC-I are only made if the whole farm actual revenue drops below the whole farm guarantee revenue. This means payments are made on a whole-farm basis not commodity-by-commodity.

ARC-I may provide higher guarantees but may not, provide higher actual payouts. There are a couple of reasons to expect an ARC-I guarantee to be higher on a farm choosing that option over taking an average of the ARC-C guarantees using historical base allocations. First is that ARC-I uses current planted acres versus the fixed base allocation. It is reasonable to expect that plantings will move to crops with higher recent prices so that the ARC-I has the advantage of having that reflected in the guarantee calculation. Second, a farm opting into ARC-I over ARC-C likely has yields that are outperforming the county average often enough to provide higher ARC-I guarantees. But ARC-I has a big negative because the payout for ARC-I is only made on 65% of the base acres compared to 85% for ARC-C. Farmers doing a comparison of the two will need to see enough advantage in the ARC-I guarantee levels to overcome this 20 percentage point discount on payment acres

Organizing Information for Making Program Decisions

Producers will have multiple considerations that must be weighed as part of evaluating their program enrollments later this year. The following outline represents a summary of the decision set they will face with a more detailed discussion that follows:

What farm program parameters can producers adjust?

a. For those considering PLC, should yields be updated? For many farms this should be an easy decision. Program yields are at least 12 years old for most farms and updating to 90% of the average yield for the 2008 to 2012 crops will generally increase payments under PLC.
b. Should the allocation of base acres be updated? This will vary based on the particulars of a farm. Base acreage allocations to crops are old for many farms. Updating may more closely match the current planting intentions but may not maximize expected payments

Which of the three program alternatives should I select?

a. For each program crop on the farm, is ARC-C preferred to PLC or not? This will depend on a producer's expectations about prices. Many estimates using published forecast prices show ARC-C to have a payout advantage over PLC because the statutory prices in PLC are considerably lower than the Olympic average prices from the past five years.
b. Is the whole farm ARC-I preferred to the best commodity by commodity enrollments? Once a producer has an idea of how ARC-C versus PLC fares for each commodity on the farm, the total expected payment (or payment per planted acre) can then be compared to the expected payment per acre from ARC-I

To fairly evaluate PLC most farmers should at least find out what their updated yields would be under PLC. Their alternatives are to stay with current FSA program yields or to update them to 90% of the simple average of actual yields from 2008 to 2012. PLC is the only alternative that uses payment yields. For most farms with current FSA yields reflecting late-1990s levels this has a strong probability of increasing their payment yields and expected payments under PLC.

Next, producers will want to consider the choices they have to allocate base acres for each farm which can be important for PLC and ARC-C. Base acres are important because they are part of the payment formulas. For each FSA farm, the total base acres cannot be changed, but you can elect to stay with the current allocation of acres on the farm, or to reallocate the base acres to the average acreage mix on that farm for the 2009 to 2012 crops.

An example is helpful. Say a farm currently has a 100 acre base and that the acreage allocation is 50 acres of corn base and 50 acres of soybean base. If during the 2009 to 2012 crops that farm averaged 60 acres of corn and 40 acres of soybeans, then 100 acres of base could either stay 50/50, or be switched to 60 acres of corn base and 40 acres of soybean base. Again the total acres cannot be changed, just the allocation of the 100 acres.

The decision on base reallocation is not so straightforward. One strategy farmers should consider is doing analysis of farm program enrollments using both their current and updated base allocations. This would lead to three sets of outcomes which would be compared:

1. Stay with old base allocation and do commodity by commodity program evaluations (ARC-C & PLC)
2. Move to new base and do commodity by commodity program evaluations (ARC-C & PLC)
3. Compare #1 and #2 with the whole farm program that uses current year planted acres (ARC-I)

The first two options will differ by how plantings over the 2009-2012 period differed from the historical record on the farm. It is possible that a 2009-2012 update will produce more expected value if plantings featured corn more heavily than the farm history due to elevated corn prices. If these prices taper off over the next five years as some forecasts suggest, then the update decision could produce significant payment advantages, even if it represents a poor match for actual plantings for the coming five years.

Once an economic evaluation of #1 and #2 has been made, the final task is to compare these against ARC-I with its whole farm requirement. Recall that ARC-I begins with potential advantages and a big disadvantage since program payments are made on only 65% of base acres rather than the 85% for ARC-C and PLC. This means that the nominal payment difference from being in ARC-I would need to be about 30% greater (0.85/0.65 = 1.307) for the programs to be equivalent. The primary advantages of ARC-I are for farms where actual yields are well above the county averages used in ARC-C, and the opportunity to use an acreage base allocation determined by what is planted that year.

The bottom line is that most producers will want to make and study economic evaluations of all three alternatives for each of their FSA farms before making their final one-time decision for the 2014 to 2018 crops. Decision aids and educational programs will be available to producers on their farm program choices from USDA and Land Grant Universities like Purdue, and from other agricultural organizations. USDA is currently targeting the winter of 2015 for the sign-up period for PLC, ARC-C or ARC-I.

82nd Annual Indiana Farm Management Tour in DuBois and Spencer Counties

Alan Miller,
Farm Business Extension Specialist

The annual statewide Indiana Farm Management Tour provides a unique and free opportunity for an inside look at the management of five outstanding farms. Due to biosecurity practices on their farms, we will explore two of the operations at the new and comfortable Spencer County Youth and Community Center while tours of the other three will be on their farms. In addition, you are invited to attend the *Indiana Prairie Farmer* "Master Farmer Banquet" on the evening of June 16 for which tickets must be purchased separately before the event.

Monday June 16, 2014

Fischer Farms Natural Foods — Tour starts at 1:00 p.m. CDT (2:00 p.m. EDT). — Fischer Farms produces natural beef for the wholesale market and also are meat suppliers to 80 Indiana restaurants. Fischer Farms works with Sander Processing to market individual custom cuts of beef under the farm's brand name. You will learn about the beef production and grazing management practices with their 250 cows. You will be fascinated by their rapidly expanding "direct-to-consumer" marketing program with a growing lists of natural food products produced on multiple Indiana farms. Address: Spencer County Youth and Community Center 1101 E County Rd 800 N, Chrisney, IN 47611

Vogel Seed Farm — Tour starts at 3:00 p.m. CDT (4:00 p.m. EDT) at 4560 N County Rd 200 W, Rockport, IN 47635. — Vogel Seed produces yellow corn, beans, beef calves, registered Angus bulls, and operates a thriving Pioneer seed and seed treatment dealership that is now in its 51st year of business. You will enjoy visiting this dynamic and innovative multi-family, multi-generational farm and getting an up close look at remodeling of their 300,000 bushel grain system and exploring the modern machinery technology on this 3,500 acre farm.

Indiana Prairie Farmer Master Farmer Banquet — This special event honors top Indiana farm families and starts at 5:30 p.m. CDT (6:30 p.m. EDT). — The banquet requires preregistration and a ticket to enter. Tickets cost $25 per person. Preregister by Friday June 6 by calling 765-494-8593. Tickets will NOT be available for the banquet on the day of the tour. Address: Spencer County Youth and Community Center 1101 E. County Rd 800 N, Chrisney, IN 47611

Tuesday June 17, 2014

Whitsitt Farm — Tour starts at 7:00 a.m. CDT (8:00 am EDT) at 6626 W 350 S, Huntingburg, IN 47542. — The Dennis Whitsitt farm increases revenue per acre by raising valued added crops like food-grade white corn, popcorn and a test plot of miscanthus. Other commodities include yellow corn, soybeans, hay, and pasture production. Conservation farming is essential in the rolling terrain and highly variable soils on this farm and you will see how they carry out the conservation mission. You will have the opportunity to learn about the interesting management information system the farm has developed that has enabled them to improve decision-making.

Giles Farms — tour starts at 9:15 a.m. CDT (10:15 a.m. EDT). The farm is notable as a winner of multiple awards for their conservation farming practices. Learn about the wetlands restoration project Giles Farms completed and walk the corn and bean test plots on the farm. Address: 374 W State Rd 62, Gentryville, IN 47537.

Vollmers Turkey Farms — This stop is at 11:30 p.m. CDT (12:30 p.m. EDT) back at the Spencer County 4-H Fairgrounds, 1101 E. County Rd 800 N, Chrisney, IN 47611. A FREE LUNCH will be provided by local sponsors including Farm Credit Mid-America; German American Banking; Old National Bank; Hopf Equipment CaseIH; Ken Shourds Equipment; Agrigold; Crop Production Services; and Superior Ag Resources Co-op. Please preregister for lunch so we can obtain an accurate lunch count. Preregister by calling 765-494-4310 or on-line at: http://www.agecon.purdue.edu/commercialag/progevents/tour.html

Lunch will be followed at 12:30 p.m. CDT (1:30 p.m. EDT) by a visit with the proprietors of Vollmers Turkey Farms. Dubois County is the number one turkey producing county in Indiana. The Vollmers will share their experiences investing in turkey production and managing turkey grow-out operations. At 1:00 p.m. CDT (2:00 p.m. EDT) Dr. Chris Hurt will wrap up the 82nd annual farm management tour with a upbeat presentation on the Outlook for Indiana Agriculture in 2014 and 2015.

Crop Machinery Benchmarks

Michael Langemeier, Professor and Assistant Director of the Center for Commercial Agriculture

The continued increase in size of tractors, combines, and other machinery has enabled farms to operate more acres and reduce labor use per acre. However, this increase in machinery size also makes it increasingly important to monitor machinery investment and cost per acre. This article discusses and illustrates crop machinery investment and cost using a case farm. The first section of the article illustrates the estimation of machinery costs for a tractor. The second section illustrates the estimation of machinery investment and cost for a case farm. The third section discusses factors impacting machinery investment and cost.

Estimating Crop Machinery Costs

Machinery costs can be divided into two primary categories: ownership costs and operating costs. Ownership costs are often referred to as overhead, indirect, or fixed costs. These costs do not vary with machine use intensity during the year. Operating costs are often referred to as variable or direct costs because they vary with machine use during the year.

Table 1 illustrates ownership and operating costs for a tractor owned by a case farm. This farm does not have livestock so all of the relevant costs can be assigned to the crop enterprise. If a farm has livestock production, individual machinery costs need to be allocated between the crop and livestock enterprises.

Ownership costs include depreciation, interest, property taxes, insurance, housing, and leasing cost. Depreciation is a non-cash expense that represents the reduction in asset value resulting from age, wear, and obsolescence. There are several methods that can be used to compute depreciation. Two common methods are the straight-line and declining balance methods. The idea is to mimic the actual decline in the machinery value over time. If the straight-line method is used, depreciation is computed by subtracting salvage value from original cost and dividing the result by the asset's useful life. Intensity of asset use and obsolescence should be taken into account when defining the useful life of an asset. IRS regulations compute depreciation and define the asset's life for tax purposes. Tax depreciation is typically higher in the early years of the asset's life and smaller in the later years of the asset's life. For benchmarking purposes, it is preferable to use a depreciation method and useful life other than those used for tax depreciation.

Table 1. Machinery Cost Estimates for a Tractor (260 HP)

Item	Units
Remaining Value (Dollars)	108,456
Useful Life (Years)	10
Ownership Costs (Dollars)	
Depreciation	12,759
Interest	7,809
Property Taxes	0
Insurance	542
Housing	1,085
Leasing Expense	0
Sub-Total	22,195
Operating Costs (Dollars)	
Repairs	2,107
Fuel and Lubricant	8,845
Custom Hire and Rental Expense	0
Sub-Total	10,952
Total Machinery Cost (Dollars)	33,147
Crop Acres	3,000
Machinery Cost per Acre (Dollars)	11.05

Depreciation is computed in Table 1 using the list price, salvage value (20 percent of original cost), and useful life of one of the tractors used by the case farm discussed below. Annual depreciation for the tractor is $12,759.

Interest is included as an ownership cost to reflect the fact that the money used for machinery investment has alternative uses. In other words, capital used for machinery investment has an opportunity cost. Interest is included as a cost regardless of whether the asset is purchased with debt, equity capital, or a combination of both. Interest cost can be computed by multiplying the remaining value of an asset by a long-term interest rate. Alternatively, interest cost can be computed by adding salvage value to original cost and dividing the result by two, and then multiplying by a long-term interest rate. This method uses the average value or the mid-life value in the computation.

In Table 1, interest cost is computed by multiplying the remaining value of a tractor that is four years old by a long-term interest rate (7.2 percent). Annual interest cost for the tractor represented in Table 1 is $7,809.

Other ownership costs include property taxes, insurance, housing, and leasing. Property taxes apply only to taxes related to machinery, which are common in some states. Leasing cost represents any annual lease payments for machinery. Other annual ownership costs for the tractor represented in Table 1 are $1,627.

Operating costs include repairs, fuel and lubrication, and custom hire or rental expense. Some estimates of operating costs also include labor. Annual repair costs vary with age, intensity of use, and machine type. It is particularly important to note that repair cost increases over time or as the asset ages. This fact often leads to a tradeoff between higher ownership costs and lower repairs in the early life of the asset and lower ownership cost and higher repair costs later in the asset's life. Annual repair costs for the tractor represented in Table 1 are $2,107.

Fuel and lubrication includes gasoline, diesel, oil, and other lubricants. Using a diesel price of $3.60, annual fuel and lubricant costs for the tractor represented in Table 1 are $8,845.

As noted above, labor costs are sometimes included in machinery cost estimates. These costs would include field time as well as time spent fueling and lubricating, repairing, and transporting machinery.

Custom hire and rental expense should be included as a machinery operating cost. If a farmer receives custom hire income and the amount received is relatively small, this income can be subtracted from other machinery costs to arrive at total machinery costs. The subtraction reflects the fact that the costs associated with custom hire income would not have been incurred if the farm had not performed the custom operations. If custom hire income is relatively large, the farm should seriously consider analyzing the custom farm enterprise or activity as a profit center.

Summing the ownership and operating costs for the tractor represented in Table 1 yields an annual cost of $33,147. This farm has 3,000 acres of crops. Dividing the number of crop acres by the ownership and operating costs gives us a machinery cost per acre for the tractor of $11.05.

Machinery Investment and Cost per Acre

Two commonly used benchmarks to evaluate the efficient use of machinery are machinery investment per acre and machinery cost per acre. Machinery investment per acre is computed by dividing total machinery investment (i.e., investment in tractors, combines, and other machinery) by crop acres or harvested acres. In regions where double-cropping is prevalent, using harvested acres gives a more accurate depiction of machinery investment.

Machinery investment per acre typically declines with farm size. It is important for farms to compare machinery investment per acre with similarly sized farms and to examine the trend in this benchmark to evaluate machinery use efficiency. A farm with a relatively high machinery investment per acre needs to determine whether this high value is a problem. If the farm faces serious labor or timeliness

Table 2. Machinery Investment and Cost Estimates for Case Farm

Item		$ per Acre
Machinery Investment per Acre		
	Self-Propelled Equipment	165.89
	Machinery	138.61
	Total	304.50
Machinery Cost per Acre		
	Depreciation	42.70
	Interest	21.92
	Property Taxes	0.00
	Insurance	1.52
	Housing	3.05
	Leasing Expense	0.00
	Repairs	12.65
	Fuel and Lubricant	18.09
	Custom Hire and Rental Expense	0.00
	Total	99.93

constraints, this benchmark may be relatively high. However, if this benchmark is high due to the purchase of assets used to reduce income taxes, the manager needs to think about whether this is a profitable long-term strategy (i.e., is the farm going to have high costs per acre due to this strategy)?

Machinery cost per acre is computed by summing depreciation, interest, property taxes, insurance, housing, leasing, repairs, fuel and lubricants, and custom hire and rental expense, and dividing the resulting figure by crop acres or harvested acres. Again, in regions where double-cropping predominates, using harvested acres is preferable.

Crop machinery investment and cost for a case farm located in White County Indiana is presented in Table 2. This case farm has 1500 acres of corn and 1500 acres of soybeans. Machinery investment per acre is $304.50 for the case farm. This case farm does not custom hire any of the tillage operations. Machinery costs include depreciation, interest, insurance, housing, repairs, and fuel and lubricant. Machinery cost per acre for this case farm is $99.93. The three largest costs were depreciation ($42.70 per acre), interest ($21.92 per acre), and fuel and lubricant ($18.09 per acre).

Unfortunately, crop machinery benchmarks are not common, but some information is available from Kansas and Illinois. Crop machinery investment per harvested acre was $259 and cost per harvested acre was $88 for non-irrigated crop farms participating in the Kansas Farm Management Association program in 2013 (www.agmanager.info/kfma). The amounts for the case farm discussed above are certainly above these figures. However, Brad Zwilling, Jim Locher, and Dwight Raab in a June 22, 2012 farmdoc daily article (www.farmdoc.illinois.edu) illustrate machinery value per acre for farms with 250 to 5000 acres. A farm with 1500 acres would have a machinery investment per acre of approximately $425 per acre while a farm with 3000 acres would have a machinery investment per acre of approximately $375 per acre. The crop machinery investment per acre for the case farm is below these amounts.

A recent study by Langemeier and Ibendahl (2014), indicated that farms with above average crop machinery investment and cost per acre had average values of $429 and $124, respectively. The values for the case farm are below these values.

The discussion above focused on machinery benchmark comparisons among farms. It is just as important to track the trend in the machinery benchmarks over time on the same farm. Increases in machinery investment and cost are often related to decreases in financial efficiency such as lower asset turnover ratios and higher depreciation expense ratios.

Factors Impacting Machinery Investment and Cost

There are several factors that impact machinery investment and cost per acre. One of these factors is machinery selection. Field capacity, availability of labor, tillage practices, crop mix, and timeliness constraints are all important considerations when selecting machinery. Purchasing larger machinery ensures that operations will get done in a more timely manner, but also can lead to higher machinery investment and cost per acre unless the farm expands by renting or buying additional land.

A second factor impacting machinery investment and cost relates to the alternatives available for acquiring machinery. Alternatives include ownership, rental, leasing, and custom hire. To increase control over use and timeliness of machine use, most farm managers prefer to own machinery. If ownership is the preferred option, a farm needs to carefully monitor

Table 3. Breakeven between Owning & Custom Hiring Combine.

Item		Dollars
Annual Fixed Costs		
	Depreciation	19,996
	Interest	10,798
	Other	2,250
	Sub-Total {A}	33,043
Custom Rate per Acre {B}		27.51
Variable Costs per Acre {C}		8.94
Breakeven Acres (A / (B-C))		1,780

machinery investment and cost. Factors that can lead to reductions in investment and cost include the following: using smaller machinery, increasing annual machine use, holding onto machinery longer before trading, purchasing used machinery, using alternatives to ownership such as custom hire, and farming more intensely (e.g., utilizing double-cropping). Of course, many of these factors may decrease timeliness, which could be particularly detrimental during planning and harvesting seasons. Thus, as with most machinery issues a balance between controlling machinery investment and cost, and timeliness needs to be reached.

For machines that are used infrequently, it is important to compare ownership costs to custom hire charges. Of course, availability and timeliness concerns are pertinent to the choice between these two options. As indicated above, machinery ownership costs typically decline as acres and production increases. Custom hire rates, on the other hand, typically exhibit a fixed rate per acre. When data is available, a breakeven point where the decision switches between custom hiring an operation and owning a machine can be derived. Table 3 contains the relevant data for the case farm. The breakeven acres for this farm are 1780. If this farm had less than 1780 acres, it would be less costly to custom hire the harvesting operations on this farm. Since this farm has 3000 acres, it makes sense for the farm to own a combine.

A third factor that impacts machinery investment and cost involves replacement decisions. Many farms follow one or a mixture of the following strategies: keep and repair, trade often, trade when income is high, or invest each year. The "keep and repair" strategy is often used by farms that have one or more individuals that are mechanically inclined. The "trade often" strategy is often used by farms with severe timeliness constraints. For example, if a large farm produces primarily corn, most of their crop needs to be planted and harvested in a narrow window. This farm may thus choose to trade often so that machines are not down during the critical periods. Many farms trade when income is high. When income is high, the farm has the cash flow to purchase machinery and also reduces income taxes. Finally, some farms invest in machinery in most years. This strategy spreads out the cash flow requirements as well as the loan payments.

Concluding Comments

As farms continue to adopt technology that is labor saving but capital intensive, it becomes increasingly important to evaluate machinery efficiency. Two machinery management benchmarks to do this are machinery investment per acre and cost per acre. Farm managers should calculate these benchmarks each year and then monitor them over time. Understanding your machinery economics has great value in potentially lowering costs, increasing output and throughput, and in making decisions such as whether to own, lease, or custom hire machinery.

For additional information on machinery benchmarks see:

Edwards, W.M. "Estimating Machinery Costs." *Ag Decision Maker.* PM-710, Iowa State University, November 2009.

Farm Financial Standards Council. *Financial Guidelines for Agricultural Producers*, 2008.

Kay, R.D., W.M. Edwards, and P.A. Duffy. *Farm Management*, Sixth Edition. Boston: McGraw-Hill, 2008.

Langemeier, M. and G. Ibendahl. "Crop Machinery Benchmarks." Journal of the American Society of Farm Managers and Rural Appraisers. 77(2014), forthcoming.

Lazarus, W.F. "Machinery Cost Estimates." University of Minnesota, May 2012.

47th Purdue Top Farmer Conference: July 15 and 16

Jim Mintert, Professor and Director of the Center for Commercial Agriculture

This is your opportunity to experience one of the most successful and longest-running management programs geared specifically for farmers — the Purdue Top Farmer Conference. You will be surrounded by experts in farm management, farm policy, agricultural finance, commodity marketing, and most importantly by a group of Top Farmers from around the Midwest who are progressively moving their farms forward. The conference will stimulate your thinking about agriculture's future and help you develop the strategies to position your farm for success in the years ahead.

At this workshop, you will:

- Discover what the 2014 Farm Bill means for your farm
- Discuss key strategies to use in today's agricultural marketplace
- Learn how to develop and track your farm's financial dashboard
- Explore the use of Big Data and how to make it work for you
- Examine key commodity and interest rate drivers
- Discuss what's ahead for land values and cash rents
- Meet, network, and share ideas with other Top Midwestern Farmers

Conference Dates: July 15-16, 2014
Location: Beck Agricultural Center, West Lafayette, Indiana

Early Registration $275/person by JUNE 30 with discount code EARLYFARMER14
Regular Registration Fee: $325/person July 1 or later

Educational Credit: Certified Crop Advisers can earn continuing education units (CEUs) at this program.
For further information and registration go to: https://www.agecon.purdue.edu/commercialag/progevents/topfarmer.html
Or contact Aissa Good at aissa@purdue.edu

Returns to Corn Storage in Recent Boom Years

Chris Hurt, Extension Economist

Cropping agriculture entered a new era of much higher and more volatile prices starting with the 2006 crop. U.S. corn prices for the seven crops from 2006 through 2012 averaged $4.73 a bushel which was more than double the $2.06 of the previous seven years covering the 1999 through 2005 crops. While the average price more than doubled, the volatility of annual prices nearly tripled.

This article examines the impacts on storage returns both for on-farm and commercial storage space in the most recent seven year period compared to the more stable seven year period represented by the 1999 to 2005 crops. The study uses weekly cash corn prices for the 14 year period. These weekly prices are the mid-week corn bids of a unit train loading elevator located in central Indiana.

Many producers measure storage returns by observing whether the cash bid moves up enough after harvest to cover their storage costs and that simple concept is used here. The harvest price was considered to be the average price at the elevator in the last-half of October each year. On-farm storage costs considered interest costs only. The interest rate was the six month average certificate of deposit (CD) rate through the 2007 crop. Then, CD rates moved very low, so starting in 2008, the prime interest rate was used. The prime interest rate has been 3.25% since January of 2009. For on-farm storage, there is no-costs assigned to the grain handling and conditioning equipment, to the storage bins, nor to labor costs, etc. This means that the on-farm storage returns reported here can be considered as the amount per bushel available to cover ownership costs for dryers, legs, storage bins, labor, insurance, utilities and a return for management of these facilities.

Commercial storage costs assume the same interest costs as on-farm storage, but add commercial storage charges. Those increased over time. In 1999, they were assumed to be a 12 cents per bushel flat charge for storage from harvest until December 31 and then an additional 2 cents per bushel per month starting in January. By the 2012 crop, they were a 17 cent per bushel flat charge until December 31 with a 3 cent per bushel per month charge starting in January.

Corn Storage Returns: The Normal Condition

Economic logic suggests that over a period of years, prices need to move upward after harvest by an amount that will cover storage costs. If the upward price movement during the storage season is not enough to cover costs, then producers and grain industry managers would observe this, and over time, sell more grain at harvest time and thus less during the storage season. This action would tend to cause harvest prices to drop and prices later in the storage season to rise. Thus, over a series of years, the price rise during the storage season would tend to driven to be equal to the storage costs. This equality

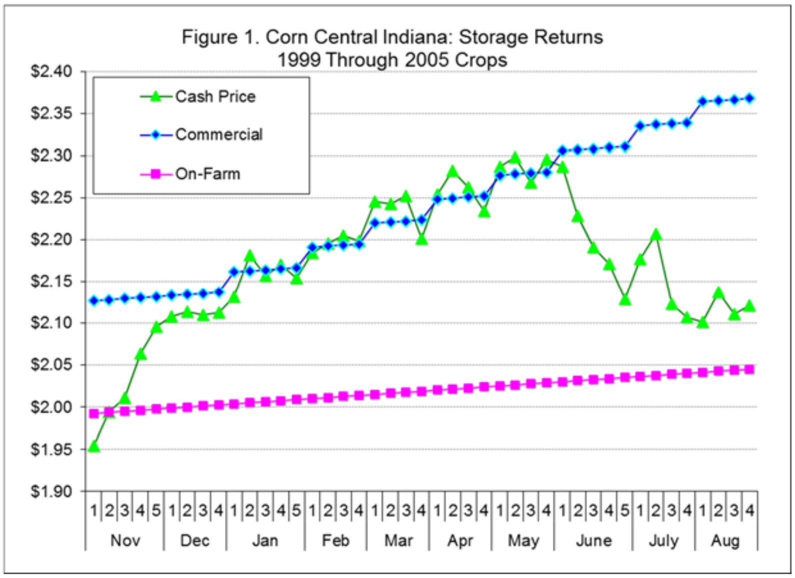


Figure 1. Corn Central Indiana: Storage Returns 1999 Through 2005 Crops

might not occur in any given year, but over time should approach this equilibrium-at least on average.

Storage costs are relatively constant, tend to be known at the time the grain is put into storage, and accumulate throughout the storage season. A manager can predict with reasonable accuracy the storage costs throughout the storage season. However the cash price pattern through the storage season is less certain. Thus it is the eventual pattern of cash prices that largely determines whether the year turns out to provide favorable storage returns or not.

This pattern of cash bids rising after harvest to equal the costs of storage can be seen in Figure 1 which represents the low priced and relatively stable price period for the 1999 through 2005 crops. The price per bushel is on the vertical axis and the weeks of the storage season are on the horizontal axis. Nov 1-2-3-4-5 represent the five weeks of November, etc. The lines in the graph for "Commercial" and "On-Farm" represent the harvest price plus the accumulating storage costs across the storage season.

On average, cash prices moved up quickly in the first month after harvest, and then continued to move higher-but at a slower rate until mid-May. It is also interesting to note that the price gain was roughly equal to the costs of commercial storage space where the full costs of interest, facility costs, labor, utilities, etc. are included. Figure 1 thus represents the normal situation that is expected over time suggested by economic logic.

Two more observations are helpful for those trying to decide how long to store under fairly normal conditions. First, for both on-farm and commercial storage, most of the positive returns above storage costs were earned by mid-March. From mid-March to early June, market prices moved upward at roughly the rate of increasing costs. This is particularly helpful to producers storing on-farm who would like to get on-farm bins emptied in the late-winter before country roads are posted and before spring planting activities get underway.

The second observation is that cash prices-on average-tended to decline after mid-May into the summer while storage costs continued to move upward. This process of falling prices and rising storage costs quickly reduces storage returns for storage into the summer-on average.

Why would cash prices tend to fall into the summer-on average? The answer is most likely related to the growing influence of the new-crop production prospects after the new-crop is planted. In the long-run, most summers do not provide poor growing weather that sharply reduces the expected size of the crop.

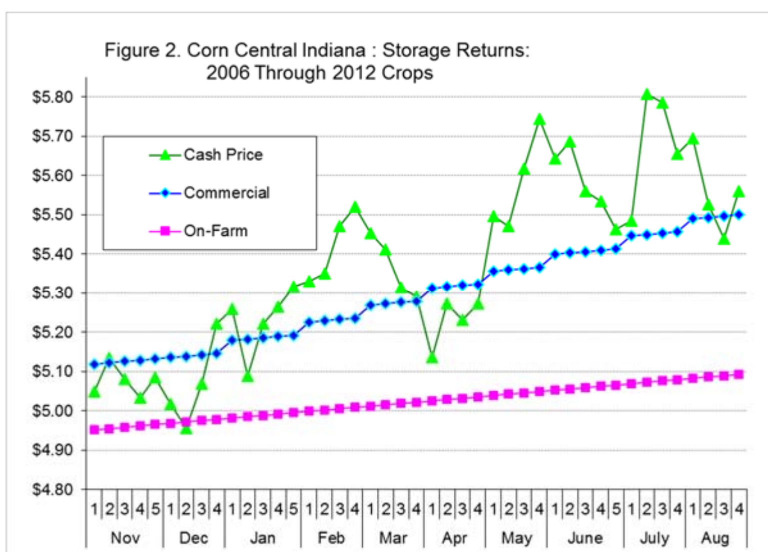


Figure 2. Corn Central Indiana : Storage Returns: 2006 Through 2012 Crops

As an example, in the 20 years representing the 1986 through 2005 crops, central Indiana cash corn prices decreased from May to July in 70% of the years. On average this price decrease was 3.5% from May to July. Thus, farmers and others who hold corn in storage in May, may tend to hold that corn awaiting a clearer picture of whether the summer growing season will bring harmful weather. They also tend to know that if summer weather does become adverse, prices on old-crop inventory could rise sharply. Since the long-run tendencies are for prices to decline into summer, this hypothesis suggest that those holding inventory in the spring tend to over-anticipate the chances for harmful weather, and/or they over-anticipate the upward price impact of harmful weather.

Storage Returns 2006 to 2012 Crops

Not surprisingly, corn storage returns look different in the most recent period of higher and more volatile prices for the 2006 to 2012 crops as shown in Figure 2. First, cash prices-on average moved up more quickly than commercial storage costs providing strong positive returns even for those storing in commercial facilities. Secondly, the volatility in these average prices is apparent moving up and down. This implies that the decision of which week to price would have had a substantial impact on storage returns. Third, prices overall tended to rise into mid-July, rather than begin a downward slide after mid-May.

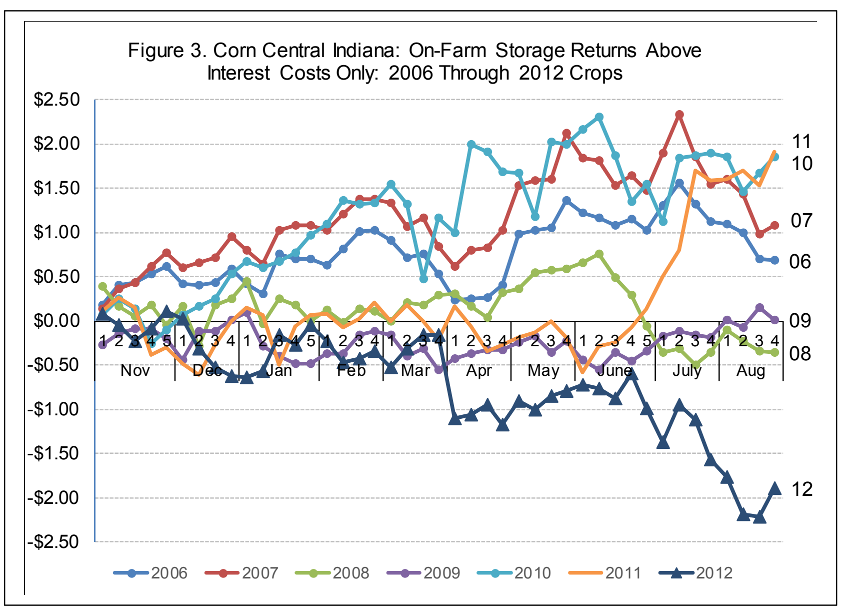
These results are fairly easily explained by the unusual conditions and events during this seven year period that vary from the norm. At the start of the 2006 marketing year, cash price were $2.07 a bushel and moved as high as $7 in early 2008 with critically short world inventories. Then world recession later in 2008 and 2009 dropped cash prices back to near $3. This was followed by short production crops in 2010 and 2011, and then in 2012 by the most severe drought since 1988 with cash prices climbing to $8.50 at this location. Intertwined in these events was the rapid buildup of corn use for ethanol from the 2006 to 2010 crops.

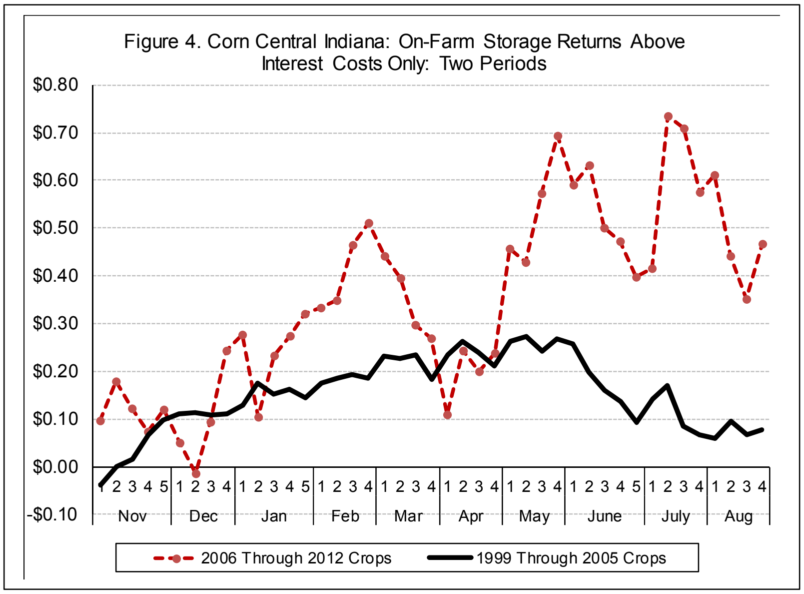
The details of storage returns by crop year as shown in Figure 3 are helpful in understanding this unusual seven year period. There were four crops that had high storage returns. Those were the 2006 and the 2007 crop when prices were rising from $2 to $7 as world inventories tightened. The other two years of extremely high returns were 2010 and 2011. Both of these had short-crops from adverse weather in the year following harvest that caused old crop prices to rise sharply the next summer.

Finally the 2008 and the 2009 crops had very low returns to storage as the world recession caused price weakness. This was an unusually set of non-normal conditions for a seven year period. In addition, they occurred at a time when inventories were unusually low. For grains, tight stocks periods tend to exaggerate price swings from a given event like a 5% decline in production.

Lessons from Two Time Periods for Future Storage Returns

Comparing corn storage returns for a more normal and more stable period represented by 1999 to 2005 crops with the more recent and more volatile 2006 to 2012 crops provides some insight into expectations for future storage returns. Figure 4 provides these comparisons of on-farm storage returns above interest costs only. These returns above interest can be viewed as the returns available for ownership of on-farm bins, grain handling and conditioning equipment, and the labor and utilities invested





in on-farm handling and storage.

For the early period these returns were about 25 to 30 cents per bushel for storage into the period from mid-March to Mid-May (see the solid line in Figure 4). In the more recent period that averaged closer to 30 to 50 cents per bushel for storage into mid-March to early June (see the dashed line). In the more recent period there was much more volatility in returns and which week was chosen to price would have had a significant impact on storage returns.

In the early period, cash prices and storage returns tended to go down starting in early June. For the more recent period, prices and returns both had one more upward surge into early July. This was likely due to the unusually large percentage of the years (four of the seven years) that had below trend yields which caused summer prices to rise.

In the future, corn inventories are expected to increase somewhat and this will tend to moderate corn prices from extreme highs. In addition, it will tend to cause corn prices to have less overall volatility than was experienced in the 2006 to 2012 crop years. Returns to cover grain handling, storage facilities, labor and utilities will also likely moderate somewhat. In the more stable period those averaged about 8% to 10% of the corn price. If corn were to average $4.50 a bushel in the future as an example, this would mean average returns of 36 cents to 45 cents per bushel per year to cover the costs of bins, handling equipment, labor and utilities, etc. At best, this is only a general guideline.

Finally, it is clear from the yearly returns shown in this article that averages over time should be a starting point as a general guideline of how long to store. Prices tend to rise in the storage season, but, they go up a lot more if the overall market is in a bullish situation as demonstrated by the 2006 and the 2007 crops. Prices can also go up a lot in the summer following harvest with adverse growing weather. However that only tends to occur about 30% of the time-or alternatively does not occur about 70% of the time. Prices can go down during the storage season when there are overall bearish events as demonstrated by the impact of the world recession on the 2008 and 2009 crops. And prices can also go down a lot through the storage season when moving from a very short production crop to a more normal crop as demonstrated by the 2012 crop price pattern.

A routine storage strategy would follow the same storage and pricing pattern each year. An example would be to put corn in the bin at harvest and price it all in mid-March. This is the type of strategy that the results of this study report on.

Alternatively, a discretionary storage strategy could be different each year based upon the unique signals in the marketplace that year as determine at the discretion of the manager. Discretionary storage strategies become more complex and require an understanding of futures carrying charges, expected basis levels, and may include a willingness to consider the outlooks for weather, southern hemisphere production, and macroeconomic events.

One simple adjustment to the routine storage strategy is to NOT STORE in years of extremely short production, like the 2012 drought crop. In these years prices tend to peak around harvest time and then tend to have a "long tail" moving lower through the storage season. If one had sold the 2012 crop at harvest rather than storing, they would have been about $1 a bushel better off than storing on-farm and selling the following spring.

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