Margin Protection Insurance

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Margin Protection is a new insurance product available for insuring corn and soybeans in Illinois. Some farmers may find Margin Protection beneficial. Farmers who purchase Area Risk Protection (ARP) may find switching to Margin Protection attractive if they want to increase the coverage level to 95%. Purchasers of Revenue Protection (RP) could use Margin Protection in conjunction with their RP product. Doing so would allow a band of county coverage from 95% roughly to the coverage level of the RP policy. This band will not be exact because expected costs entering into the calculation of Margin Protection payments. If adding this band is the desire, premiums will cost over $20 per acre for Margin Protection given that a RP policy at 85% is purchased.

What is Margin Protection Insurance?

Margin Protection comes in two forms: 1) with the harvest price option and 2) without the harvest price option. Focus in this article is given to Margin Protection with the harvest price option (MP-hpo) because most crop insurance policies sold in the U.S. have the harvest price option (e.g., Area Revenue Protection (ARP) and Revenue Protection (RP)).

MP-hpo is similar to ARP. ARP is a county-level product, making payments when county revenue falls below a county guarantee. County yields are used in the calculation of county revenue. The innovation of MP-hpo is that it makes payments based on an "expected margin" rather than crop revenue. Expected margin equals:

> Expected revenue minus expected costs.

Expected revenue is the same as used by ARP in calculating it guarantee. ARP does not have expected costs. Within MP-hpo, expected costs are based on prices of inputs times quantities of inputs. During the insurance period, quantities of inputs will not change. Expected costs will change if prices of inputs change during the insurance period.

The following points come from a comparison of MP-hpo and ARP:

- Both products are based on county yields. Actual results on a farm do not matter. This fact extends to the costs included in MP-hpo. Prices farmers pay for inputs or amount of inputs

purchased by farmers do not enter into the calculation of MP-hpo guarantees and indemnity payments.

- ARP has a 90% coverage level, which is higher than the 85% offered in RP. MP-hpo has at a 95% coverage level, which is higher than the maximum coverage levels in either ARP or RP. MP-hpo has coverage levels from 70% to 95% in 5% increments.

- Both ARP and MP-hpo have protection factors that range from .8 to 1.2. Purchasers make a choice of the protection factor. Under both ARP and MP-hpo, higher payments will occur with higher protection factors.

- At the same coverage level and same protection factor, MP-hpo and ARP will not have the same indemnity payments, even if expected costs are the same as the harvest costs used in calculating indemnities. There are different mechanisms for calculating payments. MP-hpo generally pays less than ARP given the same lose in harvest revenue.

- Choices for ARP and MP-hpo will be 1) coverage level and 2) protection factor.

- ARP and MP-hpo do not have replant or prevented planting payments.

- The period for setting the projected price differs between ARP and MP-hpo. For corn and soybeans in Illinois, ARP sets its projected price during the month of February while MP-hpo sets it projected price from August 15 to September 14 of the year before harvest. There is some value in setting a projected price earlier. On average, the projected price used by MP-hpo will equal the projected price for ARP and RP; however, there will be differences between the two in each year. By the September 30th sales closing date for MP-hpo, there will be little information for determining the direction of future prices in the next period.

- MP-hpo sales closing date is September 30th. In Illinois, all other Federal products for corn and soybeans (including ARP and RP) have a closing date is March 15th.

- Premiums supported by the Federal government are the same for MP-hpo and ARP. Premium support levels are 59% at the 70% coverage level, 55% at the 75% and 80% coverage levels, 49% at the 85% coverage level, and 44% at the 90 and 95% coverage levels.

- MP-hpo allows an individual to buy an underlying RP or any other Combo plan. This is not the case for ARP. If an RP policy is purchased, indemnity payments on the RP policy will reduce MP-hpo payments one for one. Suppose, RP indemnity payment is $40 and MP-hpo payment without considering RP payments is $100. The MP-hpo payment will be reduced to $60. Because payments are reduced, purchasers of MP-hpo will receive a premium discount on the RP policy.

Should Users of ARP Switch to MP-hpo?

Given that MP-hpo is similar to ARP, there may be some incentive for ARP users to switch to MP-hpo. In my opinion, however, there is not a compelling reason to make the switch to MP-hpo. Those ARP users who place high values on the following may find a switch to MP-hpo useful:

- Desire a 95% coverage level. MP-hpo has a 95% coverage level while ARP's highest coverage level is 90%.

- Desire to have the projected price set earlier. MP-hpo will set its projected price on settlement prices for August 15 to September 14 while RP sets its projected price based on settlement prices in February.

- Desire protection against margins as specified in the MP-hpo product.

Should Users of RP add MP-hpo?

Users of RP likely prefer the farm-level protection offered by the RP policy compared to area products. This farm-level protection includes use of farm yields in calculating payments and the existence of prevented planting and replant payments. This preference argues for maintaining the RP policy.

An RP user could maintain the RP policy and add a purchase of MP-hpo. If a MP-hpo policy is purchased, a credit will be applied to the purchase of the RP policy. Even given this credit, the purchase of the MP-hpo can be costly. Take a case of corn grown in Sangamon County, Illinois. Purchasing MP-hpo at the 95% coverage level and having an 85% RP would add from $20 to $32 in farmer-paid premium per acre, depending on the protection factor selected given that an RP 85% product is used. Adding a 90% MP-hpo product adds $10 to $20 in farmer-paid premium costs depending on the protection factor In Sangamon County, Illinois. Other counties will be higher. Those values are averages and will depend on the year. The projected price of the underlying RP policy will influence the credit.

Over time, expected payments from MP-hpo should be above what the farmer pays in premiums. If MP-hpo is rated accurately, roughly $1.60 in payments should be received for each $1 of premium paid into the product. Of course, that will vary from year-to-year. In many years, MP-hpo will not generate payments.

Example of MP-hpo

An example of MP-hpo will be given for corn in Sangamon County, Illinois. The example is for 2018. At the time of the writing of this article, the price discovery period (August 15th to September 14th) is not over. Values used in this example were pulled from the Margin Protection site on September 6th. As a result, values are not final for 2018.

Expected Margin: Expected margin is critical for determining guarantees offered by MP-hpo (see Table 1). The expected margin calculation begins with expected revenue. Expected revenue equals expected county yield times the margin projected price. Expected county yield is set by RMA and represents the most likely yield for the county. The margin projected price is the average of settlement prices during the period from August 15th to September 14th. In the example, Sangamon County has an expected revenue of $756.68 per acre (190.6 expected yield x $3.96 margin projected price).

Expected costs also enter the calculation of expected margin. Expected costs are composed of six items:

- Urea costs are based on 343.91 pounds of urea. The pounds of urea are based on the expected yield for the county (expected yield x .83 / .46). Those pounds will be lower if the expected yield for a county is lower. The projected price is based on settlement prices of urea contract (UFN) on the Chicago Mercantile Exchange (CME).

- DAP costs are based on 145.02 pounds. Pounds will vary across counties based on expected yield. The projected price is based on settlement prices of the DAP contract (DFL) on the CME.

- Potash costs are based on 79.42 units, which again are a function of expected yield. Projected price for potash is set based on National Agricultural Statistical Service (NASS) prices and will not vary during the insurance period.

- Diesel fuel costs are based on 10.12 gallons per acre, which again is a function of expected yield. The projected price for diesel fuel is based on the Diesel contract on the NYMEX contract.

- $206.90 per acre, which represent other costs. This value does not vary across counties and stays fixed across the insurance period.

- Interest costs. Interest costs equal an interest rate times "all costs except interest" time one-half. The interest rate is the CME futures contract representing federal funds rate. Settlement price are taken from August 14th to September 15th. Six percentage points are added to the Federal funds rate.

In the Sangamon County example, expected costs are $302.34 per acre. In this case, the expected margin is $454.34 per acre (see Table 1).

Table 1. Calculation of Expected Margin
Margin Protection Insurance with Harvest Price Option,
Corn, 2018, Sangamon County, Illinois

Expected yield		190.6	
Margin projected price[1]		$3.97	
Harvest price[2]			
Expected Revenue (Exp Yield x Higher of Margin Projected Price or Harvest Price)			**$756.68**

	Units[3]	Projected Price[4]	Item Costs
Urea	343.91	$196.40	33.77
DAP	145.02	$300.00	21.75
Potash	79.42	$323.81	12.86
Diesel fuel	10.12	$1.61	16.29
Unallocated costs[5]			206.90
All Costs Except Interest			291.58
Interest Cost		7.38%	10.76
Expected Costs			**$302.34**
Expected Margin (exp revenue - exp costs)			**$454.34**

[1] Average of settlement prices from August 15 to Sept 14, 2017 of December 2018 CME contract.

[2] Average of settlement prices during October 2018 of December 2018 CME contract.

[3] Units are a function of expected yield
  Urea: expected yield x .83 / .46
  DAP: expected yield x .35 / .46
  Potash: expected yield x .25 / .60.
  Diesel fuel: expected yield x .04 + 2.5

[4] Except for potash, prices are based on settlement prices averaged from August 15 to September 14 of
  Urea: Urea contract on CME (UFN),
  DAP: DAP contract on CME (DFL)
  Potash: Based on NASS prices.
  Diesel: Diesal contract on NUMEX (ULS)
  Interest rate: 30 day FED funds rate (CME) plus 6 percentage points.

[5] Always $206.90 for corn in all counties.

[6] Interest costs are All costs except interest x 1/2 x interest rate.

[7] Expected revenue minus expected costs.

Trigger Margins: The expected margin enters into the calculation of trigger margins. A trigger margin is the level of margin insurance offered by the product. Payments will occur when the harvest margin is below the trigger margin. Trigger margins will depend on the coverage level chosen, which can range from 70% to 95% in 5% increments.

Table 2 shows calculation of trigger margins for the Sangamon County case farm for coverage levels from 70% coverage level to 95% coverage level. For each coverage level, the trigger margin equals:

Expected margin – (1- coverage level) x expected revenue.

Take a 90% coverage level as an example. In this case the (1 – coverage level) is 10%. Multiplying the 10% times the $756.68 expected revenue gives $75.69 per acre. This $75.69 is the deductible. Harvest margins must decline by this amount for a MP-hpo payment to occur. Subtracting the $75.69 from the $454.34 expected margin gives the trigger margin of $378.67.

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                    Table 2.  Calculation of Trigger Margins,
        Margin Protection Insurance with Harvest Price Option,
                     Corn, 2018, Sangamon County, Illinois

            Expected Revenue (from Table 1)          $756.68
            Expected Margin (from Table 1)           $454.34

            Trigger Margin for Different Coverage Levels¹

                                Coverage         Trigger
                                 Level           Margin
                                  70%            $227.34
                                  75%            $265.17
                                  80%            $303.00
                                  85%            $340.84
                                  90%            $378.67
                                  95%            $416.51

         ¹ Trigger margin = expected margin - (1 - coverage level) x expected
         revenue.
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Given that expected costs do not change and margin projected price equals the projected price, both ARP and MP-hpo at the same coverage level will begin paying at the same harvest revenue. At a 90% coverage level, harvest revenue would have to decline by $76.69 per acre, given that harvest costs do not differ from expected costs in the MP-hpo calculation.

Harvest Margin: Payments will occur when the harvest margin is below the trigger margin (see Table 3). Harvest margin begins with the calculation of harvest revenue. Harvest revenue is based on:

- Harvest yield is the county yield. These county yields for the 2018 year will be released in spring of 2019. Hence, payments of MP-hpo will not occur till after the harvest yields are released. Harvest yields also are esed in the calculation of ARP payments.

- Harvest price is the settlement price of Chicago Mercantile Exchange contract during the month of October. The harvest price is the same as for ARP and RP.

In the example, harvest revenue is $680 based on 200 bushels per acre yield and a $3.40 harvest price.

Harvest costs are also calculated. Quantiles used for urea, DAP, potash, and diesel fuel are the same as when calculating the expected margin. Unallocated costs will be the same. Potash price will be the same. The only items that potentially vary are the interest rate and prices for urea, DAP, and diesel fuel. Urea, DAP, and diesel fuel price will be based on settlement prices on the appropriate contracts during the period from April 1 to April 30. The interest rate is based on the average CME Fed funds contract from October 1 to October 30. To this rate, 6% will be added.

In the example in Table 3, the same prices are used as in calculating harvest costs as were used in calculating expected costs. Of harvest costs, only $82.40 are in items that can vary (urea, DAP, Potash, Diesel fuel, and interest). Hence, only 27% of the harvest costs can vary from the expected costs. In most years, variability caused by changes in these input prices will have modest impacts on harvest margin when compared to changes in the harvest yield and harvest price. Payments from MP-hpo mainly will be determined by changes in harvest prices and harvest yields

Table 3. Calculation of Harvest Margin,
Margin Protection Insurance with Harvest Price Option,
Corn, 2018, Sangamon County, Illinois

Harvest yield[1]		200	
Harvest price		$3.40	
Harvest Revenue			**$680.00**

	Units	Harvest Price[2]	Item Costs
Urea	343.91	$195.43	33.61
DAP	145.02	$300.00	21.75
Potash	79.42	$323.81	12.86
Diesel fuel	10.12	$1.61	16.29
Unallocated costs			206.90
All Costs Except Interest			291.41
Interest Cost		7.38%	10.75
Harvest Costs			**$302.16**
Harvest Margin			**$377.84**

[1] Will be released in 2019

[2] Average of settlemetn prices during October 2018.

[3] Except for Potash, average of settlement prices. The month of April is used for urea, DAP, and diseal. The month of October is sued for interest rates. See footnote 4 of table 1 for contracts and exchanges.

Insurance payments: MP-hpo will make a payment when the harvest margin is below the trigger margin. Payments for three different coverage levels are shown in Table 4. The 95% coverage level has a $416.51 expected margin. In Table 3, the harvest margin was calculated at $377.84. The margin loss is $38.67 per acre for the 95% coverage level ($416.51 expected margin - $377.84 harvest margin).

Table 4. Calculation of Per Acre Indemnity Payment,
Margin Protection Insurance with Harvest Price Option,
Corn, 2018, Sangamon County, Illinois

	Coverage Level		
	85%	90%	95%
Expected Margin (see Table 1)	340.84	378.67	416.51
- Harvest Margin (see Table 3)	377.84	377.84	377.84
Margin Loss	0	0.83	38.67

Per Acre Indemnity Payments[1]

Protection Factor	Coverage Level		
	85%	90%	95%
0.8	0.00	0.66	30.94
0.9	0.00	0.75	34.80
1.0	0.00	0.83	38.67
1.1	0.00	0.91	42.54
1.2	0.00	1.00	46.40

[1] Equals margin loss x protection factor.

The per acre indemnity payment then equals the margin loss times the protection factor. Higher protection levels result in higher payments. For the $38.67 margin loss at the 95% coverage level, a choice of a protection factor of 1.0 results in a payment of $38.67 ($38.67 x 1.00 protection factor). A 1.2 protection factor results in a $46.40 payment ($38.67 margin loss x 1.2 protection factor).

Insurance Premium: Insurance premium will increase with higher coverage levels and protection factors, as is illustrated in Table 5. These premium are not final but should be fairly representative of the premiums that will be paid in Sangamon County. At a 95% coverage level, farmer-paid premiums range from $26.76 per acre for a .8 protection factor up to $40.14 per acre for a 1.2 protection factor.

Table 5. Farmer-Paid Premiums[1],
Margin Protection Insurance with Harvest Price Option,
Corn, 2018, Sangamon County, Illinois

Protection	Coverage Level			
Factor	80%	85%	90%	95%
Panel A. Farmer-Paid Premium for Margin Protection				
0.8	$4.97	$9.38	$16.95	$26.76
0.9	$5.59	$10.56	$19.07	$30.11
1.0	$6.21	$11.73	$21.19	$33.45
1.1	$6.83	$12.90	$23.31	$36.80
1.2	$7.45	$14.08	$25.43	$40.14
Panel B. Producer Credit for an RP 85% Product[2]				
0.8	$1.60	$3.23	$5.33	$6.76
0.9	$1.75	$3.49	$5.66	$6.98
1.0	$1.89	$3.73	$5.92	$7.12
1.1	$2.02	$3.94	$6.13	$7.21
1.2	$2.14	$4.12	$6.27	$7.26

[1] Final premiums will vary from those shown above.
[2] Based on a 185 APH and a projected price of $3.96 projected price.

Purchasing RP along with MP-hpo

Farmers can purchase RP with the MP-hpo product (YP and RP with the harvest price exclusion could be purchased as well). In this case, RP insurance payments will reduce MP-hpo payments. As a result, a credit will be given to reduce the RP product.

As an example, take the Sangamon County case. MP-hpo will be purchased at a 95% coverage level and a 1.0 protection factor. MP-hpo will cost $33.45 per acre (see Table 5). The credit for this policy is estimated at $7.12. This credit is based on the farm's previous yields and an estimated of the projected price. A $3.96 projected price was used in estimates. For enterprise units, an 85% RP policy would have a premium around $23 per acre. Given a purchase of the RP 85% policy, the farmer could add a 95% MP-hpo policy for $26.39 per acre ($33.45 MP-hpo premium - $7.96 credit). This would offer a zone of protection from 95% down to 85% coverage of the RP policy. This zone will be area based and not based on farm results. The zone also is a margin and not revenue.

Summary

MP-hpo will have benefits to certain users. Purchases of ARP may find a switch to MP-hpo beneficial. Also, RP purchasers may find adding MP-hpo of benefit. More on these decisions will be discussed in a September 12th *farmdoc daily* article.

farmdoc daily

Should Users of Revenue Protection Add Margin Protection?

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Farmers have until September 30th to determine whether to purchase Margin Protection, a new crop insurance product that provides payments when a harvest revenue-cost margin is below a guarantee set based on an expected revenue-cost margin (see *farmdoc daily*, September 8, 2017). Users of Revenue Protection (RP) could use Margin Protection (MP) to provide an extra band of protection on top of the RP policy. We will discuss this option in this article.

How would MP work with RP?

More detail on MP is provided in a September 8th *farmdoc daily* article. In brief, MP is not based on farm yields but based on county yields. In this manner, it is like the Area Revenue Protection (ARP) plan of insurance. Unlike ARP, MP is based on a margin that includes costs in its calculation.

Farmers can purchase both RP and MP. In this case, the farmer is getting farm-level protection based on RP and "county" margin protection based on MP. The county margin protection is on top of the farm-level coverage offered by RP. This perspective is similar to an RP user purchasing Supplemental Coverage Option (SCO), although SCO is not a margin contract but a county revenue product.

When farmers purchase both MP and RP, payments resulting from RP will reduce any MP payments that occur. Suppose that RP makes a $60 per acre payment. If a stand-alone MP product would make a $100 payment, MP purchased in combination with RP would pay $40 ($100 MP payment - $60 RP payment). If MP pays $30 per acre and RP pays $60 per acre, MP purchased in combination with RP would make no payment ($60 RP payment exceeds MP payment of $30).

Since RP reduces MP payments, there is a reduction in the RP premium. Hence, jointly purchasing RP and MP will not add the total premium costs of a stand-alone RP product and a stand-alone MP product.

To reiterate, the MP protection is not offered on farm level yields. It is offered on county yields. There will be cases when farm losses occur and MP will not make a payment, and vice versa.

In our estimation, most farmers who currently use RP likely will only consider using MP to provide an additional band of margin protection. For example, plans could be made to purchase RP at an 85% coverage level and MP could be purchased at either a 90% or 95% coverage level. The alternative of totally switching from RP to MP likely will not be attractive because farm-level coverage will be given up in this process.

What are the Costs of a Joint Purchase of RP and MP?

Table 1 presents a set of premiums for MP and the associated reduction in premiums for RP at various coverage levels. A 1.0 protection factor is assumed for the example. This example is for Saline County, Illinois. Note that these are not the final premiums for the 2018 but based on the prices for the discovery period through September 9th.

		Reduction for RP Given an RP Coverage Level[2]		
Coverage Level	Margin Protection	65%	75%	85%
	$/acre	$/acre	$/acre	$/acre
60%	7.15	1.75	3.18	4.74
75%	11.07	1.98	3.81	6.18
80%	15.21	2.01	3.98	6.90
85%	23.98	2.28	4.60	8.35
90%	34.65	2.51	5.08	9.46
95%	46.38	2.51	5.10	9.60

Table 1. Example of Margin Protection with the Harvest Price Option, Saline County, Illinois, Corn, 2018[1]

[1] Example was generated from www.marginprotection.com. Values are not final for 2018. MP premiums are given for a 1.0 protection factor.
[2] Based on a $3.96 projected price.

Farmer-paid premium costs for MP with the harvest price option (MP-hpo) range from $7.15 per acre at the 70% coverage to $46.38 for a 95% coverage level. The credit for jointly purchasing an RP and MP insurance as shown in Table 1 range from $1.75 per acre at the lowest coverage level combination to $9.60 per acre at the highest coverage level combination. To illustrate, suppose an individual plan on purchasing RP at 75% coverage. In 2017, a 75% RP policy had a farmer-paid premium of around $15 per acre for an enterprise unit. Adding MP at a 90% coverage level would have net costs of $29.57 per acre. This net cost equals the $34.65 MP-hpo premium less a $5.08 credit for the RP purchase (see Table 1). The net cost of MP varies by coverage levels for MP as follows for this example (see Table 1).

- $11.23 per acre at a 70% coverage level,

- $19.38 per acre at a 85% coverage level,

- $29.57 per acre at a 90% coverage level, and

- $41.28 per acre at a 95% coverage level.

The RP reductions in the Table 1 example assumed a projected price for the RP policy of $3.96. The actual levels of RP reduction will not be known until the projected price is set for COMBO products in February, 2018.

The Tradeoff

The tradeoff for RP users will be relatively high premiums for MP versus the risk protection offered by the addition of margin protection insurance. Over time, MP should pay out more in premiums than farmers pay into premiums due to government subsidies for the MP product. However, in a year where yields are near average and projected prices do not decrease, the amount of the additional MP payment will

eliminate a good portion of the potential profit from farming the land that exists for that year. Thus, the number of times the MP contract will pay is a factor farmers should consider.

Is the Inclusion of Costs Justification Enough to Purchase MP?

MP is the first Federal product available for corn and soybean producers that includes costs in its calculations. Doing so allows MP to base its payments on margins rather than on revenues. The question then is does the costs calculations in MP offer farmers relevant risk protection? In other words, is the margin protection offered by MP attractive enough to cause RP users to add MP?

Table 2 illustrates how costs enter the calculation of MP-hpo, again for corn in Saline County, Illinois. Prices used in the example represent averages during the August 15th to September 14th discovery period for 2018 MP. This discovery period is not over. Hence, final values for 2018 could vary from those shown in Table 2.

Table 2. Calculation of Expected Margin Margin Protection Insurance with Harvest Price Option, Corn, 2018, Saline County, Illinois				
Expected yield		170.2		
Margin projected price[1]		$3.97		
Harvest price[2]				
Expected Revenue (Exp Yield x Higher of Margin Projected Price or Harvest Price)				**$675.69**
	Units[3]	Projected Price[4]	Item Costs	
Urea	307.1	**$201.28**	30.91	
DAP	129.5	**$300.00**	19.43	
Potash	70.92	$323.81	11.48	
Diesel fuel	9.31	**$1.62**	15.08	
Unallocated costs[5]			206.90	
All Costs Except Interest			283.80	
Interest Cost[6]		**7.38%**	10.47	
Expected Costs				**$294.27**
Expected Margin (exp revenue - exp costs)				**$381.43**

[1] Average of settlement prices from August 15 to Sept 14, 2017 of December 2018 CME contract.

[2] Average of settlement prices during October 2018 of December 2018 CME contract.

[3] Units are a function of expected yield

    Urea: expected yield x .83 / .46

    DAP: expected yield x .35 / .46

    Potash: expected yield x .25 / .60.

    Diesel fuel: expected yield x .04 + 2.5

[4] Except for potash, prices are based on settlement prices averaged from August 15 to September 14 of

    Urea: Urea contract on CME (UFN),

    DAP: DAP contract on CME (DFL)

    Potash: Based on NASS prices.

    Diesel: Diesal contract on NYMEX (ULS)

    Interest rate: 30 day FED funds rate (CME) plus 6 percentage points.

[5] Always $206.90 for corn in all counties.

[6] Interest costs are All costs except interest x 1/2 x interest rate.

In Table 2, the expected margin is $381.43. The $381.43 expected margin is based on expected revenue minus expected costs. The expected revenue of $675.69 per acre is calculated in the same way as under ARP: an expected yield set by the Risk Management Agency is multiplied by the higher of the projected price or harvest price. Expected costs are based on line items for urea, DAP, potash, diesel fuel, unallocated costs, and interest costs.

Harvest costs can differ from the expected costs. Units of input and unallocated costs will not differ between expected and harvest costs. Only four items can change:

- Urea price is based on settlement prices of the UFN contracts on the Chicago Mercantile Exchange (CME). The May contract is used in determining prices. The price for the expected margin is based on settlement prices from August 15th to September 14th. The harvest margin is based on settlement prices in April.

- DAP price is based on settlement prices of the DLF contract on the CME. The price for the expected margin is based on settlement prices from August 15th to September 14th. The harvest margin is based on settlement prices in April.

- Diesel price is based on the ULS contract on the NYMEX. The May contract is used. The price for the expected margin is from August 15th to September 14th. The harvest margin is based on settlement prices in April.

- Interest rate is based on the Federal funds rate contract on the CME, plus 6 percentage points. The price for the expected margin is from August 15th to September 14th. The harvest margin is based on settlement prices in October.

Note that while potash has its own quantity and price in costs, the potash price will not vary for the expected and harvest margin calculation. Payments will occur when harvest margin, which equals harvest revenue minus harvest costs, is below the trigger margin. The trigger margin depends on the coverage level, with lower coverage levels resulting in lower trigger margins.

In essence, this contract provides protection against upward movements in the price of inputs. Take, for example, the urea price. The urea price is currently $201.28 per ton. Suppose that urea price increases to $300.00 per ton based during next April's discovery period. In this case, costs increase by $15.16 per acre ($300.00 per ton price - $201.28 per ton price) x 307.10 pounds / 2000 pounds in a ton). The $15.15 would contribute to lower margins that could result in an MP insurance payment.

When evaluating the benefits of including costs, four items should be kept in mind. The first is that in most years there will be limited movements in input prices. Whether or not MP makes a payment will largely be determined by changes in revenues and not in costs. Having made that statement, there will be years in which input prices do move, with the most likely to have the largest impacts on margins being urea and DAP prices.

The second item farmers will need to consider is how well costs in the MP product match their buying behaviors. For harvest costs, the price determination period is April. Many farmers apply nitrogen and DAP fertilizer in the fall. Furthermore, many farmers purchase inputs in the fall for application in the spring. Therefore, purchasing decisions may not match the discovery period set in MP. This factor could add risks in certain cases. For example, a farmer may have purchased nitrogen for the 2018 crop year already. If urea prices move down into spring, expected costs would go down while the farmer's costs have not. Expected costs going down would increase the amount by which revenue needs to decrease before MP makes a payment

Third, costs included in the margin do not cover all potential cost increases. Costs of herbicides, insecticides, and fungicides are not included in the formula. Drying costs are not covered, except where fuel (propane or natural gas) follows diesel prices. Moreover, additional applications of fertilizer may be necessary in certain years. Also, replanting costs may be incurred (MP does not have replant or prevented planting payments, although an underlying RP product would have those provisions).

Fourth, the determination of the urea and DAP prices occur in thin markets. At the end of trading on Friday, September 8th, there were 15 open contracts on the May urea contract, and no trades occurred during the week (taken from estimated volume on CME reports. On September 8th, CME reports zero open interest for the May, DAP contract. In thin markets, a very few trades can influence settlement

prices. As a result, prices tend to be more volatile in thin markets. This volatility can either work for or against MP making payments.

While margin protection has value, the implementation of any margin insurance will present difficulties. Farmers need to be aware that 1) most payments from MP will come from revenue changes, 2) quantities and prices specified in the margin protection contract may not match buying behavior, 3) not all costs increases are covered by MP, and 4) urea and DAP prices used by MP are traded in thin markets. For those reasons, the simple fact that MP incorporates costs does not necessarily warrant its purchase.

Summary

Adding MP to RP will have risk management benefits. Margin protection based on county yields and changes in futures prices will be added to farm-level revenue coverage offered. This comes at relatively high farmer-paid premium costs.

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Evaluating Payments from Margin Protection with Harvest Price Option

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In this article, historical payments from Margin Protection are estimated and compared to Area Revenue Protection. Both insurance contracts have the harvest price option. The example is for corn in Sangamon County Illinois from 2000 to 2016. Due to limits on cost data, only payments resulting from changes in yields and commodity prices are compared. The example suggests overall payments between Margin Protection and Area Risk Plan likely will be highly correlated but payments in any given year can vary from one another. In this article, we do not consider reductions in Margin Protection payments if purchased along with another insurance product.

Expected Margin Calculation under Margin Protection (MP)

More detail on Margin Protection insurance is provided in two previous *farmdoc daily* articles (September 8, 2017 and September 12, 2017). In brief, Margin Protection payments are based on an expected margin, which equals:

> Expected revenue – expected costs.

Table 1 shows the calculation of expected margin for a Sangamon County, Illinois corn example. Note that the parameters for this example were taken from the Margin Protection website on September 18th. Discovery periods for prices are over. Thus, prices should be close to final. However, expected yields for 2018 corn were substantially revised on September 14th. In Table 1, the 2018 expected yield for Sangamon County is 197.2 bushels per acre, up by 6.6 bushels from the prior value of 190.6 bushels per acre. A 197.2 versus 190.6 expected yield will have large impacts on guarantees. Expected yields for 2018 are not final and could change from the value used in this article. Note, for some counties, the September 18th revision reduced their estimated 2018 expected yields by a substantial amount.

In the example shown in Table 1, expected revenue is $783 per acre, expected costs are $307 per acre, and the expected margin is $476 per acre. Farmers choose a coverage level from 70% to 95%, in 5% increments. One minus the chosen coverage level is multiplied by the expected revenue and subtracted

from expected margin to give a trigger margin A 90% coverage level would result in a trigger margin of $397 per acre ($476 - 783 expected margin x (1 - 0.90 coverage level)). A payment will occur when harvest margin is below the trigger margin.

Table 1. Calculation of Expected Margin Margin Protection Insurance with Harvest Price Option, Corn, 2018, Sangamon County, Illinois				
Expected yield		**197.2**	190.6	6.6
Margin projected price[1]		**$3.97**		
Harvest price[2]				
Expected Revenue (Exp Yield x Higher of Margin Projected Price or Harvest Price)				**$782.88**
		Projected	Item	
	Units[3]	Price[4]	Costs	
Urea	355.82	**$205.48**	36.56	
DAP	150.04	**$300.00**	22.51	
Potash	82.17	$321.51	13.21	
Diesel fuel	10.39	**$1.63**	16.94	
Unallocated costs[5]			206.90	
All Costs Except Interest			296.11	
Interest Cost[6]		**7.38%**	10.93	
Expected Costs				**$307.03**
Expected Margin (exp revenue - exp costs)				**$475.85**

[1] Average of settlement prices from August 15 to Sept 14, 2017 of December 2018 CME contract.

[2] Average of settlement prices during October 2018 of December 2018 CME contract.

[3] Units are a function of expected yield
  Urea: expected yield x .83 / .46
  DAP: expected yield x .35 / .46
  Potash: expected yield x .25 / .60.
  Diesel fuel: expected yield x .04 + 2.5

[4] Except for potash, prices are based on settlement prices averaged from August 15 to September 14 of
  Urea: Urea contract on CME (UFN),
  DAP: DAP contract on CME (DFL)
  Potash: Based on NASS prices.
  Diesel: Diesel contract on NYMEX (ULS)
  Interest rate: 30 day FED funds rate (CME) plus 6 percentage points.

[5] Always $206.90 for corn in all counties.

[6] Interest costs are all costs except interest x 1/2 x interest rate.

The same formula is used when calculating the harvest margin but six yields / prices are updated to reflect their value during the final discovery period. The six items that can change are noted in red in Table 1 and include:

- County yield will replace expected yield. County yield will be released by RMA in the spring of 2019 and are the same yields as used by the Area Risk Protection Insurance (APRI) policy.

- Harvest price will replace expected price. The harvest price is the average for the December 2018 Chicago Mercantile Exchange corn contract during the month of October 2018.

- Urea price will be based on CME settlement prices during April 2018 (May contract of UFN),

- DAP price will be based on CME settlement prices during April 2018 (May contract of DFL),

- Diesel price will be based on MYMEX settlement prices during April 2018 (May contract of ULS), and

- Interest rate will be based on CME settlement prices for 30 day Fed fund contract during April 2018 (October contract of FF).

Note that none of these six values are farm yields, farm output prices, or farm input prices.

In the following section, variability in the input prices are illustrated. This then is followed by an example of how yields and corn prices have varied over time.

Input Prices and Costs

Panel A of Table 2 shows how input prices would have varied from 2014 to 2017. Also listed are 2018 expected prices. Unfortunately, long time series of consistent urea and DAP prices do not exist. Specification of fertilizer contracts have changed over time resulting in inconsistent price series. The urea and DAP contracts that Margin Protection currently uses are thinly traded. Total trades during the discovery period (August 15 to September 14) for the urea contract were 0 in 2014, 15 in 2015, 15 in 2016, and 0 in 2017. No trades have occurred in the DAP contract during the August 15th to September 14th period from 2014 to 2016. When trades do not occur, the exchange has rules for setting settlement prices, which then go into the calculation of expected and final prices for Margin Protection. While unlikely, a concern could be that a few trades could have a dramatic impact on expected or final prices. Price movements could increase or reduce the chances of Margin Protection making payments.

Table 2. Change in Prices and Costs, Margin Protection, Sangamon County, Corn

Year	Urea		DAP		Diesel		Interest Rate	
	Expected	Harvest	Expected	Margin	Expected	Harvest	Expected	Harvest
Panel A. Changes in Prices.								
	$/ton	$/ton	$/ton	$/ton	$/gal	$/gal	%	%
2014		354.35			3.03	2.96	6.35	6.08
2015	332.75	267.12		400.80	2.81	1.84	6.64	6.14
2016	275.48	219.48	414.08	315.14	1.60	1.25	6.78	6.42
2017	186.21	188.57	305.27	305.22	1.54	1.59	6.68	*7.16* *
2018	204.48		300.00		1.63		7.38	
Panel B. Change in Costs Resulting from Price Change.[1]								
	Urea		DAP		Diesel		Interest Rate	
	$/acre		$/acre		$/acre		$/acre	
2014					-0.73			
2015	-11.68				-10.08			
2016	-9.96		-7.42		-3.64		-1.25	
2017	0.42		0.00		0.52		-0.73	
Panel C. Change in Margin (Harvest Margin - Expected Margin)								
	$/acre							
2016	-22.27							
2017	0.21 *							

[1] Quantities for each costs are 2018 quantities as shown in Table 1.
* Based on an estimated harvest interest rate of 7.16%. The discovery period is October.

Impact of each price change on the margin is calculated using quantities specified in the margin contract for Sangamon County, Illinois (Panel B of Figure 2). For example, the urea price movements would have resulted in these changes in per acre cost: $11.68 decrease in 2015, $9.96 decrease in 2016, and $0.42 increase in 2017.

Based on changes in all prices, cost per acre decreased by $22.27 in 2016 and by $0.21 in 2017 in Sangamon County (see Panel C of Table 2). A reduction in costs means a larger decline in revenue would have to occur before Margin Protection would make a payment

Overall, one would expect that changes in costs will be relatively small over time. A change of around $30 per acre or less likely will be typical. But in any given year the changes could be larger. Again, cost decreases over the contract period for an input would reduce any Margin Protection insurance payments. Cost increases over the contract period for an input would increase any Margin Protection insurance payments.

The Role of Differences in Corn Price

A historical backcast of Margin Protection with the harvest price option (MP-hpo) are shown for corn in Sangamon County in Table 3. Importantly, these insurance payments are calculated given that prices of costs stay the same. As noted in the previous section, cost decreases would reduce payments and vice versa. MP-hpo payments are shown for 90% and 95% coverage levels. Also shown for comparison purposes are Area Risk Protection (ARP) at the 90% coverage level. The payments in Table 3 are calculated for a 1.0 protection factor for MP-hpo and ARP.

Table 3. Insurance Prices and Changes in Area Risk Protection (ARP) and Margin Protection for the Harvest Price Option Payments Given No Change in Prices of Costs, Corn, Sangamon County, Illinois[1]

| | Insurance Prices[2] | | | | | ARP | Margin Protection[3] | |
Year	Projected MP-hpo	Projected ARP	Harvest	Expected Yield	County Yield	90%	90%	95%
	$/bu	$/bu	$/bu	Bu/acre	Bu/acre	$/acre	$/acre	$/acre
2000	2.48	2.51	2.04	167.5	173.0	35	21	42
2001	2.34	2.46	2.08	161.6	160.2	34	7	26
2002	2.53	2.32	2.52	161.6	151.4	0	0	7
2003	2.54	2.42	2.26	165.1	193.0	0	0	0
2004	2.43	2.83	2.05	165.5	191.0	42	0	0
2005	2.59	2.32	2.02	170.1	168.3	21	57	79
2006	2.53	2.59	3.03	175.7	173.1	0	0	0
2007	3.48	4.06	3.58	175.2	197.2	0	0	0
2008	3.11	5.40	4.13	173.0	181.5	127	0	0
2009	6.10	4.04	3.72	178.4	187.5	0	282	336
2010	3.71	3.99	5.46	183.7	153.9	87	62	113
2011	4.46	6.01	6.32	186.3	164.1	31	23	81
2012	6.55	5.68	7.50	183.5	128.5	382	275	344
2013	6.51	5.65	4.39	181.4	196.1	85	202	261
2014	5.08	4.62	3.49	176.9	224.8	0	24	69
2015	4.03	4.15	3.83	182.2	182.7	0	0	0
2016	3.98	3.86	3.49	188.0	219.2	0	0	0
2017	3.74	3.96						
2018	3.97							
Average[4]	3.79	3.82	3.64			50	56	80

[1] Payments are given for the coverage levels listed and a 1.0 protection factor.

[2] Insurance prices are based on Chicago Mercantile Exchange (CME) futures contracts. The December contract is used with prices averaged from August 15 to September 14 in the year before harvest for the Margin, February for the projected, and October for the Harvest.

[3] Margin Protection payments simulated given that costs do not change between the expected and harvest periods and that Margin Protection is purchased with the harvest price option

[4] Averaged from 2000 to 2016.

The differences in projected prices used by MP-hpo and ARP impacts payments from the two products. If the MP-hpo projected price is above the ARP projected price, MP-hpo is more likely to make payments than ARP. The opposite is true as well. The MP-hpo projected price for corn is based on settlement prices from August 15th to September 14th while the ARP projected price for corn is based on settlement priced during February. As expected, on average these two prices are close to one another. From 2000 to 2016, the MP-hpo projected price averaged $3.79 per bushel vs. the average ARP projected price of $3.82. However, the difference can be large in a specific year. Projected price was higher for MP-hpo in the following years, resulting in higher simulated payments for MP-hpo:

  2005: MP-hpo projected price was $2.59 compared to a $2.32 ARP projected price.

  2009: MP-hpo projected price was $6.10 compared to a $4.04 ARP projected price.

  2013: MP-hpo projected price was $6.51 compared to a $5.65 ARP projected price.

  2014: MP-hpo projected price was $5.08 compared to a $4.62 ARP projected price.

The converse also has occurred. Projected price was higher for ARP in the following years, resulting in higher simulated payments for ARP:

  2000: MP-hpo projected price was $2.48 compared to a $2.51 ARP projected price.

  2001: MP-hpo projected price was $2.34 compared to a $2.46 ARP projected price.

  2004: MP-hpo projected price was $2.43 compared to a $2.83 ARP projected price.

  2008: MP-hpo projected price was $3.11 compared to a $5.40 ARP projected price.

  2010: MP-hpo projected price was $3.71 compared to a $3.99 ARP projected price.

  2011: MP-hpo projected price was $4.46 compared to a $6.01 ARP projected price.

Over time, one would expect the impact of the differences due to different price discovery periods to even out. To take advantage of this difference, a farmer would in essence need to be able to profitably trade the price of the crop. In other words, for 2018, the farmer would need to be able to accurately forecast by September 30, 2017 the change in the CME December 2018 corn price between August-September 2017 and February 2018.

Also note that payments will differ between MP-hpo and ARP in years in which the guarantee prices are the same for the two products.   This is most likely to occur in years when the harvest price is above the MP-hpo and ARP projected prices. In these cases, guarantee revenue is the same between both products. In those years, ARP payments will be as least as great as the MP-hpo at the same coverage level. This occurs because of differences in payments mechanisms between the two products. Between 2000 and 2016, this situation caused differences in payments in two years:

  2010: The harvest price was $6.32 and both projected prices were below the harvest price. At the 90% coverage level, ARP had an $87 per acre payment compared to $62 per acre for MP-hpo at the 90% level.

  2012: The harvest price of $7.50 was above both projected prices. At the 90% coverage level, ARP had a $382 payment at the 90% coverage level compared to a $275 per acre payment for MP-hpo.

From 2000 to 2017, average simulated payments were $50 per acre for ARP at the 90% coverage level, $56 per acre for MP-hpo at the 90% coverage level, and $80 per acre MP-hpo at the 95% coverage level. Again, these do not consider any cost changes that may have occurred during those years. Also note that higher payments from MP are primarily driven by two years: 2009 and 2013. In both of those years, projected price was over $0.80 per bushel higher for MP-hpo than ARP: $2.06 in 2009 ($6.10 MP hpo projected price minus $4.04 ARP projected price) and $0.86 in 2014 ($6.51 MP hpo projected price minus $5.65 ARP price). It is possible that a similar decrease could happen for 2018, but the margin price of $3.79 suggests that a decline of those magnitudes is less likely.

Summary

Over time, payments from ARP and MP-hpo likely will be highly correlated, but could vary notably in any given year. Moreover, changes in expected costs likely will be relatively small in most years. However, in any given year, costs could change significantly thereby impacting MP-hpo payments.

One reason an ARP user may switch to MP-hpo is that its projected price is set earlier than for ARP. As shown above, setting the price earlier will have advantages in some years. However, it is difficult to predict which years that advantage will exist.

This article considers only the case of using Margin Protection as a stand along insurance contract. The case of using Margin Protection in conjunction with a COMBO product was discussed in the September 12 *farmdoc daily* article.

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