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Case Studies on the Use of Crop Insurance in Managing Risk

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INTRODUCTION

Managing the risk associated with farming is challenging. Fortunately, farmers have a variety of risk management tools at their disposal. This series of case studies examines how crop insurance can be used to manage some of the risks faced by farmers. The examples illustrate how crop insurance purchases would impact the returns generated to a farming enterprise. While the examples cover a variety of commodities and insurance products, they do not consider every possible risk that might arise. Likewise, they do not consider all of the possible financial situations that might be experienced by a farmer. Instead, they focus on highlighting how crop insurance impacts the profitability of the farm. Companion spreadsheets are available for all of the examples so that readers can examine a wider range of scenarios than those discussed in the examples. These spreadsheets and other related materials are available for download at:

http://www.agfinance.aem.cornell.edu/CropIns.html

Cash flow is a very important financial concept. Among other things, cash flows are used to fund personal living expenses and service debt. For a more complete discussion of the role that crop insurance can play in your risk management plan readers are encouraged to examine the following tools and readings.

Gloy, B.A. "Crop Insurance Decision Making Tool." Microsoft Excel spreadsheet tool available for download at: http://www.agfinance.aem.cornell.edu/.

Gloy, B.A. and A.E. Staehr. "Directions for Using the Crop Insurance Decision Making Tool." Extension Bulleting 24(2008), 3 pages. Department of Applied Economics and Management, Cornell University.

Richards, S. "Do I Need Crop Insurance? Self Evaluating Crop Insurance as a Risk Management Tool in New York State." Revised by A.E. Staehr and B.A. Gloy.

M. Nelson and B.A. Gloy. "Making Informed Crop Insurance Decisions."

Green, J. B.A. Gloy, M. Nelson, and J. White. "Building a Safety Net with Crop Insurance."

These articles are available on-line at http://www.agfinance.aem.cornell.edu/CropIns.html. These articles cover the role that crop insurance can play in managing risk as well as a framework for determining whether one should purchase crop insurance.

EXAMPLE 1: CORN AND SOYBEANS – APH AND CRC INSURANCE

In the first example consider a NY farm that grows 400 acres of corn and 400 acres of soybeans. The farm expects that the total cost of producing an acre of corn is $410 and the cost of producing an acre of soybeans at $300. The farm's actual production history (APH) yields, expected prices, and expected costs for these crops are shown in Table 1 which also shows the relevant parameters for APH and CRC crop insurance.

Table 1. Crop Yields, Prices, and APH and CRC Insurance Parameters for a Corn-Soybean Farm.

Crop	Corn	Soybeans
Acres	400	400
Expected Yield (bu/acre)	150	45
Expected Price ($'s/bu)	5.40	13.36
Expected Revenue ($/acre)	810	601
Expected Costs ($/acre)	394	285
APH Yield (bu/acre)	150	45
APH Indemnity price ($/bu)	4.75	11.5
CRC Base Price ($/bu)	5.40	13.36

Given the farm's projected costs and revenues the farm expects a substantial profit. The farm would like to consider how the addition of crop insurance would impact its projected profits under a variety of scenarios. In order to make this calculation, it is necessary to have information regarding the cost of insuring the crops. Table 2 shows potential premiums for various levels of CRC and APH insurance coverage. These premiums are meant to reflect the magnitude of premiums that would be expected for a farm operating in Cayuga county NY. However, the premiums are for illustration purposes only. Individuals considering the purchase of crop insurance should obtain quotes from qualified insurance provider.

Table 2. APH and CRC Premiums ($'s/acre)

Insurance Plan and Coverage Level	Corn	Soybeans
CRC 50%	6.44	10.14
CRC 55%	9.19	13.25
CRC 60%	11.85	15.65
CRC 65%	17.20	21.74
CRC 70%	22.72	28.50
CRC 75%	32.74	41.46
APH 50%	3.63	6.1
APH 55%	5.11	7.79
APH 60%	6.52	8.98
APH 65%	9.34	12.23
APH 70%	12.12	15.81
APH 75%	17.17	22.81

The premiums shown in Table 2 reflect the fact that CRC insurance is more expensive than APH insurance. This is because CRC insurance covers losses arising from price changes as well as yield losses. In order to calculate the indemnities under the CRC policy, it is necessary to know the final CRC harvest price and the calculated revenue. The following example illustrates the calculation of the indemnity for 75% CRC corn coverage when the final corn CRC harvest is $3.50 and the farm achieved a yield of 140 bushels per acre.

Step 1: Determine the minimum guarantee per acre by multiplying the APH yield by the coverage level and the CRC base price.

150 bu/acre *75% * $5.40 = $607.50

Step 2: Determine the harvest guarantee per acre by multiplying the APH yield by the coverage level and the CRC harvest price

150 bu/acre * 75% * $3.50 = $393.75

Step 3: Determine the calculated revenue by multiplying the production achieved by the CRC harvest price.

140 bu/acre * $3.50 = $490.00

Step 4: Subtract the calculated revenue obtained in step 3 from the greater of the values calculated in steps 1 and 2. If the value is positive this is the indemnity due.

$607.50 - $490.00 = $117.50

In this example, the farm would receive an indemnity of $117.50 per acre. The cost of the insurance was $32.74 so the net indemnity is $84.76. There are several things worth noting in this example. First, although prices fell, the revenue guarantee remained the same. In this way the policy protected against the risk of falling prices. Had prices risen, the revenue guarantee would have increased. However, the calculated revenue would have also have risen.

The next example illustrates how to calculate the indemnities for a corn APH insurance policy with a 75% coverage level. Here, assume that the farm produces a corn crop that actually yields 100 bushels per acre. In the case of APH insurance the market price of corn does not play a direct role in the calculation of the indemnity.

Step 1: Determine the minimum bushel guarantee by multiplying the APH yield by the coverage level.

150 bu/acre * 75% = 112.50 bu/acre

Step 2: Determine the bushel loss by subtracting the actual bushels produced from the minimum bushel guarantee

112.50 bu/acre – 100 bu/acre = 12.50 bu/acre

Step 3: If the amount in step 2 is positive, multiply the loss by the APH indemnity price

12.50 bu/acre * $4.75/bu = $59.38/acre

Here, the farmer would receive an indemnity of $59.38 per acre. The cost of this insurance was $17.17 so the net indemnity is $42.21. In this situation, the market prices for the crop at harvest time are not used in the calculation of the indemnity.

Differences in the way that the indemnities are calculated are important in determining whether the policy provides the amount of risk protection that the farm requires. Given the expected costs of production in Table 1 and the crop insurance premiums in Table 2, it is possible to analyze how expected profits would change under different insurance coverage, yield, and price scenarios. These calculations make the assumption that the price that the farmer receives at harvest is equivalent to the CRC harvest price. If the farm achieves higher or lower realized prices the results can differ considerably from those shown in the following tables.

The calculations used to produce the following tables are available for the reader to examine in the spreadsheet *corn-soy.xlsx*. This spreadsheet allows the user to examine coverage levels other than those shown in the following tables. It also allows the user to examine different price/yield combinations as well as different insurance parameters such as premium levels and costs of production.

Table 3 shows how the expected profits to corn production would change with different yields and prices if no insurance were purchased. This table assumes that the farm realizes the CRC final harvest price and that the cost of producing an acre of corn is $394.

Table 3. Expected Profits without Crop Insurance, $'s per Acre.

		Final CRC Harvest Price ($'s/bu)							
		3	3.5	4	4.5	5	5.5	6	6.5
Actual Yield (bu/acre)	170	116	201	286	371	456	541	626	711
	150	56	131	206	281	356	431	506	581
	130	-4	61	126	191	256	321	386	451
	110	-64	-9	46	101	156	211	266	321
	90	-124	-79	-34	11	56	101	146	191
	70	-184	-149	-114	-79	-44	-9	26	61
	50	-244	-219	-194	-169	-144	-119	-94	-69

Table 3 illustrates that the farm would expect a substantial loss ($244 per acre) if prices were to fall to $3 per bushel and yields were to fall to 50 bushels per acre. Likewise, if prices were to rise to $6.50 per bushel and yields were to fall to 50 bushels per acre the farm would still experience a loss of $69 per acre on corn production.

Table 4 shows how this situation is altered by the purchase of CRC crop insurance at the 75% coverage level. This table was calculated using a premium of $32.74 per acre. In this situation, one can see that the purchase of CRC crop insurance puts a floor under the profits at $181 per acre. This happens whether prices or yields fall from their projected levels. However, as opposed to the no-insurance case, the purchase of the CRC reduces the amount of profits that the farm would receive were prices and yields to rise or even fall only modestly from their projected levels of 150 bushels per acre and $5.40 per bushel.

The areas where the farm is better off with insurance are shaded light gray in Table 4. This illustrates how crop insurance tends to protect the farm from adverse outcomes but also reduces the amount of profits that would be achieved under ideal circumstances. The individual farmer has to make the determination whether they are willing to give up $32.74 per acre in profits in good years for the protection of putting a floor under their profits of $181 per acre.

Table 4 Expected Profits with CRC Insurance at the 75% Coverage Level, $'s per Acre.

		Final CRC Harvest Price ($'s/bu)							
		3	3.5	4	4.5	5	5.5	6	6.5
Actual Yield (bu/acre)	170	181	181	253	338	423	508	593	678
	150	181	181	181	248	323	398	473	548
	130	181	181	181	181	223	288	353	418
	110	181	181	181	181	181	181	233	288
	90	181	181	181	181	181	181	181	181
	70	181	181	181	181	181	181	181	181
	50	181	181	181	181	181	181	181	181

Next, the same comparison is made for the case of the purchase of APH corn insurance at the 75% coverage level (Table 5). Again, situations where the profits are higher with APH insurance than with no insurance are highlighted in light gray. These results show that APH insurance does not provide the protection against adverse price movements that CRC insurance provided. This is evident by comparing the results in Table 4 to those in Table 5. One can see that in situations where revenue falls due to low prices that CRC insurance generally provides a greater level of income support. However, APH insurance is less costly than the CRC product so that in situations where insurance is not needed profits are higher with APH insurance.

Table 5. Expected Profits with APH Insurance at the 75% Coverage Level, $'s per Acre.

		Final CRC Harvest Price ($'s/bu)							
		3	3.5	4	4.5	5	5.5	6	6.5
Actual Yield (bu/acre)	170	99	184	269	354	439	524	609	694
	150	39	114	189	264	339	414	489	564
	130	-21	44	109	174	239	304	369	434
	110	-69	-14	41	96	151	206	261	316
	90	-34	11	56	101	146	191	236	281
	70	1	36	71	106	141	176	211	246
	50	36	61	86	111	136	161	186	211

EXAMPLE 2: CORN AND SOYBEANS – GRP INSURANCE

This example illustrates how the Group Risk Plan (GRP) insurance product can be used to manage risk for a NY farm that grows 400 acres of corn and 400 acres of soybeans. The farm can only purchase GRP for corn production because the product is not available for soybean production in NY. The farm expects that the total cost of producing an acre of corn is $410. The farm's actual production history (APH) yields, expected prices, and expected costs for these crops are shown in Table 1 which also shows the relevant parameters for GRP crop insurance.

Table 1. Crop Yields, Prices, and APH and CRC Insurance Parameters for a Corn-Soybean Farm.

Crop	Corn
Acres	400
Expected Yield (bu/acre)	150
Expected Price ($'s/bu)	5.40
Expected Revenue ($/acre)	810
Expected Costs ($/acre)	394
GRP Expected County Yield (bu/acre)	124.2
Maximum GRP Protection per acre ($/acre)	698.63

With costs estimated at $394 per acre and revenues projected at $810 per acre, one can see that the farm expects a substantial profit from corn production. GRP insurance makes indemnity payments when county yields fall below the county yield trigger. The expected county yield in this situation is 124 bushels per acre. This yield is estimated by the National Agricultural Statistics Service (NASS). The county yield that will be used to determine if an indemnity is due will be set by the Risk Management Agency and is based upon NASS's estimates of the county yields. In this case the farm is located in Cayuga county New York. The estimated premiums for this insurance product are shown in Table 2.

Table 2. GRP Insurance Premiums, $'s/acre.

Coverage Level	Premium
70%	1.69
75%	1.91
80%	2.64
85%	4.30
90%	7.89

There are several important points that one should understand about GRP insurance. First, GRP is sold at higher coverage levels than products such as CRC and APH. Second, the premiums are generally small relative to APH and CRC insurance. However, it is very important to understand this is possible because GRP acts very differently from these products. The most important difference is in how a payout is calculated. Payouts under GRP do not depend upon the yields or prices received by an individual farm. They are completely determined by the level of county yields. This means that our example farm could have a disastrous year and if the county average yield was high, there would be no payout. Likewise, the opposite is also true. Because county level yields are much less uncertain than farm level yields the product is cheaper and one is able to insure at a higher level. However, the product may not provide the insurance coverage that is necessary in a bad year.

The county level corn yields for Cayuga county NY are shown in Table 3. These yields are available from the New York Agricultural Statistics Service at http://www.nass.usda.gov/Statistics_by_State/New_York/index.asp. These yields should be roughly consistent with those that are used by RMA to determine the payout on GRP insurance. However, it is important to note that RMA makes the final yield determination.

Table 3. County Level Corn Yields for Cayuga County New York, 1990-2007.

Year	Corn Yield (bushels per acre)
1990	104
1991	112
1992	86
1993	110
1994	114
1995	109
1996	107
1997	112
1998	112
1999	102
2000	99
2001	132
2002	94
2003	125
2004	124
2005	152
2006	126
2007	136

The following steps illustrate the process used to calculate indemnities under a 90% coverage level GRP plan. The maximum GRP protection per acre is $698.63 and the GRP expected county yield is 124.20. Further, assume that RMA determines that the actual county yield obtained is 100 bushels per acre. Again, note that the actual yields and prices obtained by the farm do not impact the indemnity calculation.

Step 1: Determine the GRP trigger yield by multiplying the expected county yield by the coverage level.

124.20 (bu/acre) * 90% = 111.78

Step 2: If the actual county yield is less than the trigger yield calculate the payment calculation factor by dividing the difference between the trigger yield and the actual yield by the trigger yield.

(111.78 bu/acre – 100 bu/acre) / 111.78 bu/acre = 0.10539

Step 3: Multiply the maximum GRP protection per acre by the calculation factor in step 2 to determine the indemnity.

$698.63/acre * 0.10539 = $73.63

In this case the indemnity is $73.36. Given, the $7.89 premium, the net indemnity is $65.47. This amount of net indemnity will be paid to the farmer regardless of the actual outcome that they achieve on their farm.

The expected costs of production in Table 1 and the crop insurance premiums in Table 2 were used to calculate the potential profits of the farm under the following situations:

1) the farm does not purchase crop insurance (Table 4);
2) the farm purchases crop insurance and the county yield is above the yield trigger (Table 5);
3) the farm purchases insurance and the county yield is below the trigger (Table 6).

The calculations used to produce the following tables are available for the reader to examine in the spreadsheet *corn-GRP.xlsx*. This spreadsheet allows the user to examine coverage levels other than those shown in the following tables. It also allows the user to examine different price/yield combinations, different county yield realizations, and different insurance parameters such as premium levels and costs of production.

Table 4 shows how the expected profits to corn production would change with different yields and prices if no insurance were purchased. This table assumes that the farm sells its entire crop at the harvest and that the cost of producing an acre of corn is $394.

Table 4. Expected Profits without Crop Insurance, $'s per Acre.

		Harvest Price ($'s/bu)							
		3	3.5	4	4.5	5	5.5	6	6.5
Actual Yield (bu/acre)	170	116	201	286	371	456	541	626	711
	150	56	131	206	281	356	431	506	581
	130	-4	61	126	191	256	321	386	451
	110	-64	-9	46	101	156	211	266	321
	90	-124	-79	-34	11	56	101	146	191
	70	-184	-149	-114	-79	-44	-9	26	61
	50	-244	-219	-194	-169	-144	-119	-94	-69

The expected profits that would be obtained when the farm purchases GRP insurance at the 90% coverage level and the county level yield is below the GRP yield trigger are shown in Table 5. In this case, assume that the final county level yield is 100 bushels per acre. The calculation of the indemnity is exactly the same as that illustrated in the 3 step procedure above. Because the indemnity payment does not depend upon the actual prices and yields achieved by the farm, the profit is greater in every situation shown in the table. Specifically, each outcome is increased by the amount of the net indemnity payment, $65.47. It is probably unlikely that the farm would achieve high yields when county yields are below the yield trigger, but this situation is not precluded. Each farm will have to evaluate the likelihood of these occurrences given their own situation.

Table 5. Expected Profit with GRP Insurance and the 90% Level, County Yields at 100 bushels per acre, Expected County Yield of 124.20 bushels per acre, and Maximum Coverage of $698.63, ($'s/acre).

		Harvest Price ($'s/bu)							
		3	3.5	4	4.5	5	5.5	6	6.5
Actual Yield (bu/acre)	170	182	267	352	437	522	607	692	777
	150	122	197	272	347	422	497	572	647
	130	62	127	192	257	322	387	452	517
	110	2	57	112	167	222	277	332	387
	90	-58	-13	32	77	122	167	212	257
	70	-118	-83	-48	-13	22	57	92	127
	50	-178	-153	-128	-103	-78	-53	-28	-3

This scenario illustrates several key features of the GRP program. In contrast to the APH and CRC policies described in Example 1, the farm can still have quite low income when yields fall. For example, the expected net income per acre is negative $178 when prices are $3 per bushel and yields are 50 bushels per acre. On the other hand, if the farm were to achieve high yields and prices, the expected profits would be greater than the no insurance, APH, or CRC cases. This can be seen for the case of yields at 170 bushels per acre and prices of $6.50 per bushel. Here, the farm still receives an indemnity payment because county yields were low. In the case of CRC or APH no indemnity would have been paid.

The situation where county level yields are above the yield trigger is shown in Table 6. In this situation the actual county yields is 120 bushels per acre. As a result, no indemnity would be paid. All of the outcomes in this case are $7.89 per acre less than in the case of no insurance. When purchasing GRP insurance, the farm must carefully consider the likelihood that low farm level yields will also be accompanied by low county level yields. When the farm must have the cash flow from the insurance policy for financial survival, the value of GRP insurance is questionable as it is possible that no indemnity will be paid when profits are low.

Table 6. Expected Profit with GRP Insurance and the 90% Level, County Yields at 120 bushels per acre, Expected County Yield of 124.20 bushels per acre, and Maximum Coverage of $698.63, ($'s/acre).

		Harvest Price ($'s/bu)							
		3	3.5	4	4.5	5	5.5	6	6.5
Actual Yield (bu/acre)	170	108	193	278	363	448	533	618	703
	150	48	123	198	273	348	423	498	573
	130	-12	53	118	183	248	313	378	443
	110	-72	-17	38	93	148	203	258	313
	90	-132	-87	-42	3	48	93	138	183
	70	-192	-157	-122	-87	-52	-17	18	53
	50	-252	-227	-202	-177	-152	-127	-102	-77

EXAMPLE 3: APPLE PRODUCTION – APH INSURANCE

This example is for a Wayne county New York farm that grows 250 acres of apples for the fresh market and is considering the purchase of APH insurance. The farm expects that the total cost of producing an acre of apples is $3,700. The farm's actual production history (APH) yields, expected prices, and expected costs for these crops are shown in Table 1 which also shows the relevant parameters for APH crop insurance.

Table 1. Apple Crop Yields, Prices, and APH Insurance Parameters.

Crop	Apples
Acres	250
Expected Yield (bushels/acre)	500
Expected Price ($'s/bushel)	11
Expected Revenue ($/acre)	5,500
Expected Costs ($/acre)	4,000
APH Yield (bushels/acre)	500
APH Indemnity Price ($'s/bushel)	10.10

The premiums for APH insurance at various coverage levels is shown in Table 2. These premiums are meant to reflect the magnitude of premiums that would be expected for a farm operating in Wayne county NY with similar APH yields. However, the premiums are for illustration purposes only. Individuals considering the purchase of crop insurance should obtain quotes from qualified insurance provider.

Table 2. APH Premiums ($'s/acre)

Coverage Level	Apples
APH 50%	16.80
APH 55%	25.27
APH 60%	33.70
APH 65%	49.80
APH 70%	66.70
APH 75%	95.97

The process used to calculate indemnities under the APH insurance policy at a 75% coverage level are illustrated with a three-step process. Here, assume that the farm produces an apple crop that actually yields 300 bushels per acre.

Step 1: Determine the minimum bushel guarantee by multiplying the APH yield by the coverage level.

500 bushels/acre * 75% = 375 bushels/acre

Step 2: Determine the bushels lost by subtracting the actual bushels produced from the minimum bushel guarantee

375 bushels/acre - 300 bushels/acre = 75 bushels/acre

Step 3: If the amount in step 2 is positive, multiply the loss by the APH indemnity price

75 bushels/acre * $10.10 / bushel = $757.50 /acre

Here, the farmer would receive an indemnity of $757.50 per acre. The cost of this insurance was $95.97 so the net indemnity is $661.53. This calculation procedure was used to compare the projected profits for the farm under the case of no insurance (Table 3) and with APH insurance at the 75% coverage level (Table 4). The calculations cover a range of possible prices and yields and assume the cost of producing an acre of apples is $4,000.

The calculations used to construct these tables are available in the spreadsheet *apples-aph.xlsx*. The spreadsheet allows the user to examine coverage levels other than those shown in the following tables. It also allows the user to examine different price/yield combinations as well as different insurance parameters such as premium levels and costs of production.

Table 3. Expected Profits without Crop Insurance, ($'s/acre).

		Harvest Price ($'s/bu)							
		8	8.5	9	9.5	10	10.5	11	11.5
Actual Yield (bu/acre)	600	800	1100	1400	1700	2000	2300	2600	2900
	500	0	250	500	750	1000	1250	1500	1750
	400	-800	-600	-400	-200	0	200	400	600
	300	-1600	-1450	-1300	-1150	-1000	-850	-700	-550
	200	-2400	-2300	-2200	-2100	-2000	-1900	-1800	-1700
	100	-3200	-3150	-3100	-3050	-3000	-2950	-2900	-2850
	0	-4000	-4000	-4000	-4000	-4000	-4000	-4000	-4000

In the case of no crop insurance (Table 3) the farm is exposed to significant profit risk. The purchase of APH insurance has the potential to reduce risks associated with yield production shortfalls. The farmer would be compensated for these shortfalls at the APH indemnity price of $10.10 per bushel of apples below the APH guarantee. Table 4 shows how APH insurance would help protect the farm from yield shortfalls. This table was constructed for coverage at the 75% level and uses a premium of $95.97 per acre.

Table 4. Expected Profits with APH Insurance at the 75% Coverage Level, $'s per Acre.

		Harvest Price ($'s/bu)							
		8	8.5	9	9.5	10	10.5	11	11.5
Actual Yield (bu/acre)	600	704	1004	1304	1604	1904	2204	2504	2804
	500	-96	154	404	654	904	1154	1404	1654
	400	-896	-696	-496	-296	-96	104	304	504
	300	-938	-788	-638	-488	-338	-188	-38	112
	200	-728	-628	-528	-428	-328	-228	-128	-28
	100	-518	-468	-418	-368	-318	-268	-218	-168
	0	-308	-308	-308	-308	-308	-308	-308	-308

By examining the results in Table 4 it is possible to see that the purchase of the APH product significantly reduces the risk associated with apple production. One interesting feature is that purchasing that the product would actually produce a smaller net loss if the farm were to produce no apples than if it produced 300 tons of apples when prices are less than $10 per bushel. This is because the product pays the farmer for lost bushels at the APH indemnity price of $10.10 per bushel. As a result, when prices are less than $10.10, lost bushels are effectively "sold" at a higher price than produced bushels. Of course the risk protection that is provided by the product comes at a cost of producing lower profits when yields are above the guaranteed yield level.

EXAMPLE 4: GRAPE PRODUCTION – APH INSURANCE

In this example a Chautauqua county New York farm is considering the purchase of APH insurance for its grape production. The farm grows 100 acres of Concord grapes. The expected yield, prices, costs, actual production history (APH) yield, and APH indemnity price are shown in Table 1.

Table 1. Concord Grape Crop Yields, Prices, and APH Insurance Parameters.

Crop	Concord
Acres	100
Expected Yield (tons/acre)	6.8
Expected Price ($'s/ton)	230
Expected Revenue ($/acre)	1,564
Expected Costs ($/acre)	1,300
APH Yield (tons/acre)	6.8
APH Indemnity Price ($'s/ton)	215

The farm is interested in examining how APH insurance could be used to manage yield risks associated with grape production. The premiums for APH insurance at various coverage levels is shown in Table 2. These premiums are meant to reflect the magnitude of premiums that would be expected for a farm operating in Chautauqua county NY. However, the premiums are for illustration purposes only. Individuals considering the purchase of crop insurance should obtain quotes from qualified insurance provider.

Table 2. APH Premiums ($'s/acre)

Coverage Level	Concord
APH 50%	9.04
APH 55%	11.91
APH 60%	15.03
APH 65%	22.21
APH 70%	30.13
APH 75%	41.52

The next example illustrates how to calculate the indemnities under the APH insurance policy at a 75% coverage level. Here, assume that the farm produces a crop that actually yields 4 tons per acre.

Step 1: Determine the minimum ton guarantee by multiplying the APH yield by the coverage level.

6.8 tons/acre * 75% = 5.1 tons/acre

Step 2: Determine the tons lost by subtracting the actual tons produced from the minimum ton guarantee

5.1 tons/acre – 4 tons/acre = 1.1 tons/acre

Step 3: If the amount in step 2 is positive, multiply the loss by the APH indemnity price

1.1 tons/acre * $215 /ton = $236.50 /acre

Here, the farmer would receive an indemnity of $236.50 per acre. The cost of this insurance was $41.52 so the net indemnity is $194.98. This calculation procedure was used to compare the projected profits for the farm under the case of no insurance (Table 3) and with APH insurance at the 75% coverage level (Table 4). The calculations cover a range of possible prices and yields and assume the cost of producing an acre of grapes is $1,300.

The calculations used to construct these tables are available in the spreadsheet *grapes-aph.xlsx*. The spreadsheet allows the user to examine coverage levels other than those shown in the following tables. It also allows the user to examine different price/yield combinations as well as different insurance parameters such as premium levels and costs of production.

Table 3. Expected Profits without Crop Insurance, ($'s/acre).

		Harvest Price ($'s/ton)							
		150	170	190	210	230	250	270	290
Actual Yield (tons/acre)	7.5	-175	-25	125	275	425	575	725	875
	6.8	-280	-144	-8	128	264	400	536	672
	6	-400	-280	-160	-40	80	200	320	440
	5	-550	-450	-350	-250	-150	-50	50	150
	4	-700	-620	-540	-460	-380	-300	-220	-140
	3	-850	-790	-730	-670	-610	-550	-490	-430
	2	-1000	-960	-920	-880	-840	-800	-760	-720

The results in Table 3 indicate that the farm faces a substantial risk due to falling yields and prices. When the farm purchases APH insurance it helps to provide protection due to falling yields. It also provides some protection against prices falling below the APH indemnity price but this protection is only good on yield losses. In other words, the policy does not compensate the producer for price declines on produced grapes. In the same way it does not compensate the grower if yields are strong but prices low. For instance, there is no indemnity due if yields are 7.5 tons per acre but prices are $170 per ton.

Table 4. Expected Profits with APH Insurance at the 75% Coverage Level, $'s per Acre.

		Harvest Price ($'s/ton)							
		150	170	190	210	230	250	270	290
Actual Yield (tons/acre)	7.5	-217	-67	83	233	383	533	683	833
	6.8	-322	-186	-50	86	222	358	494	630
	6	-442	-322	-202	-82	38	158	278	398
	5	-570	-470	-370	-270	-170	-70	30	130
	4	-505	-425	-345	-265	-185	-105	-25	55
	3	-440	-380	-320	-260	-200	-140	-80	-20
	2	-375	-335	-295	-255	-215	-175	-135	-95

EXAMPLE 5: FORAGE PRODUCTION – APH INSURANCE

The final example considers the case of a Jefferson county New York farm that wishes to consider purchasing forage production insurance. The farm has 200 acres of forage production that meets the requirements for the policy. Among other things, the forage crop is a mixed alfalfa and perennial grass crop in which alfalfa comprises between 25 and 60 percent of the ground cover. In addition, it has been grown for at least one growing year since establishment and has an adequate stand. Interested growers should consult a qualified insurance agent to determine if their forage crop will meet these requirements. The expected yield, prices, costs, actual production history (APH) yield, and APH indemnity price are shown in Table 1.

Table 1. Forage Crop Yields, Prices, and APH Insurance Parameters.

Crop	Forage
Acres	200
Expected Yield (tons/acre)	2.0
Expected Price ($'s/ton)	160
Expected Revenue ($/acre)	320
Expected Costs ($/acre)	150
APH Yield (tons/acre)	2.0
APH Indemnity Price ($'s/ton)	147

The farm is interested in examining how APH insurance could be used to manage yield risks associated with forage production. The premiums for APH insurance at various coverage levels is shown in Table 2. These premiums are meant to reflect the magnitude of premiums that would be expected for a farm operating in Jefferson county NY. However, the premiums are for illustration purposes only. Individuals considering the purchase of crop insurance should obtain quotes from qualified insurance provider.

Table 2. APH Premiums ($'s/acre)

Coverage Level	Forage Crop
APH 50%	2.03
APH 55%	2.64
APH 60%	3.24
APH 65%	4.55
APH 70%	5.80
APH 75%	8.48

Again, the three step process is used to calculate the indemnities under the APH insurance policy at a 75% coverage level. Here, assume that the farm produces a forage crop that actually yields 1 ton per acre.

Step 1: Determine the minimum ton guarantee by multiplying the APH yield by the coverage level.

2.0 tons/acre * 75% = 1.5 tons/acre

Step 2: Determine the tons lost by subtracting the actual tons produced from the minimum ton guarantee

1.5 tons/acre – 1 tons/acre = 0.5 tons/acre

Step 3: If the amount in step 2 is positive, multiply the loss by the APH indemnity price

0.5 tons/acre * $147 /ton = $73.50 /acre

Because the policy cost $8.48, the net indemnity is $65.02. This calculation procedure was used to compare the projected profits for the farm under the case of no insurance (Table 3) and with APH insurance at the 75% coverage level (Table 4). The calculations cover a range of possible prices and yields and assume the cost of producing an acre of forage is $150.

The calculations used to construct these tables are available in the spreadsheet *Forage-aph.xlsx*. The spreadsheet allows the user to examine coverage levels other than those shown in the following tables. It also allows the user to examine different price/yield combinations as well as different insurance parameters such as premium levels and costs of production.

Table 3. Expected Profits without Crop Insurance, ($'s/acre).

		Harvest Price ($'s/ton)							
		100	110	120	130	140	150	160	170
Actual Yield (tons/acre)	2.5	100	125	150	175	200	225	250	275
	2.0	50	70	90	110	130	150	170	190
	1.8	30	48	66	84	102	120	138	156
	1.5	0	15	30	45	60	75	90	105
	1.0	-50	-40	-30	-20	-10	0	10	20
	0.5	-100	-95	-90	-85	-80	-75	-70	-65
	0	-150	-150	-150	-150	-150	-150	-150	-150

In this case the farm will experience negative profits if yields fall below 1.5 tons per acre. APH insurance helps to protect the farm from low yields. The projected profits that would be received if the farm were to purchase forage production insurance at the 75% coverage level of $8.48 per acre are shown in Table 4.

Table 4. Expected Profits with APH Insurance at the 75% Coverage Level, $'s per Acre.

		Harvest Price ($'s/ton)							
		100	110	120	130	140	150	160	170
Actual Yield (tons/acre)	2.5	92	117	142	167	192	217	242	267
	2.0	42	62	82	102	122	142	162	182
	1.8	22	40	58	76	94	112	130	148
	1.5	-8	7	22	37	52	67	82	97
	1.0	15	25	35	45	55	65	75	85
	0.5	39	44	49	54	59	64	69	74
	0	62	62	62	62	62	62	62	62

The purchase of APH insurance for forage production has the potential to reduce some of the downside risk that the farm faces. Of the price/yield combinations shown in Table 4, only one results in negative profits. Again, the purchase of insurance also reduces profits when yields are greater than the yield guarantee of 1.5 tons per acre.

OTHER A.E.M. EXTENSION BULLETINS

EB No	Title	Fee (if applicable)	Author(s)
2009-01	Do I Need Crop Insurance? Self Evaluating Crop Insurance as a Risk Management Tool in New York State		Richards, S., Staehr. A. and B. Gloy
2008-26	Immigration Issues: Perceptions of Golf Course Superintendents		Maloney, R. and R. Bills
2008-25	New York Economic Handbook	($10.00)	Extension Staff
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