Integrating Crop Insurance and Marketing Decisions

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Introduction

Producers often hear extension economists and other market advisors talk about the importance of a marketing plan. The point of such remarks is that it is a good idea to give some careful thought to how a crop will be marketed at some point before the crop is actually produced.

When most people think about a marketing plan, they think first about when and how to price the crop. The effective management of price risk is very often a central goal of producer marketing plans. Common price risk management tools such as forward contracts, futures contracts, and/or options on futures contracts generally figure prominently in these plans. This is entirely appropriate, as risk management strategies employing these tools have proven effective for countless producers over many years.

It is possible, however, that producers may not always give enough consideration to how their choice of crop insurance products fits into their marketing plan. Traditional yield insurance, such as Actual Production History (APH) protection, is rightly viewed as a means of dealing with the risk of production losses. The effect of such coverage on producer marketing plans, while potentially important, is fairly straightforward. With the widespread availability of products like Crop Revenue Coverage (CRC) and Revenue Assurance (RA), which include some price risk as well as production risk protection, the question of how best to integrate such products with the marketing plan becomes more complex.

Crop Yield Insurance

APH protection remains very popular with cotton producers. According to USDA's Risk Management Agency, in 2003, out of a total of almost 89,000 crop insurance policies sold on cotton, over 59,000 were APH policies (including both catastrophic coverage and buy-up protection).

While APH protection is geared solely toward compensating producers for production losses, the availability of this protection can have an important influence on a producer's marketing decisions. To illustrate why this is so, consider the example of a producer who forward contracts a portion of his expected production.

Suppose, for example, that a Mississippi cotton producer—anticipating an 800-pound yield on 500 acres of cotton—forward contracts to sell 250,000 pounds of that production (500 pounds per acre) for $0.65 per pound. Now suppose that at harvest time, an extended period of unusually wet weather occurs in this producer's area, devastating the cotton crop. Instead of the expected 800-pound yield, the producer realizes a 460-pound yield (230,000 pounds on 500 acres). In this case, the producer does not have enough cotton to deliver against the forward contract. He must pay market price for the additional 20,000 pounds of cotton necessary to fulfill the forward contract requirements. If, for example, at harvest time the market price has risen to $0.70 per pound, the producer must pay $14,000 to make up for the shortfall in contracted production. Table 1 summarizes the outcome of the contract in terms of the producer's actual revenue

Table 1. Forward Contracting with Production Risk: Effect of Production Shortfall

Contracted Production	250,000	lbs.
Contracted Price	$0.65	per lb.
Expected Revenue from Contract	**$162,500**	
Actual Production	230,000	lbs.
Contracted Price	$0.65	per lb.
Value of Actual Production	$149,500	
Less market value of production shortfall (50,000 x $0.70)	-$14,000	
Actual Revenue from Contract	**$135,000**	

This example illustrates the adverse affect that produc-

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tion losses can have on the outcome of a forward contract arrangement. The potential for such losses to occur may act as an impediment to the use of forward pricing by producers. The availability of yield insurance, however, can reduce the adverse financial impact of such production losses and make contracting a more attractive marketing alternative.

Consider how the outcome of the situation described above would be different for a producer with APH coverage at the 65/100 level (insuring 65% of the APH yield and 100% of the price established by RMA). If the established cotton price insured with the APH policy were $0.60 per pound, the producer would receive an the following indemnity:

1) (100% x $0.60) x ((65% x 800) – 460) = $36.00/acre,

or a total indemnity of $18,000 on 500 acres. With the indemnity provided by the APH coverage, the producer is able to cover the cost associated with forward pricing and then experiencing a production shortfall.

Of course, it is possible—depending on the amount of expected production contracted, the size of any production shortfall, and the magnitude of price changes over the course of the growing season—that the indemnity received from crop insurance would not be sufficient to cover the value of the loss. In any case, however, the availability of insurance provides a means of offsetting at least a portion of the value of production losses, and can therefore make forward pricing a less risky prospect. It is important to note, also, that this observation holds true for other methods of forward pricing besides just cash forward contracting. A producer hedging with futures or options is also at risk of realizing lower than expected returns due to production risk.

Referring to the previous example, suppose that instead of entering into a forward contact, the producer took a slightly more aggressive marketing approach and sold 6 New York Board of Trade December Cotton futures contracts at $0.65 per pound, thereby hedging 75% of expected production.[1] Again, if actual production came in at 460 pounds per acre on 500 acres, the outcome of the forward pricing strategy would be adversely affected by the production losses. This is best illustrated by calculating the net price received by the producer considering income and losses in both futures and cash markets. This calculation is shown in Table 2:

The important thing to note here is that because of production losses, the realized price per pound on cotton actually produced is lower than the expected forward price established with the short hedge ($0.635 realized versus $0.65 expected). The reason for this is that the producer ends up with a larger position in the futures market than in the cash market; therefore, the losses on the futures position are not entirely offset by gains in the value of cotton in the cash market. As in the previous example, the indemnity from an APH 65/100 policy would offset the effect of the production losses.[2]

The general conclusion to be drawn from the preceding examples is that by mitigating the impact of production losses, yield insurance may allow producers to be more aggressive in forward pricing their crop. This is because the costs associated with a production shortfall will be offset, at least to some degree, by an indemnity from the crop insurance.

Revenue Insurance

Revenue insurance products protect not only against variation in yield but also against changes in market prices. With these types of crop insurance policies, a level of revenue is guaranteed instead of a level of yield. Revenue insurance products on cotton include Crop Revenue Coverage (CRC), Income Protection (IP), and Revenue Assurance (RA). Only CRC is currently available across the entire cotton belt. For that reason, this discussion will focus mainly on the CRC product.

Table 2. Hedging and Production Risk: Effect of Production Shortfall on Net Price

Time	Futures Market	Cash Market
Growing Season	Sell 6 Dec Cotton contracts @ $0.65/lb	Expected Price = $0.65
Harvest	Buy 6 Dec Cotton contracts @ $0.70/lb	Sell 230,000 lbs cotton Actual Price = $0.70/lb
Revenue	-$15,000	$161,000
Net price for cotton: ($161,000—$15,000) ÷ 230,000 = $0.635/lb		

Note: For simplicity, in this example basis is assumed to be zero.

[1] The size of a NYBOT futures contract is 50,000 pounds.

[2] Again, it should be noted that whether or not the indemnity would be sufficient to cover the total value of production losses would depend on the size of the futures position taken, the size of any production shortfall, and the magnitude of price changes over the course of the growing season.

With CRC coverage, a producer selects a revenue coverage level from 50% to 85%. The amount of revenue guaranteed under the policy is determined by as follows:

2) *APH Yield* x *Coverage Level* x higher of *Base Price* or *Harvest Price*.

Base Price is determined prior to planting is the average closing price of the December Cotton contract on the New York Cotton Exchange from January 15 through February 14. *Harvest Price* is calculated as the average closing price of the December Cotton contract on the New York Cotton Exchange during the month of November. The producer receives an indemnity when actual yield times *Harvest Price* is less than the revenue guarantee as calculated in equation 2. Revenue Assurance, Harvest Price Option (RA-HPO) functions very much like a CRC policy. With Revenue Assurance, Base Price Option (RA-BPO) and Income Protection (IP) the level of coverage is fixed when the policy is purchased. The revenue guarantee does not increase if prices increase during the growing season.

The main thing to note about revenue policies is that they include protection not only against production losses but also, to some degree, against falling prices. If revenue declines below the guaranteed level, the producer will receive an indemnity—whether the decline in revenue is due to production losses, market losses, or some combination of the two. To illustrate, let's return to the example of the producer raising 500 acres of cotton with an APH of 800 pounds per acre. If this producer purchases a CRC policy with 75% coverage, the producer's revenue guarantee (on a per acre basis) will be

3) (800 x $0.60) x 0.75 = $360.

Suppose that the producer experiences significant drought-related losses so that actual production is only 400 pounds per acre. At the same time, suppose that the Harvest Price of cotton increases to $0.70 per pound. With this increase in harvest price, the producer's Final Guarantee under the terms of the CRC coverage is

4) (800 x $0.70) x 0.75 = $420/acre.

The producer will thus receive an indemnity, which is calculated as follows:

5) 420 – (400 x $0.70) = $140/acre.

Revenue Insurance and Marketing Decisions

The relevant marketing question for a producer who has purchased revenue insurance is how much, if any, additional price protection is needed. We can define different levels of price protection using hedge ratios. A hedge ratio is a number indicating what percentage of a producer's expected production should be hedged with a futures market position (using either futures contracts or options on futures contracts). The optimal hedge ratio reveals the amount of hedging that a decision maker would prefer, considering not only the level of returns available but also the variability of those returns.[3]

A recent study[4] on the interaction between crop insurance design and futures market hedging provides some useful insight for producers in integrating crop insurance and marketing decisions. This research indicates that a higher level of hedging is typically optimal with yield insurance than with any type of revenue insurance product. This makes sense because yield insurance provides no price protection at all. Thus, whatever the desired level of price protection, it must be obtained from some other source.

For revenue insurance products, the optimal hedge ratio for products with a fixed coverage level—such as RA-BPO or IP—is considerably lower than for revenue insurance products that allow the revenue guarantee to increase—such as CRC or RA-HPO. Also, as the selected coverage level increases, the optimal hedge ratio for a revenue product with a fixed coverage level decreases. By contrast, for a product with upside price protection like CRC or RA-HPO, the optimal hedge ratio increases at higher coverage levels. Table 3 presents optimal hedge ratios for three different insurance products calculated using cotton production data from Worth County, Georgia.

Table 3. Optimal Hedge Ratio for Different Insurance Products and Coverage Levels

Insurance Coverage Level	*Optimal Hedge Ratios* MPCI	RA-BPO	CRC
0.50	0.44	0.36	0.46
0.70	0.52	0.37	0.51
0.80	0.55	0.33	0.53

Source: Coble, Heifner, and Zuniga.

A couple of points about the research on crop insurance and marketing strategies bear special emphasis. First, there did not appear to be any situations where having a revenue insurance product as opposed to a yield insurance product increase the amount of expected production that the producer would want to hedge. Second, when revenue insurance without upside price protection was used (e.g., RA-BPO or IP) hedging became less attractive as the selected coverage level increased. Third, the upside price protection afforded by a revenue product

[3] There is not a "one-size-fits-all" optimal hedge ratio. An individual producer's decision regarding the optimal hedge ratio will be influenced strongly by the producer's attitude toward risk. It is also influenced by factors such as basis risk and production risk. Generally, the greater the basis and/or production risk for a given crop in a given location, the lower the optimal hedge ratio will be.

[4] Coble, K.H., M. Zuniga, and R. Heifner. "Evaluation of the Interaction of Risk Management Tools for Cotton and Soybeans." *Agricultural Systems*. 75(2003): 323-340.

with upside price protection (e.g., CRC or RA-HPO) seems to make hedging more attractive than with a straight revenue product because the upside price protection reduces the adverse affect of being over hedged (i.e., having a larger position in the futures than in the cash market). Still, a slightly lower level of hedging was optimal with revenue products with upside price protection than with yield insurance. This is because the revenue product provides a measure of price risk protection that yield insurance does not. Finally, with the right level of hedging, a producer can end up equally well off with any type of crop insurance product. It is useful to recognize, though, that a hedging strategy that is appropriate with one type of insurance may not be appropriate with another.

Marketing Pools and the Choice of Insurance Product

Marketing pools are a very popular way for producers to market cotton. Typically, producers will commit their cotton (or a portion of their cotton) to a pool before planting season. Most producers who send cotton to the pool let the pool handle all of the marketing.[5] Marketing managers for the pool are able to make use of all available marketing tools. Given that the pricing—and price risk management—on cotton placed in the pool is being handled professionally by a third party, the producer probably has less need for dealing with price risk using an insurance product. For this reason, for cotton going into a pool, yield insurance would seem to make more sense than revenue insurance. As the work mentioned above shows, however, using revenue insurance with upside price potential does not tend to greatly affect the optimal amount of hedging compared to yield insurance, so these products may also be appropriate on cotton going into a pool. Revenue products with a fixed revenue guarantee make less sense for cotton going into a pool since the price protection afforded by the insurance is likely redundant given the pricing and price risk management activities being carried out by the pool managers.

Conclusions

Producers need to consider the inter-relation between crop insurance and marketing decisions. Specific marketing plans may differ in terms of the tools used and in terms of the timing of pricing decisions. Crop insurance should be considered an element of an overall marketing plan. In this context, it is important that the characteristics of a given crop insurance product be compatible with the other elements of the marketing plan.

[5] Some pools will take cotton under a "call" arrangement whereby the producer retains the power to make all pricing decisions. This generally represents a fairly small percentage of cotton committed to pools. The discussion in this section deals with cotton for which the producer has handed over all marketing decisions to the pool manager.