PREVENTED PLANTING PROVISION INFLUENCE ON COTTON PRODUCERS' LATE PLANTING DECISION

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Abstract

Starting with the Federal Crop Insurance Reform and Department of Agriculture Reorganization Act of 1994, producers that purchased certain crop insurance policies were eligible for an indemnity if natural causes prevented them from planting their crop by the final planting date. Increases in prevented planting indemnity payments over the last two decades has triggered investigations into prevented planting claims and recommendations were made to reduce the payment structure of prevented planting in the future. We determined the prevented planting option a cotton producer would maximize net returns at different insurance coverage levels, prevented planting coverage factors, and planting windows. Data were used from a Tennessee cotton and soybean planting date experiment conducted. A quadratic response function was used to estimate the yield response to planting date. Net return equations were calculated and compared for planting during the late planting period, taking the full prevented planting payment, and planting soybeans as a second crop. Results suggest that a cotton producer would maximize profits by accepting the 35% prevented planting payment and planting uninsured soybeans. These results will help policy makers improve the prevented planting provision to encourage efficient land use.

Introduction

Under the prevented planting provision of crop insurance, a producer has several options if they were unable to plant the insured crop in the defined planting window. The producer could plant the originally insured crop during the late planting period but the producer's production guarantee would decrease 1% per day after the final planting date until the insured crop is planted. For example, if a producer has a 60% coverage level for their crop and plants 10 days into the late planting period, the adjusted coverage level would be 54% (60% - (10 days x 1% x 60%). Conversely, the producer could leave the acreage unplanted and receive the full prevented planting indemnity payment. For cotton, the full prevented planting payment is 50% of the original production guarantee (i.e., prevented planting coverage factor). This option requires the producer to leave the land fallow or plant a summer cover crop after the late planting period that cannot be harvested or grazed before November 1st. This option does not impact the producer's actual production history (APH), a 4 to 10-year trend adjusted average yield used for future crop insurance purchases. The third option is to plant an uninsured later season crop such as soybeans after the late planting period and receive a prevented planting payment equal to 35% of the full prevented planting payment. Finally, a producer could forgo the prevented planting payment and change their crop insurance to cover a later season crop such as soybeans if they are still in the defined planting window for that crop.

While the prevented planting provision reduces risk exposure, increases in prevented planting indemnity payments over the last two decades has triggered investigations into claims (Rejesus et al., 2003; Rejesus et at., 2005; United States Department of Agriculture Office of Inspector General (USDA OIG), 2013). A 2013 audit by the USDA OIG (2013) found that prevented planting indemnities paid producers $480 million more than their estimated losses from 2008-2011. Furthermore, the report by USDA OIG (2013) found that less than one percent of the producers receiving a prevented planting payment were replanting or planting a second crop. They concluded the current prevented planting provision was potentially encouraging inefficient land use and moral hazard. The USDA OIG (2013) recommended reducing the full prevented planting payment coverage factors for several crops, but however the coverage factor has not been reduced for cotton (USDA Risk Management Agency (RMA), 2018a). More research is needed to explore how this change to the provision would affect producers risk and moral hazard.

The objective of this study is to determine the prevented planting option a cotton producer would select based on net returns and variability of net returns if they were unable to plant. The solution will be determined under the current prevented planting provision coverage level for three levels of revenue protection (RP) coverage. We also show how reductions in the prevented planting coverage factor would change the optimal selection. The results will provide insight to policy makers on further adjustments to prevented planting provisions to limit moral hazard and can educate producers on selecting crop insurance policies to limit losses due to delayed planting.

Economic Framework

If a cotton producer is confronted with planting late due to weather, the producer must choose to plant their original crop late, switch to planting soybeans with or without the prevented planting payment for the first crop, or accept the full prevented planting payment. This is a complex decision that depends on several factors. A risk neutral, profit-maximizing producer would select the prevented planting option that maximizes net returns, which is a function of prices and yield expectations given a certain planting window. Enterprise budgets were used to calculate net returns for cotton producers that are confronted with these options during late planting.

Figure 1 shows an example of a producer's expected net returns for all four options. The expected net returns of the crops are decreasing as planting is prolonged demonstrating that late planting generally causes decreases in yields (shown by yellow line). The net returns for the prevented planting payment for cotton is constant throughout the late planting period (shown by blue line). The other two options of planting uninsured soybeans (shown by green line) and insured soybeans (shown by orange line) are also displayed in Figure 1. The RP coverage for all crops is also constant until the producer plants during the late planting period of that crop, where the production guarantee will start to decrease 1% per day (shown in dotted yellow and oranges line). Any one of these options could be profit maximizing depending on the producer's planting window, RP coverage level, and prevented planting coverage factor. This analysis will adjust the full prevented planting payment coverage factor as well as the RP coverage to examine how those changes will affect the producer's optimal option.

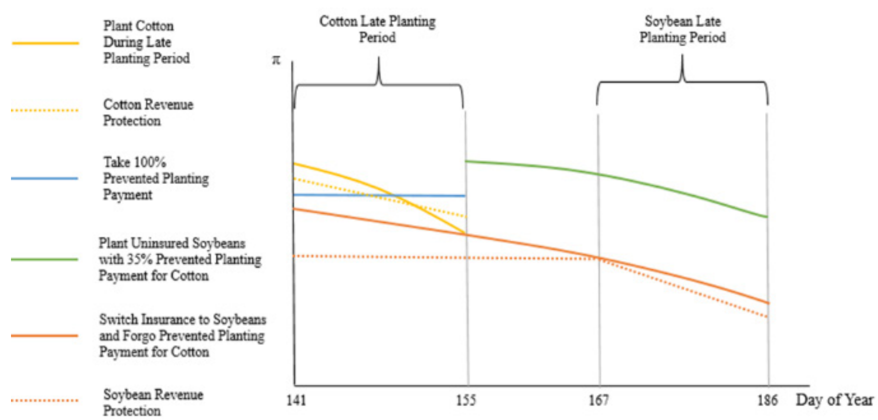

Figure 1. Example of Producer's Expected Profits at each Prevented Planting Option.

Data

The data used comes from a non-irrigated, planting date experiment for cotton and soybeans in Milan, Tennessee. Cotton experiments were conducted from 2008 to 2012 with six different planting dates. A total of 960 experiment observations were collected. The planting dates are April 14th, April 21st, May 1st, May 15th, June 1st, and June 15th. The average yield over all the years was 1,124 lb/acre (Table 1). The soybean data comes from experiments conducted from 2008 to 2010 with six different planting windows ranging from April 17th to August 10th. There were a total of 641 observations. The average yield of all observations was approximately 44 bu/acre (Table 1).

Table 2 shows the prices, costs, and crop insurance data used. Crop insurance price data was available from 2011 to 2017 so all crop insurance and market prices were calculated using the annual average Tennessee producers from 2011 to 2017 for cotton and soybeans (USDA NASS, 2018). Production costs were the average costs from 2011 to 2017 from the University of Tennessee field crop budgets for no-till, non-irrigated cotton and soybeans (University of Tennessee Department of Agricultural and Resource Economics, 2018). Pre-planting costs include land rent and the chemical and machinery costs for burndown and pre-emerge herbicides. If prevented from planting, fertilizer and seed were assumed to not been purchased yet or could be returned. Production costs after planting are all costs not included in before planting costs.

Table 1. Summary of cotton and soybean yields at each planting date or planting window.

Planting Date or Planting Window	Average Yield	Minimum Yield	Maximum Yield	Standard Deviation
		Cotton (lb/acre)		
April 14	1,397	663	2,306	370.48
April 21	1,266	755	1,912	286.92
May 1	1,368	791	2,212	313.36
May 15	1,159	318	1,903	293.41
June 1	944	230	1,575	300.54
June 15	611	176	1,571	280.01
		Soybeans (bu/acre)		
April 17 – May 6	48	17	74	10.94
May 7 – May 25	52	21	75	11.52
May 26 – June 13	51	12	68	8.89
June 14 – July 1	45	17	71	9.72
July 2 – July 21	38	18	83	10.16
July 22 – August 10	25	11	65	11.95

Table 2. Data used to calculate net returns for cotton and soybeans.

Variable Definition	Cotton	Soybeans
Market Price ($/bu or $/lb)	$0.73	$11.31
Revenue protection price ($/bu or $/lb)	$0.82	$11.29
Actual Production History yield (bu or lb)	1124	44
Production cost before planting ($/acre)	$133	$55
Production cost after planting ($/acre)	$509	$246
Premium with 60% coverage ($/acre)	$11	$9
Premium with 70% coverage ($/acre)	$20	$15
Premium with 80% coverage ($/acre)	$41	$32
Final Planting Date (Julien day)	140	166

Note: Land rent included in corn and cotton production cost before planting

Average RP insurance premiums were estimated for Gibson County, Tennessee from 2011 to 2017for 60%, 70%, and 80% coverages with basic unit structure (USDA RMA, 2018d). Gibson County was selected because this was the location where the experiment. The RP harvest price used for cotton and soybeans will be the average harvest price projected by the USDA RMA (2018c) for Gibson County, Tennessee from 2011 to 2017. The base prevented planting coverage levels for cotton of 50% was assumed (USDA RMA, 2018b). The same analysis was also conducted for prevented planting coverage level of 10% less than the original coverage level, so the new prevented planting coverage factor for cotton was 40%. Average yields from the data were assumed as the APH yields. Data in table 2 were used to calculate the net returns from the full prevented planting payment for cotton with three RP coverage levels and both prevented planting coverage factors. Under the current prevented planting coverage factor of 50%, the full payment was $133/acre, $170/acre, and $195/acre with 60%, 70%, and 80% RP coverage, respectively. With the reduced coverage factor, these payments decrease to $78/acre, $105/acre, and $121/acre with 60%, 70%, and 80% RP coverage, respectively.

Method

A quadratic response function was estimated for yield response to planting date and a year random effect was included. The Likelihood Ratio test was used to test the yields for heteroscedasticity with respect to year. If heteroscedasticity was present, the results for the model that adjusts for the unequal variances by year are reported.
Maximum likelihood was used to estimate the model in the MIXED procedure in SAS 9.4 (SAS Institute, 2013). The response function was substituted into the net returns equations to estimate net returns for the three prevented planting options that require planting, and they can now be compared to the expected net returns for the full prevented planting payment option.

Monte Carlo simulation models were developed to estimate distributions of net returns for each prevented planting option available to the producer by crop, RP coverage level, and prevented planting coverage factor. We compare the distribution of the net returns for each scenario to the corresponding full prevented planting payment, to find the probability of prevented planting option having greater net returns than the corresponding full prevented planting payment. Yield variability was considered by randomly assigning parameter estimates based on the planting date. This was done by considering the yield response function parameters to be drawn from the multivariate normal distribution. This method of considering production risk has been successfully used for crop yield response functions (Boyer et al., 2018). Simulation and Econometrics to Analyze Risk (SIMETAR©) was used to develop the distributions and perform the simulations (Richardson et al., 2008). A total of 5,000 net return observations were simulated for each scenario.

Results

Yield Response

The yield response function results for cotton and soybeans are shown in Table 3. The linear (β_1) and the quadratic (β_2) parameter estimates were significant for both crops at the 1% level of probability. The intercept (β_0) was significant at the 5% level of probability for soybeans. Heteroscedasticity was corrected for in both crops. The parameter estimates show that yields were increasing at a decreasing rate as planting was delayed. The yield maximizing planting dates for cotton and soybeans were April 7th and May 18th. These yield maximizing planting dates are within the planting window for the RP policy and coincide with much of the literature.

Table 3: Parameter estimates for cotton and soybean yield response function to planting date.

Parameter	Cotton	Soybeans
Intercept (${}^{2}{}_{0}$)	-252.52	-49.9654**
Day (${}^{2}{}_{1}$)	32.8457***	1.4556***
Day*Day (${}^{2}{}_{2}$)	-0.1663***	-0.00522***
Number of Observations	960	641

Note: Single, double, and triple asterisks (*, **, ***) represent significance at the 10%, 5%, and 1% level. Units are reported in bu/acre for soybeans and lb/acre for cotton.

Simulation

For a cotton producer, the prevented planting option that maximizes expected net returns at all RP coverage levels under the current prevented planting policy is planting uninsured soybeans after receiving a 35% prevented planting payment for cotton followed by planting uninsured soybeans and then late planted cotton. Table 4 shows the simulation results for the cotton producer. As RP coverage increased, the expected net returns for late planting cotton and planting insured soybeans decreased because the higher premium prices with increased RP coverage were proving unnecessarily high crop insurance protection. Conversely, the expected net returns for taking the 35% prevented planting payment and planting uninsured soybeans increased as RP coverage increased. This is because the 35% prevented planting payment increased with higher RP coverage.

A profit-maximizing producer would choose to planting uninsured soybeans after receiving a 35% prevented planting payment for cotton regardless of the RP coverage level. This option would provide higher net returns on average. However, the probability of the planting options generating higher net returns than the full prevented planting payment option decrease as RP coverage increases. Therefore, producers with higher RP coverage will be more likely to choose the full prevented planting option. Reducing the cotton prevented planting coverage factor to 40% will increase the probability of the planting options of having higher net returns than the full prevented planting payment option, but it will not change a risk neutral, profit maximizer's decision.

Summary

The objectives of this study are to determine the prevented planting option a cotton producer would select at the current prevented planting coverage factor based on net returns and also show how reductions in the prevented planting coverage factor would influence a producer's prevented planting decision.
The option that maximized net returns at all RP coverage levels at the current prevented planting coverage factor is planting uninsured soybeans after receiving a 35% prevented planting payment for the first crop. The probability of the planting options generating higher net returns than the full prevented planting option decreases as RP coverage increases, meaning that producers with higher RP coverages will be more likely to choose the full prevented planting

payment option and forgo planting. Lowering the prevented planting coverage factor by 10% increases probability of the planting options generating higher net returns than the full prevented planting payment option will increase, thus, likely encouraging producers to not abandon their crop.

Acknowledgements

We thank the leadership and staff at the University of Tennessee Research and Education Centers for field research support. This research is also supported by U.S. Department of Agriculture, Cooperative State Research, Education, and Extension Service through Tennessee Hatch Project TEN00442.

Table 4. Summary statistics from the simulated net returns ($/acre) for cotton producer by prevented planting option, revenue protection coverage level, and prevented planting coverage factor.

	60% Revenue Protection		70% Revenue Protection		80% Revenue Protection	
Option	Net Returns ($/acre)	Probability Net Returns e Full Prevented Planting Payment [a]	Net Returns ($/acre)	Probability Net Returns e Full Prevented Planting Payment	Net Returns ($/acre)	Probability Net Returns e Full Prevented Planting Payment
		With a 50% Prevented Planting Coverage Factor				
Late Planting	$47 ($69)	11%	$39 ($65)	3%	$36 ($46)	1%
35% Prevented Planting + Uninsured Soybeans	$178 ($64)	77%	$192 ($65)	64%	$201 ($66)	53%
Insured Soybeans	$95 ($61)	28%	$90 ($62)	10%	$74 ($62)	3%
		With a 40% Prevented Planting Coverage Factor				
Late Planting	- [b]	33%	- [b]	16%	- [b]	7%
35% Prevented Planting + Uninsured Soybeans	$161 ($65)	90%	$169 ($66)	84%	$176 ($66)	80%
Insured Soybeans	- [b]	62%	- [b]	40%	- [b]	22%

Note: Standard deviation is in parenthesis.
[a] Probabilities were calculated using the expected net returns for each crop, revenue production coverage level, and prevented planting coverage factor.
[b] Simulated net returns for were the same as when the prevented planting coverage factor was 50%.

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