A GSD ESTIMATION OF THE RELATIVE WORTH OF COVER CROPS IN COTTON PRODUCTION SYSTEMS:

BY

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ABSTRACT:

Cover crops can help reduce the negative environmental impacts of cotton production. This study used Generalized Stochastic Dominance to evaluate the relative worth, via risk premiums, of four cover crop regimes and two conventional production practices. Results indicate that cover crop regimes may be feasible alternatives to conventional practices.

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INTRODUCTION:

Cotton acreage in Louisiana and the southeastern United States has expanded during a period when there has been growing public concern regarding the environmental impacts associated with the production of cotton and many other row crops. From the producer's perspective, there are growing uncertainties associated with the price and availability of petroleum based nitrogen fertilizers and the corresponding firm level effects on profitability. Although current nitrogen fertilizer costs are a relatively small component of total production costs for a representative Louisiana cotton producer, this situation could be altered significantly depending on several factors, most notably, world oil prices. This factor, coupled with the detrimental environmental impacts associated with conventional production practices (topsoil erosion and nitrate runoff) and consequent potential for legislation being incorporated into future Food Security Acts that would limit production methods, could drastically affect commercial cotton production practices and net returns to cotton production. This study focuses on the relative economic feasibility, from a risk attitude perspective, of using cover crops (grasses and legumes) to supply all or part of the nitrogen required by cotton.

Cotton makes a significant contribution to the state's general economy (LSU Agricultural Center). Any changes mandated by legislation, which would alter yields and net returns, could have extremely important economic consequences for cotton producing regions within the state and significant implications for the entire state.

An underlying premise of this analysis is the generally accepted reasoning that the use of cover crops to provide winter ground cover does significantly reduce soil erosion and, where those cover crops are legumes, can also reduce nitrate runoff, due to decreased or zero use of commercial nitrogen fertilizers. Given this, the use of cover crops implies smaller environmental impacts stemming from cotton production and is in line with the precepts of LISA (low input sustainable agriculture).

DATA:

This research used data from an ongoing cover crop study being conducted at the Red River Research Station in Bossier City, La., which was instituted approximately 30 years ago (Millhollon et al.). If only by virtue of its length, this study represents one of the premier sources of yield data for cotton produced with cover crops, as well as conventional methods. In addition, this study evaluates the yield differences between different cover crops, even different legume cover crops, as well as evaluating the effects of cover crops used in conjunction with conventional nitrogen fertilizers. A total of eight treatments comprise the study:

1) Wheat and 60 lbs. Nitrogen (WH60N)
2) Austrian Winter Peas (AWP)
3) Hairy Vetch (HV)
4) Check (CHECK) (no cover crop or nitrogen fertilizer)
5) Common Vetch (CV)
6) Vetch and 40 lbs. Nitrogen (VE40N)
7) 40 lbs. Nitrogen (40N)
8) 60 lbs. Nitrogen (60N)

The actual data used in this analysis encompassed 22 years, 1968-89 inclusively. Truncation of the data (from 30 years) was necessary due to the initiation and suspension of several previous treatments during the early stages of the cover crop study. Each treatment was replicated four times. For purposes of this analysis, the yields from each replication were averaged over replications in an attempt to negate any measuring error in the field. The final treatments evaluated were all of the above except AWP and CV[1].

Table 1 shows average (over four replications) lint yields for each production system for the 22 years of data used in this analysis. In order of descending means, the systems are HV, VE40N, WH60N, 60N, 40N and CHECK.

Table 1: Lint Yield for Selected Production Systems. Red River Research Station, Bossier City, La. 1968-1989.

	Production Systems					
YEAR:	HV	CHECK	40N	60N	WH60N	VE40N
	--------lbs. per acre--------					
1968	638	435	611	648	710	648
1969	468	287	445	446	374	421
1970	859	640	854	873	891	870
1971	825	579	763	731	782	720
1972	889	542	776	867	979	926
1973	550	280	488	523	515	544
1974	813	458	709	736	762	677
1975	592	224	459	534	483	566
1976	867	272	595	632	798	870
1977	835	512	776	854	790	811
1978	792	400	686	624	755	870
1979	830	326	833	830	822	953
1980	702	344	582	592	720	809
1981	744	256	648	624	707	766
1982	975	327	790	811	984	887
1983	743	191	552	558	657	766
1984	1380	605	1222	1140	1096	1449
1985	924	429	720	889	1033	927
1986	475	211	420	442	475	463
1987	828	174	507	584	734	822
1988	937	234	791	871	787	939
1989	977	274	613	842	834	738
AVERAGE	802	364	675	711	759	793

[1]AWP was dropped because its mean and standard deviation were nearly identical to 40N. Although AWP's mean was $0.20 per acre greater than 40N's, it also had much lower minimum and maximum values. Only a risk neutral (interval 8) decision maker would rank AWP higher than 40N. Therefore, it could never be ranked higher than fifth. CV was not included because it was suspended from the cover crop study in 1985.

STOCHASTIC DOMINANCE ANALYSIS:

Stochastic Dominance (SD) techniques have been used to order numerous kinds of farm management decisions that must be made in an environment of risk and uncertainty. Examples include Klemme, Lee et al., Kramer and Pope, and Williams, among many others. A major advantage of the three more commonly used forms of stochastic dominance, First Degree (FSD), Second Degree (SSD) and Second Degree With Respect to a Function (SDWRF or GSD), is they incorporate all four moments of the comparison distributions. Therefore, they do not require normality in the probability distribution functions (PDF's) of the outcome variables, as does the more traditional Mean-Variance (E-V) analysis.

While FSD and SSD may be more useful than E-V analysis, they are not as efficient as GSD in selecting the preferred strategies from the outcome distributions, due to the assumptions each makes about the decision maker's utility function. FSD is limited in narrowing the efficient set from the choice set because it makes only the weak assumption that more is preferred to less by the decision maker. SSD incorporates this assumption, plus the stronger assumption of risk averseness at all income levels. Due to this additional assumption, SSD can define a smaller efficient set than FSD, but it excludes the entire class of risk preferring decision makers. GSD is a generalized technique that is often more useful because it does not impose global restrictions on the decision maker's utility function. Therefore, it can be used to model the whole spectrum of risk attitudes, via the Pratt risk aversion coefficient[2].

Mathematically, the Pratt risk aversion coefficient is defined as $-U''(x)/U'(x)$, where U represents an individual's or a group of decision maker's utility function and x is income or wealth. By using the Pratt risk aversion

[2]Sometimes referred to as the Pratt-Arrow risk aversion coefficient.

coefficient to specify the lower and upper bounds (r1 and r2), a definite range on the admissible set of utility functions is established, thereby setting lower and upper limits on the range of risk attitudes that enter into the analysis. Briefly, the following integral is minimized:

$$\int [F(x) - G(x)]U'(x)dx \quad \text{for } -\infty < x < \infty$$
$$\text{Subject to: } r1(x) \leq -U''(x)/U'(x) \leq r2(x)$$

Where r1(x) and r2(x) are the lower and upper bounds on the absolute risk aversion coefficient, respectively, and F and G represent two competing outcome distributions[3].

GSD allows the analyst to model many different risk attitudes, by varying r1 and r2, without having to exactly represent any specific risk attitude. In addition, it also allows the calculation of risk premiums, or the amount that a decision maker would be willing to pay to maintain the use of the dominant distribution over a comparison distribution.

A criticism that has been leveled at standard stochastic dominance techniques is that they treat all of the outcome distributions in a dichotomous manner, therefore, no portfolio strategies among the outcome distributions are allowed. McCarl et al. present a test, which utilizes the correlation coefficient, mean, and standard deviation of the distributions, along with the Pratt risk aversion coefficient, for determining whether portfolio strategies should be considered. Their findings show that in many past studies employing stochastic dominance, some strategies not included in the stochastically efficient set are, in fact, members of the efficient set when portfolio strategies are considered. For purposes of this study, no portfolio strategies are considered because a complete dichotomous ranking of each alternative

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[3]This paragraph draws substantially on Lee et al., and Cochran and Raskin. A more comprehensive mathematical treatment may be found in Kramer and Pope.

strategy was desired. For firm level decision making, it is possible that some degree of diversification among these strategies may dominate an individual strategy, depending on the risk attitude of the decision maker.

PROCEDURE:

The yield data provided by the Red River Research Station was expressed in pounds of seed cotton per acre. Seed cotton yields were converted to pounds of lint and cottonseed based on percentages published by USDA-ERS for Louisiana in the 1988-89 season (Glade and Johnson[4]). Over the course of the cover crop study, new production technology (cotton varieties, defoliants, herbicides and insecticides) was utilized as it became commercially available, thereby, possibly contributing to an "across the board" upward trend in yields. Conversely, continuous cropping, even with cover crops, could cause significant downward yield trends due to changes in organic matter, soil erosion and other agronomic considerations. However, neither linear nor curvilinear trend analysis revealed the existence of any broad based trend. Therefore, the trends that were present were assumed to be solely the result of a specific treatment (cover crop) and no detrending procedures were used[5].

After calculating the yields to each treatment in terms of both the lint and cottonseed components, standard enterprise budgets, altered to reflect cultural practices specific to the Red River study, were constructed for each treatment. Unit input and output prices were held constant at 1990 levels to isolate the stochastic effects of yields on net returns. Subsequently, input

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[4]The percentages used were 34.3% and 65.7% of seed cotton yield for lint and cottonseed, respectively.

[5]Those treatments exhibiting significant trends in the linear analysis were HV (T-stat 2.4934) and CHECK (T-stat -2.8248). In the non-linear analysis, only CHECK had a significant trend (T-stat -2.9037).

costs, with the exception of ginning costs, do not vary within treatments. However, they do vary between treatments, introducing an element of economic as well as production risk[6]. Output prices used in enterprise budget generation were $0.50/lb market price for lint, $0.23/lb. deficiency payment for lint and $0.05/lb. for cottonseed products.

The Mississippi State Budget Generator (MSBG) microcomputer program was used to generate the distributions of net returns (over variable costs, fixed equipment costs and overhead) for each treatment, each distribution including twenty-two observations. These distributions were then entered into a generalized stochastic dominance program written at the University of Arkansas (Goh et. al). Table 2 shows the mean, standard deviation, maximum, minimum and skewness values of net returns for each distribution in terms of dollars per acre.

Table 2: Mean, S.D., Max., Min., and Skewness Values for each Cotton Production System.

Distribution:	Mean	S.D.	Max.	Min.	Skewness
	-----net returns per acre-----				
HV	194.54	146.83	625.15	-54.24	.67
CHECK	-101.11	106.07	105.02	-243.20	.53
40N	120.59	134.13	528.36	-69.04	1.06
60N	145.47	130.34	464.77	-55.23	.40
WH60N	164.12	136.07	415.49	-122.34	-.26
VE40N	177.60	158.12	666.45	-99.37	.90

Due to a lack of specific information about the true risk preferences of cotton producers in Louisiana, the lower bound (rl) was set at the negative of the calculated relative risk aversion coefficient[7] (-0.150049) for the first

[6]Input costs differ due to variations in cover crop seed costs, cover crop planting costs and fertilizer costs among treatments.

[7]Following Goh et.al, the formula for the relative risk aversion coefficient (rrac) is rrac = r * x, where the maximum possible value of rrac equals 100 and x equals the value of the highest observation in any of the comparison distributions (666.45 in this case).

interval and a systematic iterative procedure employed to search for the highest value of r2 that could be entered, while still allowing all rotations to be ranked without question. Following the establishment of this value, the r1 value for the second interval was set at the r2 value of the first interval plus 0.000001, and the highest value of r2 where all rotations could be ranked was again searched for iteratively. This procedure continued until the r2 value of the last interval was equal to the relative risk aversion coefficient (0.150049)[8].

Because the objective was to define the largest interval possible while still ranking all strategies, thereby disallowing Type II (inability to order) errors, the width of the intervals varies significantly, as does the probability of Type I (inaccurate ranking) errors (Cochran, Robison and Lodwick). The narrower intervals have a correspondingly higher probability of Type I errors as compared to the wider intervals.

The initial intervals were generated using per acre net returns, therefore, the corresponding r values are much larger than the intervals typically seen in the literature. In an effort to make these original intervals conform to the semi-standardized intervals usually reported in the literature, a scaling procedure, described by Raskin and Cochran, was utilized. The actual transformation was performed by multiplying the per acre net returns by 415, which, based on a recent survey, is the average cotton acreage of a representative farm in the Red River area of Louisiana (Vandeveer et al.), and dividing the per acre intervals by 415. Although a representative farm in this region has other income producing enterprises besides cotton, income from the

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[8]This procedure is similar to McCarl's breakeven risk aversion coefficient (BRAC) identification procedure.

cotton enterprise generates approximately 70% of the projected operating receipts for crop farms (Vandeveer et al.), and would therefore dominate decision making by the producer, even in a diversified management strategy.

After transforming the data, the intervals corresponding to whole farm income were carried out to eight decimal places, rather than six places as in the per acre intervals. This was necessary due to the small number of intervals that remained (at six decimal places) after being divided by 415, and the presence of Type II errors. This was accomplished by using the iterative procedure described previously. Neither the rankings nor the risk premiums change as a result of the transformation[9]. The only difference is a slight reduction in the number of intervals, from 19 to 16[10].

RESULTS:

The intervals for whole farm income are given in Table 3. The rankings of the treatments change significantly based on the risk attitudes of the decision maker. Two of the cover crop production strategies, either HV or VE40N, are ranked highest across all intervals and across intervals six through ten inclusive, cover crop strategies are in the top three rankings. However, toward the risk averse end of the spectrum, the conventional treatments 60N and 40N move up in the rankings. For interval 16, they are ranked two and three, respectively. In total, cover crop treatments are preferred across all sixteen intervals, cover crop treatments are ranked one and two in twelve of the intervals and hold the

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[9]The risk premiums may vary by approximately $1.00/acre due to rounding errors.

[10]The reduction in intervals occurred because there are three whole farm intervals where r1 equals r2. Carrying the r values past eight decimal places would result in the division of these intervals, but would not result in any change in the rankings.

top three spots for five intervals. On the other hand, conventional practices 60N and 40N are never preferred over at least one cover crop practice and are ranked two and three in only one interval (16).

Table 3: Final Intervals and Rankings
From Risk Preferring to Risk Averse

Interval:	R1:	R2:	Rankings (a):
1	-.00036156	-.00002845	V,H,4,6,W,C
2	-.00002844	-.00002829	V,H,4,6,W,C
3	-.00002828	-.00002810	V,H,4,W,6,C
4	-.00002809	-.00002047	V,H,4,W,6,C
5	-.00002046	-.00002046	V,H,4,W,6,C
6	-.00002045	-.00001728	V,H,W,4,6,C
7	-.00001727	-.00001189	V,H,W,6,4,C
8	-.00001188	.00001865	H,V,W,6,4,C
9	.00001866	.00001930	H,V,W,6,4,C
10	.00001931	.00001931	H,V,W,6,4,C
11	.00001932	.00002081	H,V,6,W,4,C
12	.00002082	.00002700	H,V,6,W,4,C
13	.00002701	.00003366	H,6,V,W,4,C
14	.00003367	.00003367	H,6,V,W,4,C
15	.00003368	.00004618	H,6,V,4,W,C
16	.00004619	.00036156	H,6,4,V,W,C

(a) where H=HV, 6=60N, 4=40N, V=VE40N, W=WH60N, C=CHECK

Another important aspect of GSD is the calculation of risk premiums associated with each interval. In the GSD program, both an upper and lower bound on the risk premium is calculated. "The upper bound corresponds to the minimum shift in the dominant distribution" (or CDF) "that results in the dominant distribution being dominated by the comparison distribution" (Cochran and Raskin). The lower bound represents the minimum shift in the dominant distribution where both the dominant and comparison distributions are in the efficient set (Cochran and Raskin). Alternatively, the upper bound may be thought of as the amount at least one decision maker in that interval would pay to use the dominant strategy as opposed to a competing (inferior) strategy, while all would be willing to pay an amount equal to the lower bound. Mathematically, following Cochran and Raskin, the program performs the following calculations:

1) Min $\pi \ni EU(F - \pi) - EU(G) < 0 \ \forall U \in u$
2) Min $\pi \ni EU(F - \pi) - EU(G) \leq 0$ for at least one $U \in u$

where: π = risk premium
EU = expected utility
F = dominant distribution
G = comparison distribution
u = admissible set of utility functions
U = individual decision maker's utility function
$\forall$ = for all, $\in$ = is an element of, $\ni$ = such that

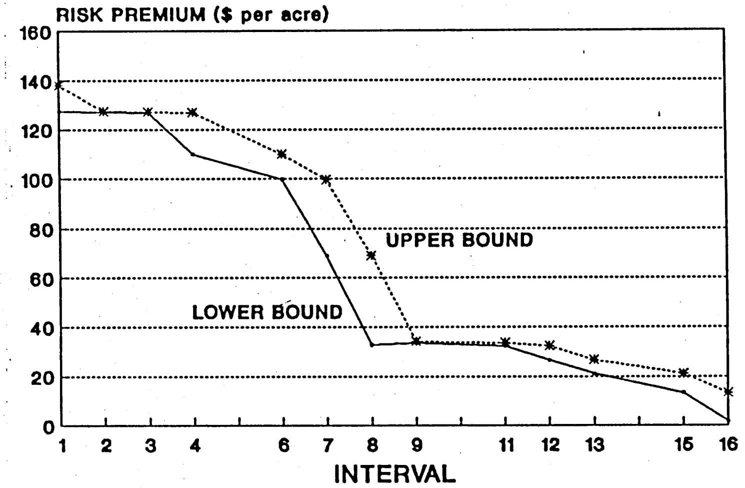
and equations 1 and 2 represent the upper and lower bounds, respectively. Due to the lengthy format used for presenting the risk premiums, they are presented in two appendices at the end of the paper.

The appendices show the risk premiums calculated with both VE40N and HV held dominant. These premiums were generated using whole farm net returns and r-values. They were then divided by the number of acres (415) in a representative farm to reflect per acre values (yielding premiums equivalent to those generated using per acre net returns and r-values). The eighth interval in both sets is the crossover interval where the truly dominant distribution switches from VE40N to HV, hence the reason for negative risk premiums on either side of this interval.

In an attempt to make the risk premiums easier to comprehend and show the degree of dominance cover crop systems possess over conventional systems, Figure 1 presents the risk premiums between the highest ranked cover crop system and the highest ranked conventional system, on an interval by interval basis. Intervals 1 - 6 show the premiums between VE40N and 40N. In interval 7, VE40N still dominates HV, but 40N ceases to dominate 60N, therefore, the premium shown in this interval is between VE40N and 60N. For intervals 8 - 16, HV dominates VE40N and 60N dominates 40N, so the premiums shown are between HV and 60N.

Figure 1 shows that cover crop production systems, either HV or VE40N, are significantly dominant over the entire risk attitude spectrum. For the most risk

Figure 1: Lower and Upper Bounds on the Risk Premium Associated with True Dominance of VE40N or HV, and 40N or 60N.



preferring group of decision makers represented by interval 1, the premiums at the lower (upper) bound are $127.44 ($138.09) per acre. Moving into a more risk neutral area (interval 8), the premiums are reduced to $32.77 at the lower bound and $69.06 for the upper bound. For the most risk averse interval (16), the premiums at the lower bound are $1.76 and $13.23 at the upper bound. Although the risk premiums decline with increasing decision maker risk averseness, they are substantial across the entire risk attitude spectrum.

The decreasing amount of these premiums as the degree of risk aversion increases agrees with the progressively higher rankings shown in Table 3 for these two conventional practices and gives some indication of why conventional practices have been so pervasive in cotton production. This statement is strengthened by the assumption of some degree of risk averseness on the part of many, if not most, agricultural producers. Although the results of this study show that HV is the dominant strategy over the range from mildly risk preferring to extremely risk averse (Intervals 8-16), the decreasing risk premiums indicate that as risk aversion increases, the degree of HV's dominance over conventional practices diminishes considerably.

LIMITATIONS AND CONCLUSIONS:

This paper has presented a GSD evaluation of the relative economic feasibility of using alternative cover crop production systems, and compared them to two conventional practices in cotton production. Results show that, depending on the risk attitude of the decision maker, two cover crop strategies (HV and VE40N) are viable alternatives to conventional practices. Of course, this finding is contingent upon the invariance of the relative prices of the inputs varied between the systems.

A limitation of this study is the timeliness of operations question. This concerns the consideration of additional production risk associated with cover crop production systems, due to the minimum ten-day waiting period between when a cover crop is disked under and when cotton may be planted (Millhollon et. al). This period, especially in the event of a wet planting season, could significantly affect net returns by negatively influencing the number of acres a producer is able to plant. To a lesser extent, adverse affects on the timeliness of operations may also be present during the harvest season because of the increased demands cover crop systems place on a producer's limited stock of equipment, labor, time and managerial skills.

A secondary limitation which could impede the adoption of cover crop systems is they may reduce producer flexibility to plant crops other than cotton. Because the cover crop must be planted in the fall, it forces production decisions to be made over a longer time horizon (with inherently more unknown factors) relative to conventional systems. Should weather or market conditions dictate planting a different crop, there is no guarantee that the benefits of the cover crop (the cost of which must be treated as sunk at this point) will accrue to the alternative crop in the same manner they accrue to cotton.

Incorporation of historical, area specific weather patterns could help negate these limitations. Simulation of the stochastic variables influencing cotton growth, to account for delays in planting dates due to interactions between the weather and the ten-day waiting period may provide additional information. Alternatively, altering the machinery and labor complements in the enterprise budgets associated with cover crops could give some insight into this problem, although it would almost certainly negatively affect cover crop strategies. On the flip side of the coin, additional charges to conventional practices reflecting an estimation of increased soil erosion may make cover crop production practices more attractive.

Table A.1: GSD Risk Premiums with VE40N Dominant.
(Dollars per Acre).

Interval	Distribution	Lower Bound	Upper Bound
1	HV	34.20	41.30
R1 = -.00036156	CHECK	446.94	561.43
R2 = -.00002845	40N	127.44	138.09
	60N	159.34	201.68
	WH60N	159.55	250.96
2	HV	34.04	34.19
R1 = -.00002844	CHECK	446.05	446.89
R2 = -.00002829	40N	127.21	127.42
	60N	158.71	159.30
	WH60N	158.72	159.50
3	HV	33.84	34.03
R1 = -.00002828	CHECK	444.97	445.99
R2 = -.00002810	40N	126.93	127.19
	60N	157.96	158.67
	WH60N	157.73	158.67
4	HV	21.35	33.83
R1 = -.00002809	CHECK	393.49	444.91
R2 = -.00002047	40N	109.92	126.91
	60N	119.25	157.92
	WH60N	109.96	157.68
6	HV	13.62	21.30
R1 = -.00002045	CHECK	369.00	393.34
R2 = -.00001728	40N	99.75	109.86
	60N	99.78	119.13
	WH60N	87.30	109.82

Table A.1 (cont'd): GSD Risk Premiums with VE40N Dominant. (Dollars per Acre).

Interval	Distribution	Lower Bound	Upper Bound
7	HV	0.01	13.60
R1 = -.00001727	CHECK	330.27	368.92
R2 = -.00001189	40N	81.99	99.72
	60N	68.90	99.72
	WH60N	52.25	87.23
8	HV	-24.10	-0.02
R1 = -.00001188	CHECK	237.58	330.20
R2 = .00001865	40N	31.79	81.96
	60N	9.95	68.85
	WH60N	0.59	52.19
9	HV	-24.41	-24.21
R1 = .00001866	CHECK	236.23	237.56
R2 = .00001930	40N	30.85	31.78
	60N	9.16	9.93
	WH60N	8.99	9.19
11	HV	-24.86	-24.41
R1 = .00001932	CHECK	233.10	236.18
R2 = .00002081	40N	28.68	30.83
	60N	7.34	9.14
	WH60N	9.07	9.50
12	HV	-26.60	-24.86
R1 = .00002082	CHECK	220.77	233.08
R2 = .00002700	40N	20.09	28.67
	60N	0.00	7.33
	WH60N	9.18	10.83

Table A.1 (cont'd): GSD Risk Premiums with VE40N Dominant. (Dollars per Acre).

Interval	Distribution	Lower Bound	Upper Bound
13	HV	-28.24	-26.60
R1 = .00002701	CHECK	208.91	220.75
R2 = .00003366	40N	11.86	20.07
	60N	-7.15	-0.01
	WH60N	10.46	12.00
15	HV	-30.66	-28.24
R1 = .00003368	CHECK	191.38	208.88
R2 = .00004618	40N	0.00	11.84
	60N	-17.43	-6.45
	WH60N	11.60	13.94
16	HV	-45.13	-30.66
R1 = .00004619	CHECK	143.83	191.37
R2 = .00036156	40N	-30.33	-0.01
	60N	-44.14	-17.44
	WH60N	11.21	22.97

Table A.2: GSD Risk Premiums with HV Dominant.
(Dollars per acre)

Interval	Distribution	Lower Bound	Upper Bound
1	CHECK	412.74	519.99
R1 = -.00036156	40N	93.08	96.79
R2 = -.00002845	60N	125.14	160.38
	WH60N	125.35	209.65
	VE40N	-41.30	-34.20
2	CHECK	412.00	412.70
R1 = -.00002844	40N	93.17	93.23
R2 = -.00002829	60N	124.67	125.11
	WH60N	124.68	125.31
	VE40N	-34.19	-34.04
3	CHECK	411.13	411.96
R1 = -.00002828	40N	93.08	93.16
R2 = -.00002810	60N	124.12	124.64
	WH60N	123.89	124.64
	VE40N	-34.03	-33.84
4	CHECK	372.14	411.08
R1 = -.00002809	40N	88.53	93.09
R2 = -.00002047	60N	97.90	124.09
	WH60N	88.61	123.84
	VE40N	-33.83	-21.35
6	CHECK	355.38	372.03
R1 = -.00002045	40N	86.10	88.57
R2 = -.00001728	60N	86.16	97.83
	WH60N	73.68	88.52
	VE40N	-21.30	-13.62

Table A.2 (cont'd): GSD Risk Premiums with HV Dominant. (Dollars per Acre).

Interval	Distribution	Lower Bound	Upper Bound
7	CHECK	330.26	355.33
R1 = -.00001727	40N	81.88	86.18
R2 = -.00001189	60N	68.86	86.12
	WH60N	52.23	73.63
	VE40N	-13.60	-0.01
8	CHECK	261.80	330.22
R1 = -.00001188	40N	56.01	82.66
R2 = .00001865	60N	32.77	69.06
	WH60N	19.44	52.26
	VE40N	0.02	24.24
9	CHECK	260.63	261.78
R1 = .00001866	40N	55.26	55.99
R2 = .00001930	60N	33.55	34.17
	WH60N	33.24	33.57
	VE40N	24.22	24.41
11	CHECK	257.95	260.60
R1 = .00001932	40N	53.54	55.24
R2 = .00002081	60N	32.16	33.59
	WH60N	33.54	34.31
	VE40N	24.41	24.86
12	CHECK	247.37	257.94
R1 = .00002082	40N	46.69	53.53
R2 = .00002700	60N	26.55	32.32
	WH60N	34.22	37.26
	VE40N	24.86	26.60

Table A.2 (cont'd): GSD Risk Premiums with HV Dominant. (Dollars per Acre).

Interval	Distribution	Lower Bound	Upper Bound
13	CHECK	237.15	247.35
R1 = .00002701	40N	40.10	46.67
R2 = .00003366	60N	21.08	26.64
	WH60N	37.21	40.09
	VE40N	26.60	28.24
15	CHECK	222.04	237.12
R1 = .00003368	40N	30.66	40.08
R2 = .00004618	60N	13.23	21.09
	WH60N	32.86	44.36
	VE40N	28.24	30.66
16	CHECK	185.84	222.03
R1 = .00004619	40N	9.38	30.66
R2 = .00036156	60N	1.76	13.23
	WH60N	44.37	65.59
	VE40N	30.66	42.67

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