Implications of Rice Variety Selection to Optimize Returns from Crop Insurance

UNIVERSITY OF ARKANSAS
DALE BUMPERS COLLEGE OF AGRICULTURAL, FOOD & LIFE SCIENCES

FARM BUREAU ARKANSAS

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Introduction

- **Goals**
  - Analyze rice crop insurance programs
    - Revenue Protection
    - Yield Protection
  - Does cultivar selection affect crop insurance outcomes?
  - Analyze a new potential crop insurance program for rice producers
    - Milling Revenue Protection

Introduction

- **Motivations for the study:**
  - Arkansas--50% of the United States' rice (2014)
  - 2014 Farm Bill changed risk management for producers
    - The previously favorable programs are gone
    - Crop insurance is the new focus
  - In the Delta, crop insurance is not viewed favorably
  - Crop insurance differences between cultivars
  - Producer price depends on post harvest processing

Rice Marketing

- Rice is milled
  - Paddy yield (rough rice) from field (bu/ac)
  - Milled Rice Yield (%) (MRY)
  - Head Rice Yield (%) (HRY).
  - Broken Rice Yield (%) (BRY)
  - Industry standard: 55% HRY and 70% MRY (55/70)
- Rice producer revenue is a function of milling quality
- Futures prices based on 55/70 milling rate

Producer Revenue Example

- $Revenue = Y_p * P_{adj}$
- $P_{adj} = [P_h + (HRY/100 - 0.55)(P_w) + (BRY/100 - 0.15)(P_b)]$
- P_h (Harvest price) = $13.00/cwt
- HRY = 49%
- MRY = 64%
- BRY= 15%
- P_w = $10.25/cwt
- P_b = $6.18/cwt
- **P_{adj} = $12.39/cwt**

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Crop Insurance

- Little crop insurance protection against adverse milling quality
- Crop insurance parameters:
  - Actual production history (APH)
  - Projected price (January 15-February 14)
  - Harvest price (September 1-September 30)
  - Prices are based on 55/70 milling rate
- Actual producer revenue – crop insurance
  - Paddy yield*harvest price
- Actual realized producer revenue - Gap

Crop Insurance

- **Revenue Protection**
  - Most popular program in Arkansas
  - 45% of Arkansas policies (2014)
- **Yield Protection**
  - Less popular
  - 22% of Arkansas policies (2014)

- Catastrophic coverage (CAT) for most others

Revenue Protection

- **Producer revenue guarantee**
  - Guarantee = APH * Coverage Level * P^{rp}
  - P^{rp} - larger value between projected price and harvest price

- **Producer revenue**
  - Revenue = Y_{adj} * P_h
  - $Y_{adj} = Y_p$ * QAF
  - Quality adjustment factor (QAF) applied when MRY < 68% or HRY < 48%
  - QAF = P_{adj}/P_h
    - QAF must be < 1

- **Indemnity**
  - Guarantee - Revenue

Yield Protection

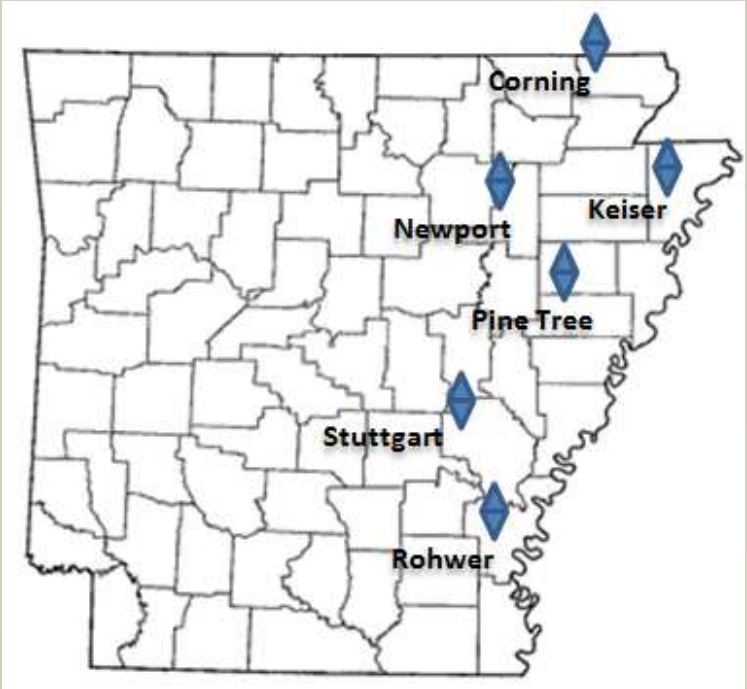
- **Producer revenue guarantee**
  - Guarantee = APH * Coverage Level * P_p
- **Producer revenue**
  - Revenue = Y_{adj} * P_p
  - Y_{adj} = Y_p * QAF
  - Quality adjustment factor (QAF) applied when MRY < 68% or HRY < 48%
  - QAF = P_{adj}/P_h
    - QAF must be < 1
- **Indemnity**
  - Guarantee - Revenue

Milling Revenue Protection (MRP)

- New potential rice revenue protection program
- Similar to traditional revenue protection
- Expands the QAF thresholds
  - HRY < 55
  - MRY < 70
  - Triggers QAF
- MRP
  - Protects producers against adverse milling
  - Eliminates RP gap
- We compare MRP to RP and YP

Our Study

- **Production data**
  - Arkansas Rice Performance Trials (ARPT)
  - Years 2003-2013 (excluding 2011)
  - 6 locations in Arkansas



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Data –Dependent Variables

Cultivar	Variable	n	Mean	Std. Dev.	CV	Minimum	Maximum
Hybrid	Yield (bu/ac)	460	210	51.5	0.24	35	336
	MRY (%)	460	70	3.2	0.05	53	82
	HRY (%)	460	57	8.8	0.15	18	72
Conv	Yield (bu/ac)	2058	176	38.2	0.22	12	325
	MRY (%)	2058	70	3.7	0.05	42	98
	HRY (%)	2058	59	10.1	0.17	7	90

Note: Data does not inlcude 2011 because of insufficient observations

Data – Dependent Variables

Pine Tree

Location	Variety	n	APH (bu/ac)	Yield (bu/ac)	MRY (%)	HRY (%)
Pine Tree	Hybrid	**54**	**206**	**206**	**70**	**57**
	Std. Dev.			*38.2*	*2.5*	*5.7*
	Conventio	**241**	**171**	**172**	**71**	**60**
	Std. Dev.			*30.1*	*3.0*	*6.3*

Note: Data does not inlcude 2011 because of insufficient observations. APH is four-year average of 2009, 2010, 2012, 2013 paddy yield.

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Data

- **Hybrid cultivars**
  - 19% higher yields
  - Higher yield variation
- **Conventional cultivars**
  - HRY 1.8 percentage points higher
  - Higher milling variation
- MRY does not vary by cultivar

Regression Models

- Paddy Yield
- MRY
- HRY

- Two models:
  - Hybrid
  - Conventional

- Weather variables were collected from the aWhere database
  - Temperature
  - Moisture
  - Solar radiation
  - Harvest moisture content

Predicting Yield, HRY, and MRY

- 1000 stochastic simulations
  - Location
  - Cultivar
  - Producer Revenue
- Simulations
  - Yield
  - HRY
  - MRY
  - Harvest price (Black-Scholes)
- 2014 projected price: $0.139/lb.
- Producer revenue and indemnity
  - Estimated for each iteration

Crop Insurance Analysis

- Revenues and indemnities
  - Computed for RP, YP, and MRP
  - Coverage levels: 55%, 70%, and 85%

- Producer paid premiums
  - USDA Cost Estimator
  - Only RP and YP – no MRP

Results – RP vs YP

Revenue Protection

		Producer Premium ($)	Mean Indemnity ($)	Indemnity Frequency (%)	Loss-Cost Ratio
		Coverage Level	Coverage Level	Coverage Level	Coverage Level
Location	**Variety**	**70%**	**70%**	**70%**	**70%**
Pine Tree	Hybrid	19.00	23.55	16.9	1.24
	Conven	17.00	13.45	14.1	0.79

Note: Mean indemnities are estimated over 1000 iterations.

Yield Protection

		Producer Premium ($)	Mean Indemnity ($)	Indemnity Frequency (%)	Loss-Cost Ratio
		Coverage Level	Coverage Level	Coverage Level	Coverage Level
Location	**Variety**	**70%**	**70%**	**70%**	**70%**
Pine Tree	Hybrid	16.00	17.84	13.8	1.12
	Conven	14.00	9.15	11.5	0.65

Note: Mean indemnities are estimated over 1000 iterations.

Results – RP vs YP

Revenue Protection

		Mean Realized Revenue	Mean Indemnity Coverage Level	Mean Total Revenue Coverage Level
Location	**Variety**		**70%**	**70%**
Pine Tree	Hybrid	1,289.97	23.55	1314
	Std. Dev.	*396*	*66*	*368*
	CV	0.31	2.82	0.28
	Conven	1,119.41	13.45	1133
	Std. Dev.	*320*	*42*	*303*
	CV	0.29	3.14	0.27

Note: Mean indemnities and revenues are estimated over 1000 iterations.

Yield Protection

		Mean Realized Revenue	Mean Indemnity Coverage Level	Mean Total Revenue Coverage Level
Location	**Variety**		**70%**	**70%**
Pine Tree	Hybrid	1,289.97	17.84	1308
	Std. Dev.	*396*	*56*	*374*
	CV	0.31	3.12	0.29
	Conven	1,119.41	9.15	1129
	Std. Dev.	*320*	*33*	*308*
	CV	0.29	3.64	0.27

Note: Mean indemnities and revenues are estimated over 1000 iterations.

Results – RP vs YP

- Revenue protection
  - Higher mean indemnities
  - Higher premiums
  - Higher loss-cost ratio (4 of 6 locations)

- Producer risk is lower under RP than YP
  - Smaller standard deviations

Results – RP vs MRP

Revenue Protection

		Mean Indemnity ($) Coverage Level	Indemnity Frequency (%) Coverage Level
Location	**Variety**	**70%**	**70%**
Pine Tree	Hybrid	23.55	16.9
	Conven	13.45	14.1

Note: Mean indemnities are estimated over 1000 iterations.

Milling Revenue Protection

		Mean Indemnity ($) Coverage Level	Indemnity Frequency (%) Coverage Level
Location	**Variety**	**70%**	**70%**
Pine Tree	Hybrid	23.99	17.0
	Conven	13.77	14.6

Note: Mean indemnities are estimated over 1000 iterations.

Results – RP vs MRP

Revenue Protection

Location	Variety	Mean Realized Revenue	Mean Indemnity Coverage Level	Mean Total Revenue Coverage Level
			70%	**70%**
Pine Tree	Hybrid	1,289.97	23.55	1314
	Std. Dev.	*396*	*66*	*368*
	CV	0.31	2.82	0.28
	Conven	1,119.41	13.45	1133
	Std. Dev.	*320*	*42*	*303*
	CV	0.29	3.14	0.27

Note: Mean indemnities and revenues are estimated over 1000 iterations.

Milling Revenue Protection

Location	Variety	Mean Realized Revenue	Mean Indemnity Coverage Level	Total Revenue Coverage Level
			70%	**70%**
Pine Tree	Hybrid	1,289.97	23.99	1314
	Std. Dev.	*396*	*67*	*367*
	CV	0.31	2.80	0.28
	Conven	1,119.41	13.77	1133
	Std. Dev.	*320*	*43*	*302*
	CV	0.29	3.09	0.27

Note: Mean indemnities and revenues are estimated over 1000 iterations.

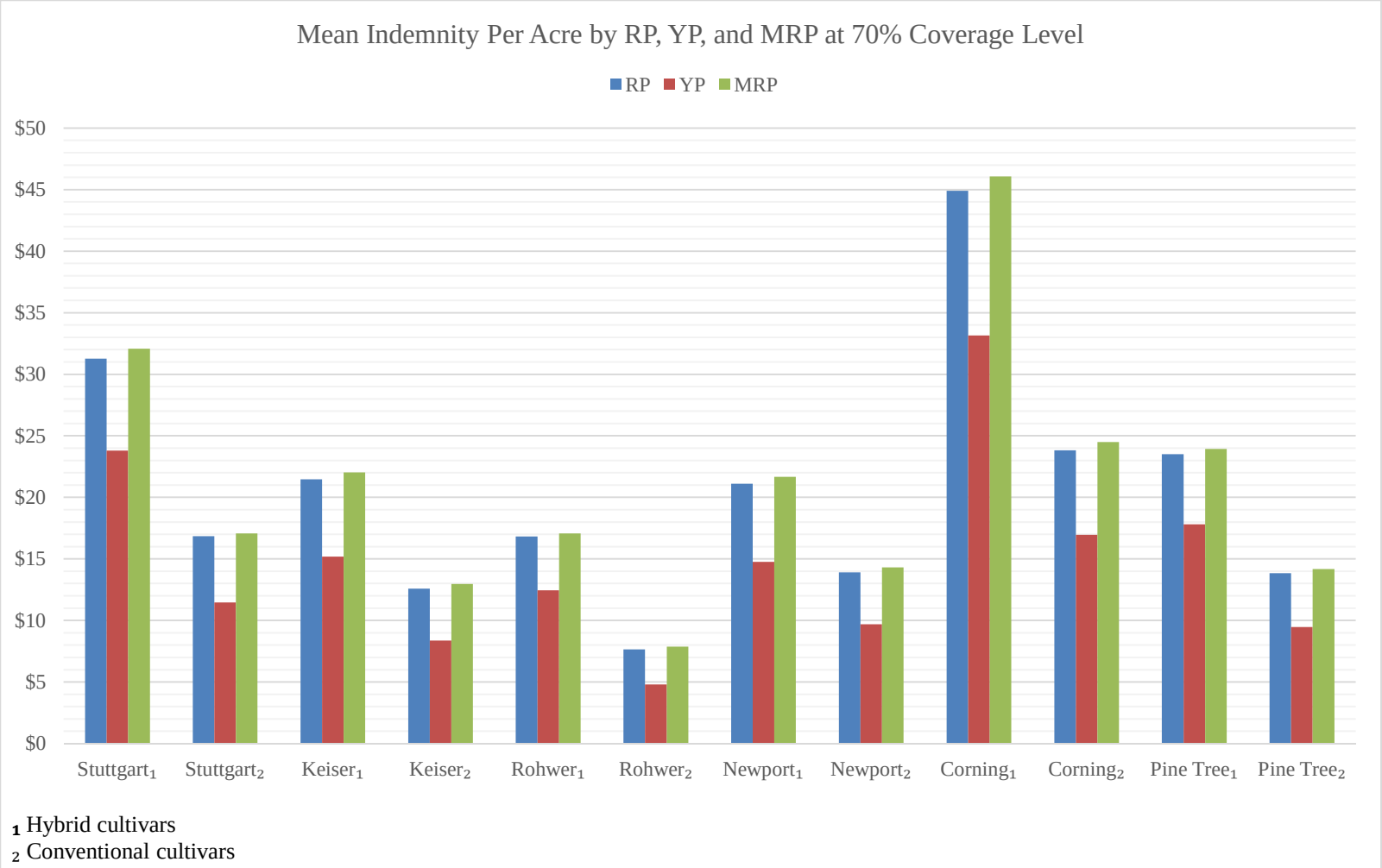
Results – RP vs MRP

- Milling Revenue Protection
  - Higher mean indemnities
  - Higher indemnity frequency
  - Lower revenue variation
  - Not substantially different from RP
  - No loss-cost ratio for MRP

Results - Cultivar Differences

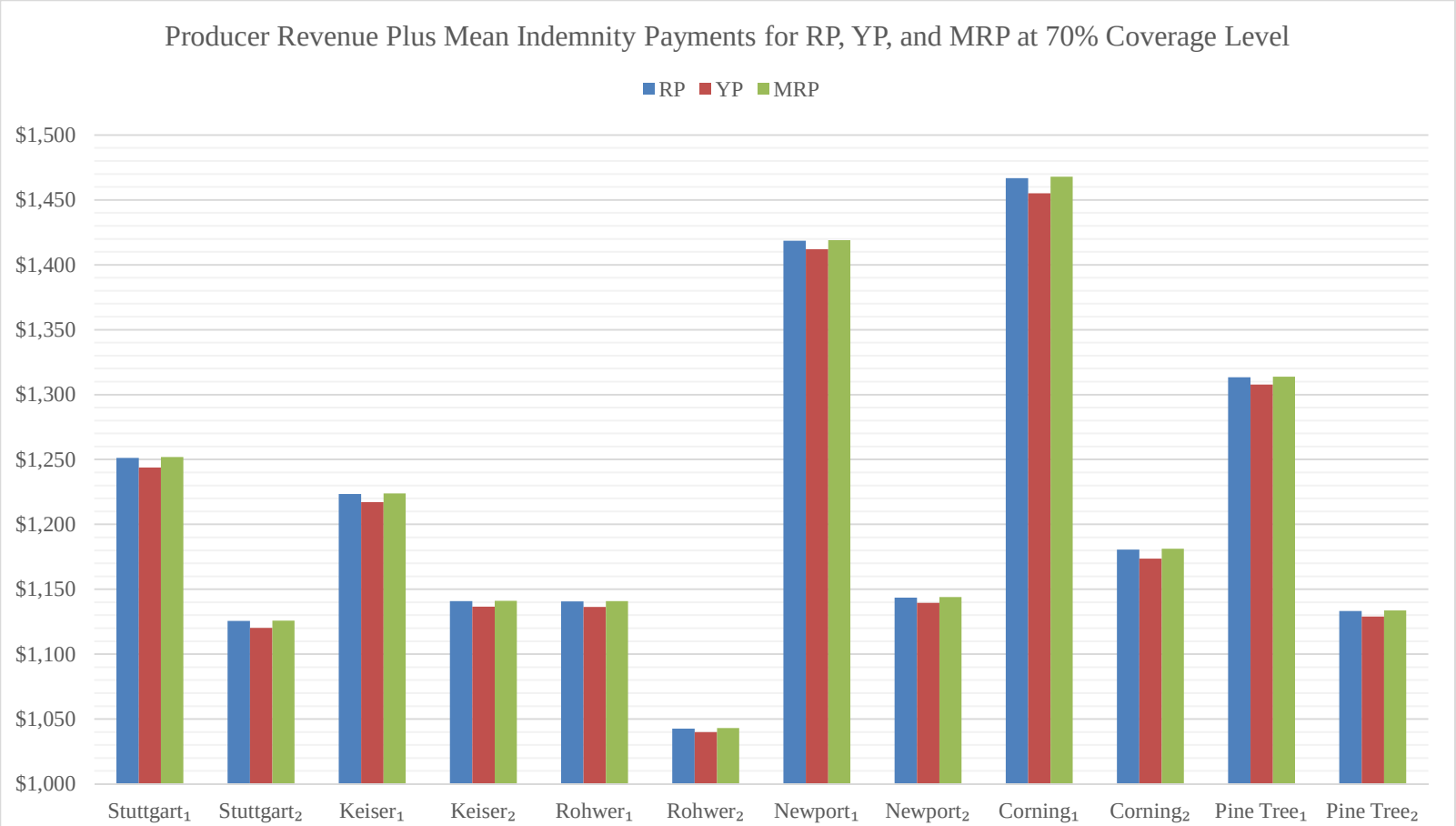
- Hybrids
  - Higher indemnity frequency
  - Higher mean indemnities
- Loss-cost ratios generally favor hybrids
  - Some location and coverage variation for YP
- Producer revenues
  - Hybrids increase revenue potential
  - Hybrids increase indemnity payment potential
  - Hybrids increase premiums
- Revenue variation
  - Hybrids have higher variation (standard deviation)
  - Hybrids have higher relative risk (CV)
- Production costs are not incorporated

Results – Cultivar Differences



1 Hybrid cultivars
2 Conventional cultivars

Results – Cultivar Differences



1 Hybrid cultivars
2 Conventional cultivars

Conclusion

- Revenue Protection more valuable than Yield Protection

- Eliminating milling gap
  - Increases indemnities
  - Reduces revenue variation
  - Marginal differences
- Hybrid cultivars
  - Higher loss-cost ratios for RP, YP

Q & A

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Tables

Table 3: Revenue Protection Mean Indemnities, Frequencies and Returns to Premiums

		Producer Premium ($) Coverage Level			Mean Indemnity ($) Coverage Level			Indemnity Frequency (%) Coverage Level			Loss-Cost Ratio Coverage Level		
Location	**Variety**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	5.00	12.00	37.00	10.24	57.84	161.01	10.4	35.7	59.9	2.05	4.82	4.35
	Conven	5.00	10.00	30.00	2.85	22.74	79.06	4.5	21.2	44.1	0.57	2.27	2.64
Keiser	Hybrid	9.00	18.00	46.00	3.84	27.50	88.82	5.7	20.4	44.0	0.43	1.53	1.93
	Conven	9.00	17.00	44.00	3.38	21.90	77.32	4.6	19.1	43.3	0.38	1.29	1.76
Rohwer	Hybrid	6.00	13.00	40.00	1.48	10.66	35.99	2.3	10.1	23.5	0.25	0.82	0.90
	Conven	6.00	12.00	38.00	0.76	7.33	32.18	1.3	9.0	26.4	0.13	0.61	0.85
Newport	Hybrid	18.00	32.00	71.00	0.90	5.15	26.54	1.0	5.3	20.6	0.05	0.16	0.37
	Conven	17.00	30.00	61.00	0.77	6.14	28.56	1.3	7.3	23.4	0.05	0.20	0.47
Corning	Hybrid	10.00	21.00	53.00	5.12	28.80	93.10	4.5	19.8	40.1	0.51	1.37	1.76
	Conven	10.00	19.00	48.00	5.71	34.76	110.79	6.3	25.2	51.2	0.57	1.83	2.31
Pine Tree	Hybrid	10.00	19.00	51.00	3.34	23.55	80.97	4.3	16.9	40.6	0.33	1.24	1.59
	Conven	9.00	17.00	43.00	1.22	13.45	52.94	2.0	14.1	34.4	0.14	0.79	1.23

Note: Mean indemnities are estimated over 1000 iterations.

Tables

Table 4: Yield Protection Mean Indemnities, Frequencies and Returns to Premiums

		Producer Premium ($) Coverage Level			Mean Indemnity ($) Coverage Level			Indemnity Frequency (%) Coverage Level			Loss-Cost Ratio Coverage Level		
Location	**Variety**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	4.00	9.00	25.00	7.39	45.00	134.59	8.5	30.5	55.5	1.85	5.00	5.38
	Conven	4.00	8.00	21.00	1.72	15.77	62.90	3.3	16.5	39.7	0.43	1.97	3.00
Keiser	Hybrid	8.00	15.00	37.00	2.44	19.89	72.03	3.7	16.9	38.5	0.31	1.33	1.95
	Conven	8.00	14.00	34.00	1.79	15.51	61.16	2.6	15.1	37.9	0.22	1.11	1.80
Rohwer	Hybrid	5.00	10.00	32.00	0.84	7.43	27.85	1.5	8.5	20.4	0.17	0.74	0.87
	Conven	5.00	10.00	30.00	0.34	4.59	22.92	0.9	6.3	21.5	0.07	0.46	0.76
Newport	Hybrid	17.00	29.00	61.00	0.49	3.46	18.73	0.7	3.8	15.4	0.03	0.12	0.31
	Conven	15.00	26.00	53.00	0.24	3.96	20.93	0.6	5.2	19.2	0.02	0.15	0.39
Corning	Hybrid	9.00	17.00	42.00	2.89	20.40	74.52	2.6	15.4	35.3	0.32	1.20	1.77
	Conven	9.00	16.00	37.00	3.66	25.74	90.48	4.6	20.7	46.2	0.41	1.61	2.45
Pine Tree	Hybrid	8.00	16.00	41.00	2.14	17.84	63.89	2.8	13.8	35.1	0.27	1.12	1.56
	Conven	8.00	14.00	34.00	0.68	9.15	40.95	1.2	11.5	29.7	0.08	0.65	1.20

Note: Mean indemnities are estimated over 1000 iterations.

Tables

Table 5: Milling Revenue Protection Mean Indemnities, Frequencies and Returns to Premiums

		Mean Indemnity ($) Coverage Level			Indemnity Frequency (%) Coverage Level		
Location	**Variety**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	10.52	58.78	162.46	10.8	36.0	60.2
	Conven	2.92	23.00	79.38	4.5	21.3	44.3
Keiser	Hybrid	4.13	28.10	89.79	5.8	20.6	38.5
	Conven	3.56	22.35	78.47	4.8	19.3	43.5
Rohwer	Hybrid	1.48	10.77	36.37	2.3	10.3	20.4
	Conven	0.85	7.57	32.62	1.5	9.1	21.5
Newport	Hybrid	0.91	5.29	27.18	1.0	5.5	15.4
	Conven	0.84	6.44	29.16	1.4	7.5	19.2
Corning	Hybrid	5.56	29.87	94.78	4.8	20.0	35.3
	Conven	5.97	35.55	112.31	6.4	25.4	46.2
Pine Tree	Hybrid	3.47	23.99	82.33	4.4	17.0	35.1
	Conven	1.24	13.77	53.54	2.1	14.6	29.7

Note: Mean indemnities are estimated over 1000 iterations.

Tables

Table 6: Realized Producer Revenue by Location and Cultivar Under Revenue Protection ($/ac)

		Mean Realized Revenue	Mean Indemnity Coverage Level			Mean Total Revenue Coverage Level		
Location	**Variety**		**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	1,219.91	10.24	57.84	161.01	1230	1277	1381
	Std. Dev.	*394*	*37*	*103*	*182*	*380*	*338*	*276*
	CV	0.32	3.59	1.79	1.13	0.31	0.26	0.20
	Conven	1,108.78	2.85	22.74	79.06	1112	1132	1188
	Std. Dev.	*322*	*17*	*58*	*119*	*317*	*294*	*248*
	CV	0.29	5.94	2.55	1.51	0.29	0.26	0.21
Keiser	Hybrid	1,201.91	3.84	27.50	88.82	1206	1229	1291
	Std. Dev.	*377*	*21*	*69*	*136*	*371*	*345*	*296*
	CV	0.31	5.52	2.51	1.53	0.31	0.28	0.23
	Conven	1,128.17	3.38	21.90	77.32	1132	1150	1205
	Std. Dev.	*325*	*20*	*60*	*121*	*320*	*298*	*254*
	CV	0.29	5.96	2.76	1.56	0.28	0.26	0.21
Rohwer	Hybrid	1,123.85	1.48	10.66	35.99	1125	1135	1160
	Std. Dev.	*366*	*13*	*40*	*84*	*363*	*351*	*326*
	CV	0.33	8.89	3.77	2.34	0.32	0.31	0.28
	Conven	1,035.07	0.76	7.33	32.18	1036	1042	1067
	Std. Dev.	*315*	*9*	*31*	*71*	*314*	*305*	*281*
	CV	0.30	11.91	4.18	2.21	0.30	0.29	0.26
Newport	Hybrid	1,397.38	0.90	5.15	26.54	1398	1403	1424
	Std. Dev.	*431*	*11*	*31*	*72*	*430*	*423*	*400*
	CV	0.31	11.89	5.99	2.71	0.31	0.30	0.28
	Conven	1,129.73	0.77	6.14	28.56	1131	1136	1158
	Std. Dev.	*331*	*8*	*29*	*70*	*330*	*322*	*299*
	CV	0.29	10.88	4.78	2.44	0.29	0.28	0.26
Corning	Hybrid	1,421.85	5.12	28.80	93.10	1427	1451	1515
	Std. Dev.	*461*	*30*	*79*	*153*	*454*	*427*	*374*
	CV	0.32	5.87	2.75	1.65	0.32	0.29	0.25
	Conven	1,156.65	5.71	34.76	110.79	1162	1191	1267
	Std. Dev.	*334*	*28*	*80*	*149*	*325*	*294*	*239*
	CV	0.29	4.98	2.30	1.34	0.28	0.25	0.19
Pine Tree	Hybrid	1,289.97	3.34	23.55	80.97	1293	1314	1371
	Std. Dev.	*396*	*21*	*66*	*133*	*391*	*368*	*322*
	CV	0.31	6.24	2.82	1.65	0.30	0.28	0.23
	Conven	1,119.41	1.22	13.45	52.94	1121	1133	1172
	Std. Dev.	*320*	*11*	*42*	*96*	*318*	*303*	*266*
	CV	0.29	9.05	3.14	1.82	0.28	0.27	0.23

Note: Mean indemnities and revenues are estimated over 1000 iterations.

Tables

Table 7: Realized Producer Revenue by Location and Cultivar Under Yield Protection ($/ac)

		Mean Realized Revenue	Mean Indemnity Coverage Level			Mean Total Revenue Coverage Level		
Location	**Variety**		**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	1,219.91	7.39	45.00	134.59	1227	1265	1355
	Std. Dev.	*394*	*30*	*91*	*167*	*384*	*349*	*292*
	CV	0.32	4.03	2.02	1.24	0.31	0.28	0.22
	Conven	1,108.78	1.72	15.77	62.90	1111	1125	1172
	Std. Dev.	*322*	*12*	*47*	*104*	*319*	*302*	*262*
	CV	0.29	6.81	2.99	1.65	0.29	0.27	0.22
Keiser	Hybrid	1,201.91	2.44	19.89	72.03	1204	1222	1274
	Std. Dev.	*377*	*16*	*57*	119	*373*	*353*	*309*
	CV	0.31	6.74	2.87	1.65	0.31	0.29	0.24
	Conven	1,128.17	1.79	15.51	61.16	1130	1144	1189
	Std. Dev.	*325*	*14*	*49*	*105*	*322*	*305*	*267*
	CV	0.29	7.77	3.13	1.72	0.29	0.27	0.22
Rohwer	Hybrid	1,123.85	0.84	7.43	27.85	1125	1131	1152
	Std. Dev.	*366*	*9*	*32*	*72*	*364*	*355*	*333*
	CV	0.33	11.18	4.25	2.58	0.32	0.31	0.29
	Conven	1,035.07	0.34	4.59	22.92	1035	1040	1058
	Std. Dev.	*315*	*4*	*23*	*58*	*314*	*308*	*289*
	CV	0.30	12.90	4.91	2.54	0.30	0.30	0.27
Newport	Hybrid	1,397.38	0.49	3.46	18.73	1398	1401	1416
	Std. Dev.	*431*	*7*	*24*	*59*	*430*	*426*	*408*
	CV	0.31	13.63	6.97	3.17	0.31	0.30	0.29
	Conven	1,129.73	0.24	3.96	20.93	1130	1134	1151
	Std. Dev.	*331*	*4*	*22*	*58*	*331*	*325*	*306*
	CV	0.29	16.86	5.56	2.76	0.29	0.29	0.27
Corning	Hybrid	1,421.85	2.89	20.40	74.52	1425	1442	1496
	Std. Dev.	*461*	*21*	*63*	*133*	*457*	*436*	*389*
	CV	0.32	7.38	3.10	1.78	0.32	0.30	0.26
	Conven	1,156.65	3.66	25.74	90.48	1160	1182	1247
	Std. Dev.	*334*	*21*	*66*	*132*	*328*	*303*	*254*
	CV	0.29	5.76	2.58	1.46	0.28	0.26	0.20
Pine Tree	Hybrid	1,289.97	2.14	17.84	63.89	1292	1308	1354
	Std. Dev.	*396*	*16*	*56*	*117*	*393*	*374*	*335*
	CV	0.31	7.57	3.12	1.84	0.30	0.29	0.25
	Conven	1,119.41	0.68	9.15	40.95	1120	1129	1160
	Std. Dev.	*320*	*8*	*33*	*82*	*319*	*308*	*277*
	CV	0.29	11.09	3.64	2.01	0.29	0.27	0.24

Note: Mean indemnities and revenues are estimated over 1000 iterations.

Tables

Table 8: Realized Producer Revenue by Location and Cultivar Under Milling Revenue Protection ($/ac)

		Mean Realized Revenue	Mean Indemnity Coverage Level			Total Revenue Coverage Level		
Location	**Variety**		**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	1,219.91	10.52	58.78	162.46	1230	1279	1382
	Std. Dev.	*394*	*38*	*104*	*183*	*380*	*338*	*275*
	CV	0.32	3.57	1.78	1.13	0.31	0.26	0.20
	Conven	1,108.78	2.92	23.00	79.38	1112	1132	1188
	Std. Dev.	*322*	*17*	*58*	*120*	*317*	*294*	*248*
	CV	0.29	5.84	2.54	1.51	0.29	0.26	0.21
Keiser	Hybrid	1,201.91	4.13	28.10	89.79	1206	1230	1292
	Std. Dev.	*377*	*22*	*70*	*137*	*371*	*344*	*295*
	CV	0.31	5.34	2.50	1.52	0.31	0.28	0.23
	Conven	1,128.17	3.56	22.35	78.47	1132	1151	1207
	Std. Dev.	*325*	*21*	*61*	*122*	*320*	*298*	*253*
	CV	0.29	5.77	2.74	1.55	0.28	0.26	0.21
Rohwer	Hybrid	1,123.85	1.48	10.77	36.37	1125	1135	1160
	Std. Dev.	*366*	*13*	*40*	*85*	*363*	*351*	*325*
	CV	0.33	8.89	3.74	2.32	0.32	0.31	0.28
	Conven	1,035.07	0.85	7.57	32.62	1036	1043	1068
	Std. Dev.	*315*	*9*	*31*	*72*	*313*	*305*	*280*
	CV	0.30	10.91	4.15	2.20	0.30	0.29	0.26
Newport	Hybrid	1,397.38	0.91	5.29	27.18	1398	1403	1425
	Std. Dev.	*431*	*11*	*31*	*73*	*430*	*423*	*400*
	CV	0.31	11.74	5.91	2.68	0.31	0.30	0.28
	Conven	1,129.73	0.84	6.44	29.16	1131	1136	1159
	Std. Dev.	*331*	*9*	*30*	*71*	*330*	*322*	*298*
	CV	0.29	10.63	4.69	2.42	0.29	0.28	0.26
Corning	Hybrid	1,421.85	5.56	29.87	94.78	1427	1452	1517
	Std. Dev.	*461*	*31*	*82*	*156*	*453*	*426*	*373*
	CV	0.32	5.64	2.73	1.64	0.32	0.29	0.25
	Conven	1,156.65	5.97	35.55	112.31	1163	1192	1269
	Std. Dev.	*334*	*29*	*81*	*150*	*325*	*294*	*238*
	CV	0.29	4.91	2.28	1.34	0.28	0.25	0.19
Pine Tree	Hybrid	1,289.97	3.47	23.99	82.33	1293	1314	1372
	Std. Dev.	*396*	*21*	*67*	*134*	*391*	*367*	*321*
	CV	0.31	6.17	2.80	1.63	0.30	0.28	0.23
	Conven	1,119.41	1.24	13.77	53.54	1121	1133	1173
	Std. Dev.	*320*	*11*	*43*	*97*	*318*	*302*	*265*
	CV	0.29	8.93	3.09	1.81	0.28	0.27	0.23

Note: Mean indemnities and revenues are estimated over 1000 iterations.

Mean

Table 3: Revenue Protection Mean Indemnities, Frequencies and Returns to Premiums

		Producer Premium ($) Coverage Level			Average Indemnity ($) Coverage Level			Indemnity Frequency (%) Coverage Level			Loss-Cost Ratio Coverage Level		
Location	**Variety**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	5.00	11.00	33.00	4.34	31.27	103.04	6.8	24.1	48.3	0.87	2.84	3.12
	Conven	4.00	10.00	29.00	1.88	16.84	63.54	3.4	17.4	38.5	0.47	1.68	2.19
Keiser	Hybrid	9.00	17.00	45.00	2.69	21.47	72.95	3.7	17.6	39.0	0.30	1.26	1.62
	Conven	8.00	16.00	41.00	1.72	12.59	49.18	2.7	11.6	33.1	0.22	0.79	1.20
Rohwer	Hybrid	6.00	13.00	41.00	2.68	16.82	52.92	3.7	14.5	31.3	0.45	1.29	1.29
	Conven	6.00	11.00	36.00	0.79	7.64	33.28	1.5	9.5	26.8	0.13	0.69	0.92
Newport	Hybrid	21.00	36.00	84.00	2.80	21.10	79.86	2.4	17.2	37.8	0.13	0.59	0.95
	Conven	17.00	29.00	68.00	1.78	13.91	55.62	2.3	13.7	36.6	0.10	0.48	0.82
Corning	Hybrid	11.00	22.00	57.00	8.22	44.91	132.60	7.0	25.6	49.3	0.75	2.04	2.33
	Conven	9.00	18.00	45.00	3.66	23.82	81.98	4.4	19.4	44.1	0.41	1.32	1.82
Pine Tree	Hybrid	10.00	19.00	51.00	3.33	23.50	80.82	4.2	16.9	40.5	0.33	1.24	1.58
	Conven	8.00	16.00	43.00	1.26	13.85	54.10	2.1	14.4	34.5	0.16	0.87	1.26

Note: Average indemnities are estimated over 1000 iterations.

Mean

Table 4: Yield Protection Mean Indemnities, Frequencies and Returns to Premiums

		Producer Premium ($) Coverage Level			Average Indemnity ($) Coverage Level			Indemnity Frequency (%) Coverage Level			Loss-Cost Ratio Coverage Level		
Location	**Variety**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	4.00	9.00	24.00	2.74	23.79	83.46	5.1	19.0	43.6	1.85	5.00	3.48
	Conven	4.00	7.00	20.00	1.04	11.46	49.55	2.3	12.6	33.7	0.43	1.97	2.48
Keiser	Hybrid	8.00	14.00	35.00	1.66	15.18	58.35	2.6	14.0	34.2	0.31	1.33	1.67
	Conven	7.00	13.00	32.00	0.83	8.37	37.52	1.5	9.3	28.5	0.22	1.11	1.17
Rohwer	Hybrid	6.00	11.00	32.00	1.56	12.44	42.00	2.5	11.7	26.6	0.17	0.74	1.31
	Conven	5.00	9.00	29.00	0.36	4.81	23.79	0.9	6.5	22.1	0.07	0.46	0.82
Newport	Hybrid	19.00	32.00	72.00	1.84	14.75	62.18	1.8	12.7	33.8	0.03	0.12	0.86
	Conven	15.00	25.00	58.00	0.99	9.68	42.66	1.9	10.2	31.3	0.02	0.15	0.74
Corning	Hybrid	10.00	18.00	45.00	4.89	33.16	108.70	4.6	21.2	44.6	0.32	1.20	2.42
	Conven	8.00	14.00	35.00	2.19	16.96	65.34	3.3	15.7	39.0	0.41	1.61	1.87
Pine Tree	Hybrid	8.00	16.00	41.00	2.13	17.80	63.76	2.7	13.8	35.0	0.27	1.12	1.56
	Conven	7.00	13.00	34.00	0.71	9.47	41.93	1.3	11.8	30.0	0.08	0.65	1.23

Note: Average indemnities are estimated over 1000 iterations.

Mean

Table 5: Milling Revenue Protection Mean Indemnities, Frequencies and Returns to Premiums

		Average Indemnity ($) Coverage Level			Indemnity Frequency (%) Coverage Level		
Location	**Variety**	**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	4.52	32.08	104.25	6.8	24.4	48.6
	Conven	1.93	17.07	63.85	3.6	17.4	38.5
Keiser	Hybrid	2.91	22.02	73.84	4.0	17.6	44.2
	Conven	1.83	12.96	50.08	2.9	11.8	43.5
Rohwer	Hybrid	2.68	17.06	53.46	3.7	14.7	31.7
	Conven	0.89	7.88	33.73	1.7	9.6	27.2
Newport	Hybrid	2.88	21.67	80.86	2.4	17.5	38.2
	Conven	1.89	14.32	56.48	2.4	13.9	36.7
Corning	Hybrid	8.88	46.08	134.54	7.6	25.8	49.9
	Conven	3.89	24.49	83.33	4.5	19.8	44.7
Pine Tree	Hybrid	3.46	23.94	82.17	4.3	17.0	40.9
	Conven	1.28	14.18	54.71	2.2	14.9	34.5

Note: Average indemnities are estimated over 1000 iterations.

Mean

Table 6: Realized Producer Revenue by Location and Cultivar Under Revenue Protection ($/ac)

		Mean Realized Revenue	Mean Indemnity Coverage Level			Mean Total Revenue Coverage Level		
Location	**Variety**		**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	1,219.91	4.34	31.27	103.04	1224	1251	1323
	Std. Dev.	*394*	*22*	*73*	*143*	*388*	*360*	*308*
	CV	0.32	5.07	2.33	1.39	0.32	0.29	0.23
	Conven	1,108.78	1.88	16.84	63.54	1126	1126	1172
	Std. Dev.	*322*	*13*	*49*	*105*	*318*	*300*	*259*
	CV	0.29	6.91	2.91	1.65	0.28	0.27	0.22
Keiser	Hybrid	1,201.91	2.69	21.47	72.95	1223	1223	1275
	Std. Dev.	*377*	*17*	*59*	*121*	*373*	*351*	*307*
	CV	0.31	6.32	2.75	1.66	0.30	0.29	0.24
	Conven	1,128.17	1.72	12.59	49.18	1141	1141	1177
	Std. Dev.	*325*	*14*	*44*	*94*	*322*	*308*	*274*
	CV	0.29	8.14	3.49	1.91	0.28	0.27	0.23
Rohwer	Hybrid	1,123.85	2.68	16.82	52.92	1141	1141	1177
	Std. Dev.	*366*	*18*	*53*	*105*	*362*	*344*	*312*
	CV	0.33	6.72	3.15	1.98	0.32	0.30	0.27
	Conven	1,035.07	0.79	7.64	33.28	1043	1043	1068
	Std. Dev.	*315*	*9*	*31*	*72*	*314*	*305*	*280*
	CV	0.30	11.39	4.06	2.16	0.30	0.29	0.26
Newport	Hybrid	1,397.38	2.80	21.10	79.86	1418	1418	1477
	Std. Dev.	*431*	*22*	*64*	*135*	*427*	*406*	*356*
	CV	0.31	7.86	3.03	1.69	0.30	0.29	0.24
	Conven	1,129.73	1.78	13.91	55.62	1144	1144	1185
	Std. Dev.	*331*	*14*	*46*	*100*	*328*	*313*	*276*
	CV	0.29	7.87	3.31	1.80	0.29	0.27	0.23
Corning	Hybrid	1,421.85	8.22	44.91	132.60	1467	1467	1554
	Std. Dev.	*461*	*40*	*102*	*185*	*450*	*412*	*348*
	CV	0.32	4.87	2.27	1.40	0.31	0.28	0.22
	Conven	1,156.65	3.66	23.82	81.98	1160	1180	1239
	Std. Dev.	*334*	*22*	*64*	*127*	*328*	*305*	*258*
	CV	0.29	6.01	2.69	1.55	0.28	0.26	0.21
Pine Tree	Hybrid	1,289.97	3.33	23.50	80.82	1313	1313	1371
	Std. Dev.	*396*	*21*	*66*	*133*	*391*	*368*	*322*
	CV	0.31	6.31	2.81	1.65	0.30	0.28	0.23
	Conven	1,119.41	1.26	13.85	54.10	1133	1133	1174
	Std. Dev.	*320*	*11*	*43*	*98*	*318*	*302*	*265*
	CV	0.29	8.73	3.10	1.81	0.28	0.27	0.23

Note: Average indemnities are estimated over 1000 iterations.

Mean

Table 7: Realized Producer Revenue by Location and Cultivar Under Yield Protection ($/ac)

		Mean Realized Revenue	Mean Indemnity Coverage Level			Mean Total Revenue Coverage Level		
Location	**Variety**		**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	1,219.91	2.74	23.79	83.46	1223	1244	1303
	Std. Dev.	*394*	*17*	*63*	*128*	*390*	*367*	*322*
	CV	0.32	6.20	2.65	1.53	0.32	0.30	0.25
	Conven	1,108.78	1.04	11.46	49.55	1110	1120	1158
	Std. Dev.	*322*	*9*	*39*	*90*	*320*	*307*	*272*
	CV	0.29	8.65	3.40	1.82	0.29	0.27	0.23
Keiser	Hybrid	1,201.91	1.66	15.18	58.35	1204	1217	1260
	Std. Dev.	*377*	*13*	*48*	*105*	*374*	*358*	*319*
	CV	0.31	7.83	3.16	1.80	0.31	0.29	0.25
	Conven	1,128.17	0.83	8.37	37.52	1129	1137	1166
	Std. Dev.	*325*	*9*	*34*	*80*	*324*	*313*	*285*
	CV	0.29	10.84	4.06	2.13	0.29	0.28	0.24
Rohwer	Hybrid	1,123.85	1.56	12.44	42.00	1125	1136	1166
	Std. Dev.	*366*	*13*	*43*	*91*	*363*	*349*	*321*
	CV	0.33	8.33	3.46	2.17	0.32	0.31	0.28
	Conven	1,035.07	0.36	4.81	23.79	1035	1040	1059
	Std. Dev.	*315*	*5*	*23*	*59*	*314*	*308*	*288*
	CV	0.30	13.89	4.78	2.48	0.30	0.30	0.27
Newport	Hybrid	1,397.38	1.84	14.75	62.18	1399	1412	1460
	Std. Dev.	*431*	*17*	*52*	*116*	*428*	*413*	*370*
	CV	0.31	9.24	3.53	1.87	0.31	0.29	0.25
	Conven	1,129.73	0.99	9.68	42.66	1131	1139	1172
	Std. Dev.	*331*	*9*	*37*	*86*	*329*	*318*	*287*
	CV	0.29	9.09	3.82	2.02	0.29	0.28	0.24
Corning	Hybrid	1,421.85	4.89	33.16	108.70	1427	1455	1531
	Std. Dev.	*461*	*29*	*84*	*164*	*454*	*423*	*365*
	CV	0.32	5.93	2.53	1.51	0.32	0.29	0.24
	Conven	1,156.65	2.19	16.96	65.34	1159	1174	1222
	Std. Dev.	*334*	*15*	*52*	*111*	*331*	*312*	*271*
	CV	0.29	6.85	3.07	1.70	0.29	0.27	0.22
Pine Tree	Hybrid	1,289.97	2.13	17.80	63.76	1292	1308	1354
	Std. Dev.	*396*	*16*	*56*	*117*	*393*	*374*	*335*
	CV	0.31	7.51	3.15	1.84	0.30	0.29	0.25
	Conven	1,119.41	0.71	9.47	41.93	1120	1129	1161
	Std. Dev.	*320*	*8*	*34*	*84*	*319*	*308*	*276*
	CV	0.29	11.27	3.59	2.00	0.28	0.27	0.24

Note: Average indemnities are estimated over 1000 iterations.

Mean

Table 8: Realized Producer Revenue by Location and Cultivar Under Milling Revenue Protection ($/ac)

		Mean Realized Revenue	Mean Indemnity Coverage Level			Mean Total Revenue Coverage Level		
Location	**Variety**		**55%**	**70%**	**85%**	**55%**	**70%**	**85%**
Stuttgart	Hybrid	1,219.91	4.52	32.08	104.25	1224	1252	1324
	Std. Dev.	*394*	*22*	*74*	*144*	*388*	*359*	*307*
	CV	0.32	4.87	2.31	1.38	0.32	0.29	0.23
	Conven	1,108.78	1.93	17.07	63.85	1111	1126	1173
	Std. Dev.	*322*	*13*	*49*	*106*	*318*	*300*	*259*
	CV	0.29	6.74	2.87	1.66	0.29	0.27	0.22
Keiser	Hybrid	1,201.91	2.91	22.02	73.84	1205	1224	1276
	Std. Dev.	*377*	*18*	*60*	*122*	*373*	*350*	*306*
	CV	0.31	6.19	2.72	1.65	0.31	0.29	0.24
	Conven	1,128.17	1.83	12.96	50.08	1130	1141	1178
	Std. Dev.	*325*	*14*	*45*	*95*	*322*	*308*	*274*
	CV	0.29	7.65	3.47	1.90	0.28	0.27	0.23
Rohwer	Hybrid	1,123.85	2.68	17.06	53.46	1127	1141	1177
	Std. Dev.	*366*	*18*	*53*	*105*	*362*	*344*	*311*
	CV	0.33	6.72	3.11	1.96	0.32	0.30	0.26
	Conven	1,035.07	0.89	7.88	33.73	1036	1043	1069
	Std. Dev.	*315*	*9*	*32*	*73*	*313*	*304*	*279*
	CV	0.30	10.11	4.06	2.16	0.30	0.29	0.26
Newport	Hybrid	1,397.38	2.88	21.67	80.86	1400	1419	1478
	Std. Dev.	*431*	*23*	*64*	*136*	*427*	*405*	*355*
	CV	0.31	7.99	2.95	1.68	0.30	0.29	0.24
	Conven	1,129.73	1.89	14.32	56.48	1132	1144	1186
	Std. Dev.	*331*	*15*	*47*	*101*	*328*	*313*	*276*
	CV	0.29	7.94	3.28	1.79	0.29	0.27	0.23
Corning	Hybrid	1,421.85	8.88	46.08	134.54	1431	1468	1556
	Std. Dev.	*461*	*42*	*104*	*187*	*449*	*411*	*347*
	CV	0.32	4.73	2.26	1.39	0.31	0.28	0.22
	Conven	1,156.65	3.89	24.49	83.33	1161	1181	1240
	Std. Dev.	*334*	*22*	*66*	*128*	*328*	*304*	*257*
	CV	0.29	5.66	2.69	1.54	0.28	0.26	0.21
Pine Tree	Hybrid	1,289.97	3.46	23.94	82.17	1293	1314	1372
	Std. Dev.	*396*	*21*	*67*	*134*	*391*	*367*	*321*
	CV	0.31	6.07	2.80	1.63	0.30	0.28	0.23
	Conven	1,119.41	1.28	14.18	54.71	1121	1134	1174
	Std. Dev.	*320*	*11*	*43*	*98*	*318*	*302*	*265*
	CV	0.29	8.59	3.03	1.79	0.28	0.27	0.23

Note: Mean indemnities are estimated over 1000 iterations