

**CROP INSURANCE:
REVENUE PRODUCTS AND BEYOND**

**CAS FALL MEETING – SESSION C7
13 NOVEMBER 2006**

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Crop Insurance: Revenue Products and Beyond

CAS Fall Meeting – Session C7

13 November 2006

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Overview

- ◆ Group Risk Plan (GRP)
- ◆ Group Risk Income Protection (GRIP)
- ◆ Whole Farm Concept
 - ◆ Enhancement to RA
 - ◆ Adjusted Gross Revenue (AGR)
 - ◆ Other developments



Group Risk Plan (GRP)

- ◆ Shifts from Individual Producer Yield Experience to County Average Yield.
- ◆ Basic elements
 - ◆ Expected County Yield (RMA promulgates)
 - ◆ Individual Producer Selects Coverage Level (70 – 90%) of county average = “trigger yield”
 - ◆ Producer’s price election: up to 150% of RMA-established price (which remains fixed)
 - ◆ Producer receives indemnity payment if actual county yield is less than the “trigger yield”
- ◆ Equivalent to “put option” on county yield



GRP Indemnity Calculation

- ◆ Selected \$ Protection = expected yield x price election
- ◆ Indemnity =
Max of
0,
[(Trigger yield – county yield)/trigger yield
x selected \$ protection]

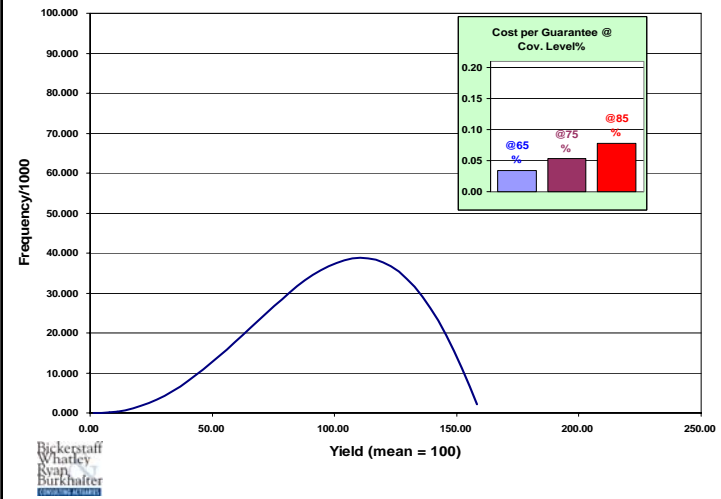


GRP Actuarial Considerations

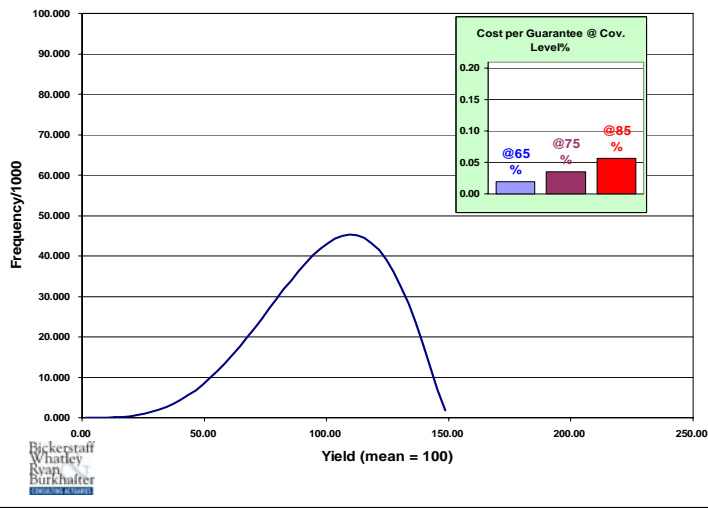
- ◆ Individual Producer Yield History has no impact
- ◆ Expected County Yield based on yield history with provision for trend
- ◆ Fixed price base from RMA (Feb. futures)
- ◆ Rate per selected \$ protection level is function of probability distribution around expected county yield
- ◆ Rate less than APH (county yield CV < farm yield CV)



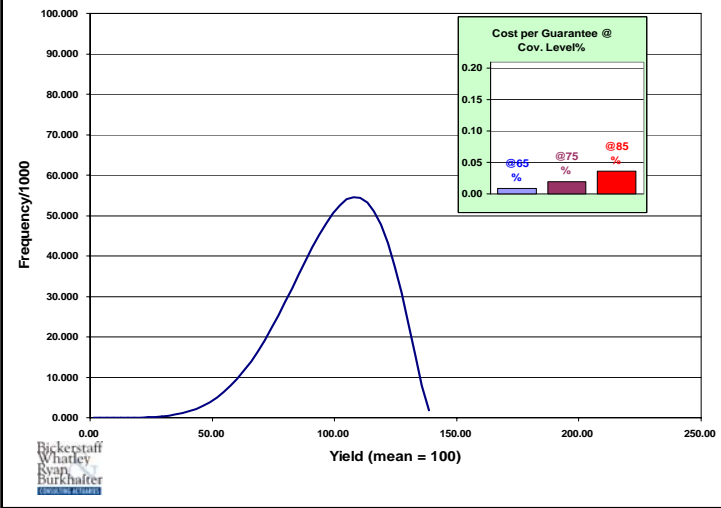
Beta Distribution: Mean = 100, CV = 0.30

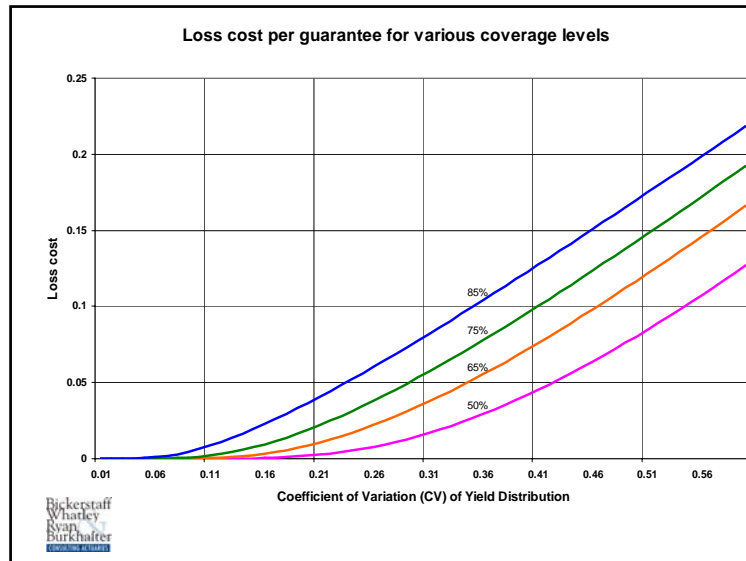


Beta Distribution: Mean = 100, CV = 0.25



Beta Distribution: Mean = 100, CV = 0.20





Group Risk Income Protection (GRIP)

- ◆ Based on County Average Yield AND change from expected price to harvest price.
- ◆ Basic elements
 - ◆ Expected County Yield (RMA promulgates)
 - ◆ Producer's price election: up to 150% of RMA-established expected
 - ◆ Individual Producer Selects Coverage Level (70 – 90%) of county average = "trigger REVENUE" = expected county yield x price election
 - ◆ Producer receives indemnity payment if actual county revenue is less than the "trigger revenue."
- ◆ Equivalent to "put option" on expected county revenue

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GRIP Actuarial Considerations

- ◆ Individual Producer Yield History has no impact
- ◆ Expected County Yield based on yield history with provision for trend (same as GRP)
- ◆ Initial expected price from RMA (Feb. futures)
- ◆ Final harvest price established 6 mo. after harvest
- ◆ Rate per selected \$ protection level is function of probability distribution around expected county yield AND probability distribution around price (volatility factor in option pricing model)
- ◆ Yield/price correlation a significant factor

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Group Risk Income Protection Harvest Revenue Option (GRIP/HRO)

Same as GRIP but the revenue guarantee is adjusted up to the harvest price, if harvest price is higher than the initial expected price.

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**Comparison of GRP, GRIP, and GRIP/HRO Coverages
Using a Specific Price and Yield Scenario**

		GRP	GRIP	GRIP/HRO
(a) expected county yield		47.7	47.7	47.7
(b) GRP price		2.80		
(c) GRP selected factor		1.50	1.50	1.50
(d) GRP elected price	(b) * (c)	4.20		
(e) coverage level		0.90	0.90	0.90
(f) trigger yield	(a) * (e)	42.93		
(g) Base price			2.80	2.80
(h) Expected county revenue	(a) * (g)		133.56	133.56
(i) trigger revenue	(e) * (h) (e) * (f)		120.20	141.67
(j) Max protection	(a) * (d) (c) * (h)	200.34	200.34	200.34
(k) current year yield		34.9	34.9	34.9
(m) harvest price			3.30	3.30
(n) current year county revenue	(k) * (m)		115.17	115.17
(p) indemnity factor	[(f) - (k)]/(f) [(i) - (n)]/(i)	0.1870	0.0419	0.1870
(q) HRO factor	max{(m)/(g), 1}			1.179
(r) final county revenue	(a) * max{(g),(m)}			157.41
(s) indemnity/acre	(j) * (p) (i) * (p) * (q)	37.47	8.39	44.17

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GRP/GRIP Advantages & Disadvantages

- ◆ **Advantages**
 - ◆ Generally lower rates than APH
 - ◆ Simple, less paper work
 - ◆ Moral hazard virtually eliminated
- ◆ **Disadvantages**
 - ◆ Individual producer may suffer loss which is not indemnified
 - ◆ May not be suitable for producers whose yields do not correlate with county average

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Whole Farm Concepts

- ◆ Producer aggregates all his crops into one collective guarantee and is indemnified based on the collective production of all crops combined
- ◆ Can be yield coverage only (APH) with RMA-established prices fixed or can include a revenue component (harvest price option)

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Whole Farm Concepts

Whole Farm Aggregate Guarantee =

$$\text{Cov.Level\%} * \sum_{i=1}^N [\text{APH}_i * \text{RMA Price}_i * \text{Acres}_i]$$

For crops 1 through N

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Whole Farm Actuarial Considerations

- ◆ Yield means and CV by crop (implied by underlying APH loss cost)
- ◆ Correlation matrix of crop yields on farm level
- ◆ Expected prices and volatility factors (from options model)
- ◆ Correlation matrix of prices between crops
- ◆ Price-yield correlations
- ◆ Relative acreage between crops in the farm in question



Whole Farm Actuarial Considerations

- ◆ “Diversification” credit
 - ◆ Aggregate loss cost of all crops combined is less than sum of separate loss costs
 - ◆ Magnitude of credit depends on
 - Crops included and their yield and price correlations
 - Relative proportions of crops on the farm in question
 - Coverage level chosen
- ◆ Individual grower rate adjustments (up or down) can be extended to Whole Farm as well



Whole Farm: Current Products Available

- ◆ Revenue Assurance (RA): whole farm option
- ◆ Adjusted Gross Revenue (AGR)
 - ◆ Insures revenue of entire farm by guaranteeing % of avg. gross farm revenue
 - ◆ Uses Schedule F from tax return
 - ◆ May include livestock revenue as well



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