Recap of U.S. Crop Insurance Industry Gains and Losses for the 2015 Crop Year

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AIR Agricultural Model Applications

- Enterprise Risk Management
- Pricing & Actuarial
- Underwriting
- Fund Designation
- Claims
- Risk Transfer

AIR Agricultural Model for Crop Insurance and Reinsurance
### Weather Modeling is Key for Agricultural Risk Management

<table>
<thead>
<tr>
<th>Peril</th>
<th>% Crop Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought &amp; Heat</td>
<td>37%</td>
</tr>
<tr>
<td>Excess Moisture</td>
<td>33%</td>
</tr>
<tr>
<td>Hail</td>
<td>13%</td>
</tr>
<tr>
<td>Cold, Frost &amp; Freeze</td>
<td>5%</td>
</tr>
<tr>
<td>Wind &amp; Hurricane</td>
<td>4%</td>
</tr>
<tr>
<td>Flood</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Subtotal – Directly related to weather</strong></td>
<td><strong>93%</strong></td>
</tr>
<tr>
<td>Disease</td>
<td>5%</td>
</tr>
<tr>
<td>Insects &amp; Wildlife</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Subtotal – Other perils</strong></td>
<td><strong>7%</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
AIR’s Multiple Peril Crop Insurance Models are Built from the Ground Up

**HAZARD**
- AWITM WEATHER RISK
- COMMODITY PRICE RISK
- STOCHASTIC CATALOG
- TEMPERATURE
- CROP REQUIREMENTS
- SOIL
- PRECIPITATION
- HISTORICAL YIELDS/DAMAGE
- HISTORICAL PRICES
- CROP EXPOSURE DATA

**DAMAGE ESTIMATION**
- CROP DAMAGE/YIELD ESTIMATION
- CROP INSURANCE PROGRAM
- POLICY CONDITIONS

**FINANCIAL**
- INSURED LOSS CALCULATION
- GOVERNMENT REINSURANCE
- PRIVATE REINSURANCE
Low Volatility Catalog Reflects Price Uncertainty Similar to Historical Price Experience

- Modeled - Low Price Volatility
- Historical (1974-2012)
- 2008
- 2010
- 2012
- 2014
- 2015
Medium Volatility Catalog Reflects Increased Uncertainty of Harvest Price Compared to Planting Price
High Volatility Catalog Reflects Large Uncertainty in Harvest Price As Experienced From 2008-2011

- Modeled - High Price Volatility
- Historical (1974-2012)
- 2008
- 2010
- 2012
- 2014
- 2015
Which Catalog Should We Use?

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog to Use</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Volatility

Corn

- Year: 2005 to 2016
- Catalog to Use: Low, Low, Medium, High, High, High, Low, Low, Low, Low
- Volatility: 0 to 0.4
Return Period of Important Historical Droughts For Industry

- Average (Median) = 2 years
- 10 yr (10%) = 1974
- 20 yr (5%) = 2012
- 50 yr (2%) = 1988
- 100 yr (1%) = 1988
- 500 yr (0.2%) = 1988
# RMA Summary of Business Report - March 2015

## Federal Crop Insurance Corp
Summary of Business Report for 2013 thru 2016
As of March 7, 2016

*(Net Acre and Dollars in Thousands)*

<table>
<thead>
<tr>
<th></th>
<th>2013 Crop Year To Date</th>
<th>2014 Crop Year To Date</th>
<th>2015 Crop Year To Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies with Premium</td>
<td>1,224,158</td>
<td>1,207,091</td>
<td>1,202,568</td>
</tr>
<tr>
<td>Units with Premium</td>
<td>3,580,774</td>
<td>3,577,048</td>
<td>3,623,107</td>
</tr>
<tr>
<td>Net Acres Insured</td>
<td>296,087</td>
<td>294,705</td>
<td>284,921</td>
</tr>
<tr>
<td>Liability</td>
<td>123,768,859</td>
<td>109,867,098</td>
<td>102,082,627</td>
</tr>
<tr>
<td>Total Premium</td>
<td>11,805,053</td>
<td>10,069,380</td>
<td>9,693,621</td>
</tr>
<tr>
<td>Subsidy</td>
<td>7,295,011</td>
<td>6,212,793</td>
<td>6,044,602</td>
</tr>
<tr>
<td>Indemnity</td>
<td>12,076,344</td>
<td>9,121,728</td>
<td>5,798,642</td>
</tr>
<tr>
<td>Loss Ratio</td>
<td>1.02</td>
<td>0.91</td>
<td>0.60</td>
</tr>
</tbody>
</table>
RMA Rate Changes from 2015 to 2016
2015 Breakdown of Industry Liability and Premium Reveals Overall Crop Risk by State

Total Industry Liability: $102.08 B
Total Industry Premium: $9.71 B

Percent of Industry Total Liability or Premium

LIABILITY
PREMIUM

IA IL CA MN NE ND IN SD KS TX OH FL MO WA WI MI NC AR KY GA All Other
Revenue Products with Coverage Levels 75% and Greater Are the Majority of Industry Premium in 2015

By Insurance Plan

- RP & RPHPE: 71%
- APH: 14%
- YP: 6%
- All Other Plans: 6%
- Area Products: 3%
- SCO & STAX: 0.4%

By Coverage Level

- CL 75: 25%
- CL 80: 20%
- CL 85: 18%
- CL 90: 3%
- CL 50: 10%
- CL 65: 5%
- CL 55: 3%
- CL 60: 1%

Area Products: 3%
Rate Study Performed on Top Five Crops Covers More than 80% of Total Industry Premium

Analyzed Crops 82% of Industry Premium
Keeping Liabilities, Prices, and Volatility Constant Allows Pure Rate Change Analysis

Methodology:

- Five major crops → corn, soybeans, wheat, cotton, grain sorghum
- Hypothetical industry book of business → All insurance policies that were written in 2015
- Constant “price” and “volatility” → Focus on pure change in “premium rates”
- Assumptions were made about “type,” “practice,” “unit structure,” and “insurance option” to build the industry book → The actual result for a specific company could be different
- “Unit structure” and “insurance option” → assumed based on available historical experience
Premium Rate Change by State, from 2015 to 2016, Reveals Geographic Pattern
Premium Rate Change by State, from 2015 to 2016, Reveals Crop Specific Pattern

Change in Premium Rate (%)

-8 -6 -4 -2 0 2 4 6 8 10 12 14

Corn Soybeans Wheat All Five Crops

IA IL MN NE IN KS SD ND TX OH US

Crop Specific Pattern

Corn Soybeans Wheat All Five Crops

IA IL MN NE IN KS SD ND TX OH US
Premium Rate Change for Revenue Policies Is Most Significant and Is Associated with a Large Liability
Premium Rates Have Mostly Decreased for Area Products and Increased for Farm-level Products

Change in Premium Rate (%)

<table>
<thead>
<tr>
<th>Category</th>
<th>Product</th>
<th>Area-level</th>
<th>Farm-level</th>
<th>SCO</th>
<th>STAX</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corn</td>
<td>-10</td>
<td>-5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soybeans</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td>-5</td>
<td>-15</td>
<td>-20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cotton</td>
<td>-15</td>
<td>-10</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sorghum</td>
<td>-15</td>
<td>10</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>
Premium Rates Increase by Coverage Level, but Not for All Crops
Rate Change Has a Minor Impact on the Post-SRA Exceedance Probability Curve
Other External Factors Affect the Change in Final Premium Rates

- Price volatility

- Change in producers’ choice of coverage level

- TA and YE options → higher “effective” coverage levels

- Unit structure → EU vs. OU/BU

- Crop rotation and varying acreage over time
Premium Rates for Corn Decrease with Reduced Price Volatility

Change in Premium Rate (%)

-12 -10 -8 -6 -4 -2 0 2 4 6 8 10

IA IL MN NE IN KS SD ND TX OH US

Constant Volatility (0.21)

Volatility = 0.17
Premium Rates for Soybeans Decrease with Reduced Price Volatility

Change in Premium Rate (%)

Soybeans

- Constant Volatility (0.16)
- Volatility = 0.12
Current Research on Managing Risk in the 2016 Crop Year
CropAlert® Growing Conditions Report

- Monthly publication from June to October
- AIR Baseline Yield Projections
- Forecasting adjustments from changing yield and price risks
- Program and Policy Analysis pieces
AWI (Agricultural Weather Index™) Is a Measure of Yield Variability Due To Weather

Daily Temperature

Daily Precipitation

County-Specific AWI Index

Crop Specific Data

Available Water Capacity
In a Normal Year, Water Supply and Water Requirements Are Balanced and AWI Indicates Positive Yield Outcome
In a Normal Year, Water Supply and Water Requirements Are Balanced and AWI Indicates Positive Yield Outcome
In a Drought Year, Water Requirements Exceed the Water Supply and AWI Indicates Plant Damage
AWI Measures County-level Crop Performance During the Season

Seasonal Index: Plymouth County, Iowa

AWI vs Calendar Days
AWI Measures County-level Crop Performance During the Season

Seasonal Index: Plymouth County, Iowa

Calendar Days

AWI
2015 CropAlert Corn Yields Were Based On Current Growing Conditions Up To The Month Of Release

<table>
<thead>
<tr>
<th>State</th>
<th>State Yield Projection*</th>
<th>AIR 11-Sep-15</th>
<th>NASS Yield Forecast:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>188.8</td>
<td>181</td>
<td>183</td>
</tr>
<tr>
<td>IL</td>
<td>177.8</td>
<td>173</td>
<td>170</td>
</tr>
<tr>
<td>MN</td>
<td>182.3</td>
<td>183</td>
<td>184</td>
</tr>
<tr>
<td>IN</td>
<td>164</td>
<td>156</td>
<td>156</td>
</tr>
<tr>
<td>OH</td>
<td>167.8</td>
<td>163</td>
<td>165</td>
</tr>
<tr>
<td>MO</td>
<td>157.3</td>
<td>150</td>
<td>149</td>
</tr>
<tr>
<td>WI</td>
<td>169.8</td>
<td>162</td>
<td>164</td>
</tr>
<tr>
<td>NE</td>
<td>186.1</td>
<td>184</td>
<td>184</td>
</tr>
<tr>
<td>US</td>
<td>170.5</td>
<td>167.5</td>
<td>168</td>
</tr>
</tbody>
</table>

* Current Projection: Yield predictions based on observed crop growing conditions to current date.

Disclaimer: Predicting weather and growing conditions is an inherently subjective and imprecise process, involving assessment of information that comes from a number of sources and that may not be complete or accurate. AIR makes no warranty, express or implied, with respect to the information in this report, including any warranty of merchantability or fitness for a particular purpose or use. Past performance is not necessarily indicative of future performance. Readers use the information at their own risk.
Next Evolution of CropAlert Examines the Impacts of Current Weather Events at the County Level
County Estimates are Useful for Insurers with Concentrated Policy Locations, While National Estimates are Useful to Describe Price Movements

<table>
<thead>
<tr>
<th>NATIONAL YIELDS</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Feb, 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Yield</td>
<td>162.2</td>
<td>160.7</td>
<td>166</td>
<td>168.8</td>
<td>170.5</td>
<td></td>
</tr>
<tr>
<td>Final 2015 Yields</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>168.4</td>
</tr>
</tbody>
</table>
2015 Commodity Futures Curves Can Be Used to Build Expectations Over National Prices

Futures Data collected from Barchart.com

**CBOT Corn Futures**

- July (ZCN15)
- September (ZCU15)
- December (ZCZ15)

<table>
<thead>
<tr>
<th>Month</th>
<th>CBOT Corn Futures</th>
<th>Ratio of Futures Last Price to Planting Price of $4.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 20</td>
<td></td>
<td>89%</td>
</tr>
<tr>
<td>July 11</td>
<td></td>
<td>92%</td>
</tr>
<tr>
<td>August 8</td>
<td></td>
<td>92%</td>
</tr>
<tr>
<td>September 12</td>
<td></td>
<td>93%</td>
</tr>
<tr>
<td>October 10</td>
<td></td>
<td>92%</td>
</tr>
<tr>
<td>October 10</td>
<td></td>
<td>89%</td>
</tr>
</tbody>
</table>
AIR Stochastic Catalog for Corn with CropAlert National Yield and Price Outcomes Can be Used to Reasonable Expectations Over Outcomes

![Scatter plot showing the relationship between harvest price and event yield. The plot includes data points representing historical (1974-2012) and modeled scenarios for low price volatility. The x-axis represents event yield (percent of normal), and the y-axis represents harvest price (percent of planting price). The plot includes data points for different months: June, July, August, September, and October, with special emphasis on the data from October 2015.](image-url)
A Portion of The Price-Yield Cloud Is Selected for Sensitivity Tests
Example: Price Cap & Yield Band

Price < 70%
97.5% < Yield < 102.5%
A Portion of The Price-Yield Cloud Is Selected for Sensitivity Tests

Example: Price Band & Yield Band

- 65% < Price < 75%
- 97.5% < Yield < 102.5%
We Can Utilize AIR’s Different Catalogs To Run What-if Analysis in Different Price Volatility Environments

Low Volatility Catalog

High Volatility Catalog
CATRADER is designed to facilitate price and yield sensitivity analysis.

Scenario 1
- Price Corn $\leq 70$
- Price Soybean $\leq 80$
CATRADER is designed to facilitate price and yield sensitivity analysis.

**Scenario 1**
- Price Corn ≤ 70
- Price Soybean ≤ 80
CATRADER Is Designed To Facilitate Price and Yield Sensitivity Analysis

Scenario 1
Price Corn ≤70
Price Soybean ≤80
Normal Yield Coupled with Reduced Price Could Cause High Loss Ratios, Especially in High Price Volatility Environment

### Low Volatility Catalog

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Average Loss Ratio</th>
<th>Minimum LR</th>
<th>Maximum LR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenario 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price Corn</td>
<td>65-75</td>
<td>87%</td>
<td>65%</td>
</tr>
<tr>
<td>Price Soybean</td>
<td>75-85</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scenario 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price Corn</td>
<td>65-75</td>
<td>105%</td>
<td>94%</td>
</tr>
<tr>
<td>Price Soybean</td>
<td>75-85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield Corn</td>
<td>97.5-102.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield Soybean</td>
<td>97.5-102.5</td>
<td></td>
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</tbody>
</table>

### High Volatility Catalog

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<th>Average Loss Ratio</th>
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<td><strong>Scenario 4</strong></td>
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<td></td>
</tr>
<tr>
<td>Yield Soybean</td>
<td>97.5-102.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary of 2015 and Future Research for 2016

- The Industry performed well in 2015
- Premium rerating was favorable for rate increases, but overall premium in 2016 will be lower due to low price volatilities
- Insurers looking to manage risks may benefit from county level forecasting during the growing season
- Using commodity futures along with CropAlert national yields we can subdivide the AIR Stochastic Catalog to understand price and yield risks over the growing season