Yield Indexing As a Way to Calculate Approved Yields

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University Conducted Study

1. **Compared the current method of calculating approved yields with an alternative method referred to as *yield indexing*.**
2. **The two statistical criteria used were *bias* and *efficiency*. It is desirable to have an unbiased, efficient predictor of approved yield.**

Current Method for Calculating Approved Yield

- The simple average currently used by RMA to compute approved yields is based on four to ten years of producer-supplied production history.
- Under certain conditions various proportions of transition yields can be used in lieu of or to replace certain producer-supplied production history.

Figure 1
United States Wheat Yields
1919-2002

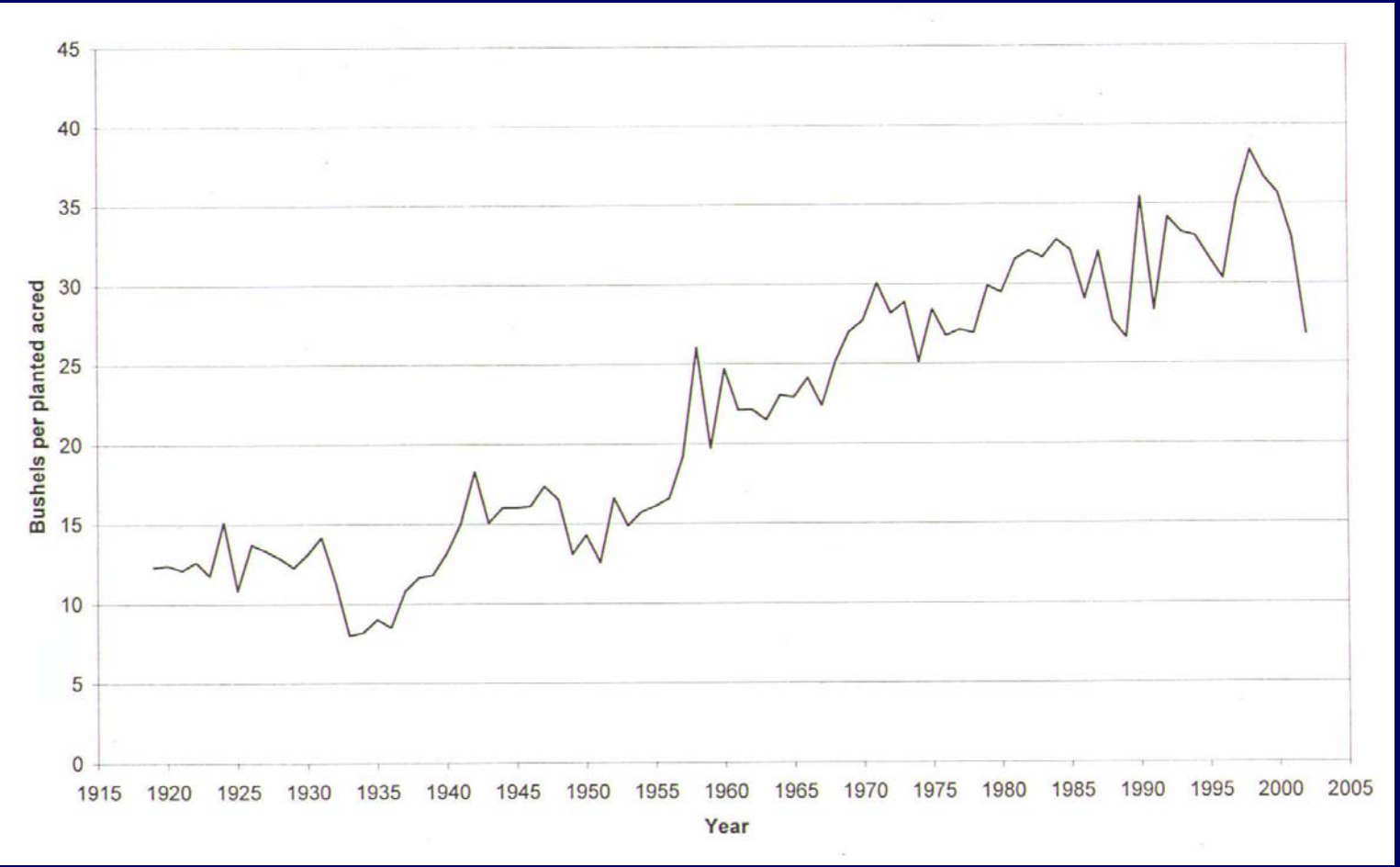
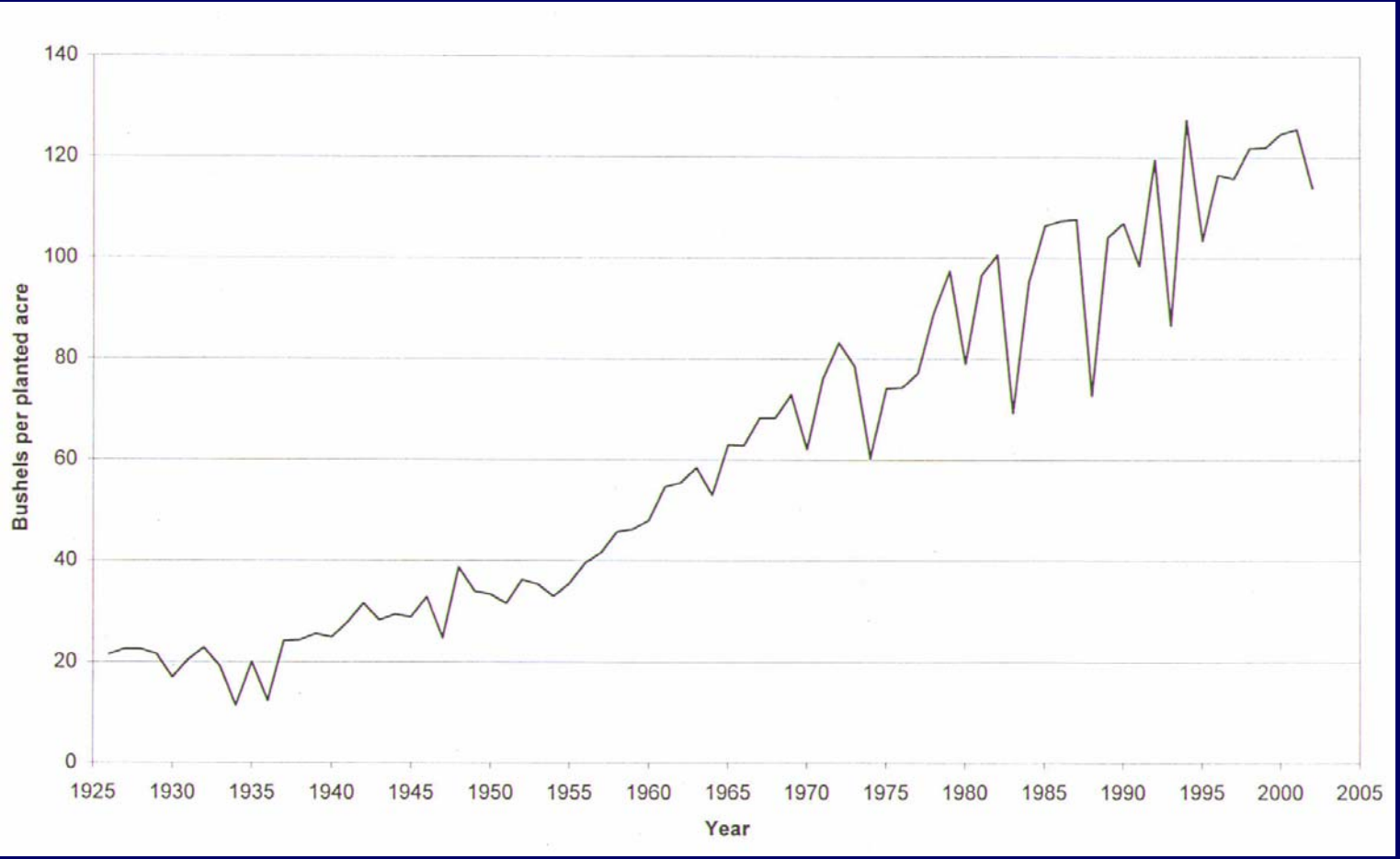


Figure 2
United States Corn Yields
1919-2002



Observations from Historical Yields

- **U.S. corn and wheat yields, as just shown, illustrate persistent yield increases.**
- **If yields over some period are averaged and used as the *approved yield*, generally the *approved yield* will be less than the *future yield* (the expected actual yield). In this case, the *approved yield* is a *biased* predictor of *future yield*.**

Observations from Historical Yields, cont.

- This method is biased because it consistently (but not necessarily always) would provide an underestimate of the expected value, the *future yield.*
- This method is relatively *inefficient* because the calculation of an average of only four to ten years results in an *approved yield* with substantial variability.

An Indexed Yield

- **The proposed alternative to a simple average method is to estimate an *approved yield* that would use long-term regional data (sometimes up to 80 years) from the USDA's National Agricultural Statistics Service (NASS) along with actual production history that is producer-provided to develop an *indexed yield.***

Basic Indexed Yield Producers

- The *indexed yield* calculation begins by statistically estimating a trend line from the long-term regional data series and then forecasting the *expected regional yield* for the year of the insurance contract.
- Then using from four to ten years of farm (producer supplied) data and regional data for the corresponding four to ten years, both farm and regional average yields are calculated.

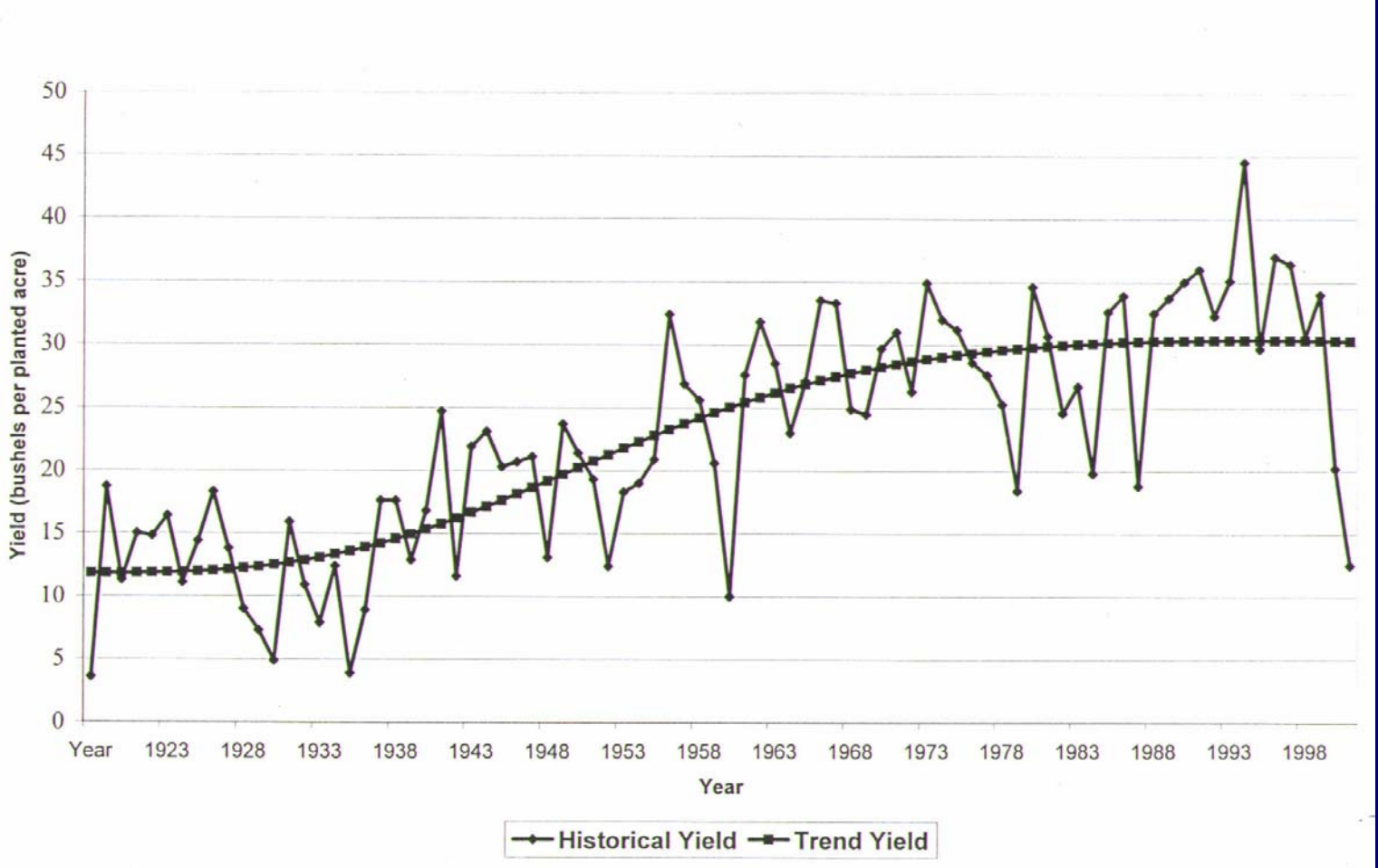
Basic Indexed Yield Producers, cont.

- **Finally, a difference between the farm and regional averages is added (subtracted) to (from) the expected regional yield generating the *indexed yield.***

The Indexed Yield Equation

- **Indexed Yield = Expected Regional Yield + (Farm Yield - Regional Yield)**

Figure 3
Historical Big Horn County Wheat Yields (Bushels Per Planted Acre)



The Fitted Trend Line

$$\hat{y} = 11.953 + \frac{19.311t^{3.7605}}{110.71 + t^{3.7605}}$$

$$\hat{y}_{2003} = 30.6$$

Big Horn County Wheat & Farm County Yield Data

Year	Regional Yield	Farm Yield (Hypothetical
1993	32.3	40.1
1994	35.9	41.1
1995	43.5	42.9
1996	29.7	33.0
1997	37.0	37.2
1998	36.4	44.0
1999	30.6	34.9
2000	34.0	32.4
2001	20.2	21.7
2002	12.5	10.2

APH For the Example Farm Calculated as a Simple Average And an Indexed Yield

Number of Years	Regional Average Yield	Simple Average Yield (farm)	Indexed Yield (Farm)
4	24.3	24.8	31.1
6			
8			
10			

Calculation of Table Entries When There are Four Years of Producer-Supplied Production Data

- **Regional Yield** = 30.6 + 34.0 + 20.2 + 12.5 = 97.3 ÷ 4 = 24.3
- **Farm Average Yield** = 34.9 + 32.4 + 21.7 + 10.2 = 99.2 ÷ 4 = 24.8
- **Indexed Yield =** Expected Regional Yield + (Farm Average Yield – Regional Average Yield)
  = 30.6 + (24.8 – 24.3)
  = 30.6 + 0.5
  = 31.1

Big Horn County Approved Wheat Yields Calculated by a Simple Farm Average and Indexed Yield

Number of Years*	Regional Average	Farm Average	Indexed Yield
4	24.3	24.8	31.1
6	28.5	30.1	32.2
8	30.5	32.0	32.1
10	31.2	33.8	33.2

*** Most Recent Years**

Summary

1. Yield indexing provides less biased and more efficient estimates of APH yields than simple averaging of four to ten years of producer-supplied yields.
2. Yield indexing is under consideration for specifying APH yields.
    a. Additional functional forms are under consideration for the fitting of the regional trend lines.
    b. Producer yield adjustments to regional yields may be improved by using multiplicative procedures where the regional expected yield is multiplied by a ratio of the farm and regional average yields.

Summary, cont.

3. Producers with yields not correlated with the regional (county) yields would likely not benefit from yield indexing.
4. Current procedures that allow yield *plugs* continue to receive scrutiny.