A Preliminary Review of Multidecadal Corn Productivity in Iowa at the County Level

Guillermo Marcillo and Fernando Miguez
Department of Agronomy – Iowa State University

Introduction

Favorable yields result from crop potential, management, and climate contribution. Research has suggested a mild climate influence on US corn yields[1], or apparent yield boosts resulting from early planting[2]. Despite general knowledge on climate/management driven productivity, no evidence to date reveals overriding effects of one yield driver over the others. Assessing yield progression promotes the design of risk minimizing strategies for producers and improved policy models for cropland expansion forecast.

To improve the understanding of corn productivity in Iowa, I pursued the following objectives:

1. Revise 40 year-series on corn yields and cropland expansion at the county level,
2. Determine yearly rates of increase of yield and area harvested,
3. Analyze regional productivity trends derived from yearly increase rates of yield and area harvested.

Methodology and Procedures

➢County-level records on yield and area harvested (1970-2013), collected from National Agricultural Statistical Service (usda.nass.gov), normalized to base year (1970), and adjusted for linear trends

➢Slope-intercept estimates plotted to check productivity trends. Slopes are yearly rates of yield gain. Intercepts refer to yields in 1970 and might denote inherent cropping capabilities (e.g. soil, climate, etc)

➢Percentage yield changes computed and plotted to evaluate multidecadal productivity in Iowa (1980, 1990, 2000, 2010) relative to base year (1970)

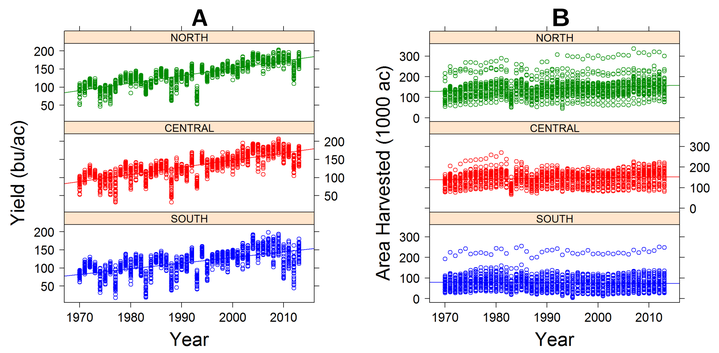

Figure 1. Yield and area harvested - linear trends per region.

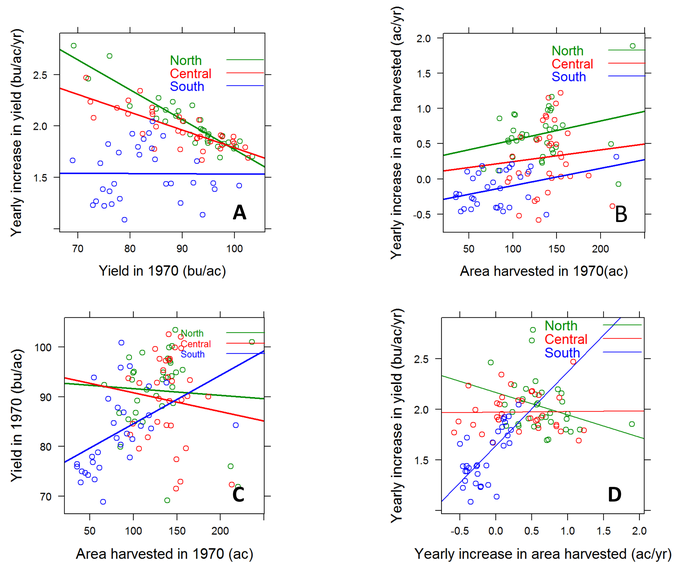

Figure 2. Slope –intercept plots. Panels A, and B show yearly increases in yield and area harvested with respect to yields and areas in 1970. Panels C shows yield vs area harvested in 1970; panel D shows yearly rates of gain yield vs yearly rates in area harvested.

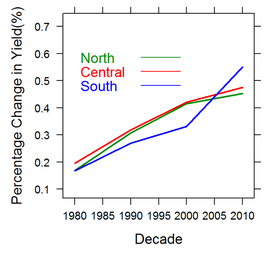

Figure 3. Yearly percentage changes in Yield, expressed as yield gains in a year relative to total average gains over the whole period

Results and Discussion

- Corn yields/region have increased (fig 1A). Area harvested has generally : increased (north), no change (central), or decreased (South) (fig. 1B)
- In north/central, there is a negative relationship between yield in 1970 and rate of yield gain. For southern counties there is no apparent relationship between yield in 1970 and rate of yield gain (fig. 2A)
- Area harvested per year has generally increased since 1970 for the three regions. (fig. 2B).
- Yield in 1970 and yield gains per year seems to follow an increasing pattern with respect to area harvested (fig. 2C, 2D)
- 30 Years of technology, climate action, or both, have brought ~40% yield gains in 2000 for north/central and roughly 30% for the south. Yet, Declined productivity noted for north/central counties (fig. 3)

Conclusions

- County level yields have increased overall. Area harvested has decreased slightly in the south.
- Counties with high yields (1970) in north/central have experienced lower yield gains/year but increasing area harvested per year.
- North/central declining productivity might denote production reaching limits of yield potential.

References

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2. Kucharik, C. 2008. Contribution of Planting date Trends to Increased Maize Yields in the Central United State. Agron.J.100:328-336

3. Grassini, P. Eskridge, P., Cassman, K. 2013. Distinguishing between Yield Advances and Yield Plateaus in Historical Crop Production trends. Nat. Commun. 4:2918

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