INVESTIGATING INPUT REDUCTION TRADEOFFS IN INDIANA

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ABSTRACT

As production margins narrow and commodity prices remain volatile, farmers face difficult decisions about where to reduce input costs while maintaining profitability. This project evaluates the economic and agronomic consequences of reducing crop protection dollars versus phosphorus (P) and potassium (K) fertility dollars, and identifies the conditions under which each strategy is most effective. The 2026 growing season served as a pilot year, with trials conducted at four locations across Indiana. Treatments compared optimum and cutback crop protection programs (including herbicides, fungicides, and insecticides) as well as optimum and cutback P and K fertility management. Other inputs, including nitrogen (N) and sulfur (S), were applied according to local farm-standard practices. Treatment details varied by location to reflect differences in management practices, soil fertility levels, and pest pressure. Preliminary findings from the pilot year are presented, along with plans for expanding the study and evaluating economic and agronomic outcomes.

INTRODUCTION

Each growing season, farmers face numerous decisions about how to allocate limited input dollars. Yet yields and revenue are highly influenced by external factors, including weather and market conditions, that are beyond farmers' control and difficult to predict with precision (Menapace et al., 2013). Uncertainty in yield, input costs, and commodity prices makes farming an inherently risky enterprise (Allahverdiyev et al., 2025), and individual risk tolerance can strongly influence management decisions. For example, fertilizer applications above established recommendations have been linked to farmers' low tolerance for risk (Sheriff, 2005). These challenges may become increasingly important as environmental, weather, and economic conditions contribute to greater uncertainty in agricultural production (Duong et al., 2019).

Traditional agronomic research does not always reflect the complexity of these real-world decisions. Experiments commonly isolate individual management factors under relatively controlled conditions. While this approach is valuable for developing recommendations for questions such as fertilizer rate or fungicide timing, it may not capture the trade-offs farmers face when deciding how to allocate limited resources among competing inputs. This disconnect may also contribute to reluctance to follow university-based recommendations when farmers perceive research conditions as different from those on their own farms. For example, Sheriff (2005) found that farmers

perceived university fertilizer recommendations based on soil test response curves as underestimating yield responsiveness in their individual production systems. Economic considerations may also be underrepresented when experiments focus primarily on agronomic performance. Bullock and Bullock (2000) argued that incorporating economics into recommendations can strengthen the relevance of farm management research.

These trade-offs become particularly important when commodity prices are low or production margins are tight. Farmers may need to determine which inputs can be reduced, by how much, and with what consequences for yield, revenue, and overall profitability. Yet data describing the outcomes of these decisions under less-than-ideal conditions are limited. This study addresses that gap by evaluating the production and economic trade-offs associated with contrasting input-management strategies, prioritizing dollars toward either crop protection or fertilizer management. A pilot study was conducted in 2026, with expanded treatments, data collection, and in-depth analyses planned for the 2027 and 2028 growing seasons. The initial results are intended to support Extension programming while providing a foundation for a more comprehensive investigation of input-management strategies and best management practices under economically constrained or otherwise non-ideal production conditions.

MATERIALS AND METHODS

A pilot study was established in the 2026 growing season to evaluate the agronomic and economic effects of input tradeoffs at five locations: Pinney Purdue Agricultural Center (PPAC, Wanatah, IN), Davis Purdue Agricultural Center (DPAC, Farmland, IN), Northeast Purdue Agricultural Center (NEPAC, Columbia City, IN), Southeast Purdue Agricultural Center (SEPAC, Butlerville, IN), and the Agriculture Research and Education Center (ACRE, West Lafayette, IN). Yield data from most locations are still being processed and analyzed, so only SEPAC corn data will be discussed, here.

At SEPAC, a 2x2 factorial design was used, with the two levels of crop protection treatments (optimum vs cutback) and two levels of soil fertility treatments (optimum vs cutback). ‘Optimum’ refers to standard farm practice under ideal economic conditions, when input and grain prices are not limiting to desired crop protection and fertilizer management. Optimum and cutback fertility treatments were set based on most recent soil test values for each trial location and following tri-state recommendations for optimum P and K rates. Cutback rates were either a percentage of the full optimum rate, or zero, depending on background soil test levels; for example, if soil test levels were within the optimal range for maintenance, the optimum rate treatments were a full maintenance rate and the cutback treatments were a zero rate. At SEPAC, background soil test P levels were around 15 ppm (Bray-1) and soil test K levels were around 90

ppm (Mehlich-3). Since P levels were right at the margin of deficiency and K levels were in the deficient range, fertilizer treatments were set at 100% and 50% of recommended rates for the optimum and cutback treatments, respectively. Nitrogen and sulfur management were consistent with normal practice for each location, which involved a total of 210 lb N/ac and 25 lb S/ac over the growing season.

Crop protection treatments were flexible in response to growing season conditions and pest pressures unique to each trial location. The goal was to investigate the overarching decision to reduce crop protection inputs compared to reducing fertilizer inputs, for the purpose of reducing input costs. To that end, crop protection decisions for both optimum and cutback treatments were at the discretion of each farm superintendent. At SEPAC, the superintendent took the approach of comparing a standard, risk averse protection package, involving prophylactic use of fungicide/insecticide, with an integrated pest management approach based on in-season scouting. Treatments specific to the SEPAC corn trial are in Table 1.

For the pilot study in 2026, yield was the main data point. Deeper investigation with more endpoints will coincide with study expansion in 2027.

Table 1. Optimum and cutback fertilizer and crop protection treatment descriptions for the corn trial at SEPAC, 2026.

Treatment	Description
Optimum crop protection	Herbicide: Pre-plant burndown + post emergence Fungicide: 2-pass in-season application Insecticide: 1-pass in-season application
Cutback crop protection	Herbicide: Pre-plant burndown + post emergence Fungicide: none Insecticide: none
Optimum fertilizer	80 lb P_2O_5/ac and 40 lb K_2O/ac
Cutback fertilizer	40 lb P_2O_5/ac and 20 lb K_2O/ac

RESULTS AND DISCUSSION

The growing season at SEPAC began very dry through mid-April, and was followed by persistent wet weather until the end of August. There were several extended periods of high temperatures that limited tar spot development, but a higher incidence of grey leaf spot was noted. However, there were no significant yield differences between treatments (Table 2), so disease pressure was not severe enough to warrant prophylactic fungicide application in the optimum treatment.

Table 2. Mean corn yield by treatment at the Southeast Purdue Agricultural Center location.

Treatment	Corn Yield (bu/ac)
Optimum crop protection, optimum fertilizer management	251a
Optimum crop protection, cutback fertilizer management	252a
Cutback crop protection, optimum fertilizer management	255a
Cutback crop protection, cutback fertilizer management	252a

The 2026 enterprise budget for this location is being compiled, but conservative estimates based on the 2025 budget indicate a savings of $30-40/ac on fertilizer inputs with the cutback fertilizer treatment, and $40-60/ac with the cutback crop protection treatment. Outcomes will be compared across locations as the remainder of the 2026 data is available, and yield effects of optimum vs cutback treatments will be assessed across background soil test levels and varying pest pressure.

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