TO APPLY OR NOT? THE ECONOMICS BEHIND IN-SEASON NITROGEN AND POTATO PRODUCTION

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INTRODUCTION

In September 2008, the price of nitrogen (N) fertilizer was approximately three-times more expensive than two years prior. A combination of higher fuel costs and an increase in global demand for petroleum and fertilizer challenged grower profits. In 2007 Columbia Basin potato growers were spending nearly $50,000/pivot on fertilizer. This increased to approximately $88,000/pivot in 2008. Because potatoes require large quantities of N, P (Phosphorous), and K (Potassium), reducing fertilizer applications appears, at first glance, to be a reasonable approach to reducing production costs.

When reducing fertilizer applications, one will most certainly reduce input costs; however, it is also likely that potato yield and quality will be altered in some fashion. At what point does a fertilizer reduction limit profit potential due to negative effects on yield and quality? Previous research with the cultivar 'Alturas' provides insight into this question. During 2007-08, five rates of in-season N were applied to Alturas in an effort to define the rate or rates that would maximize grower revenue. By utilizing data from this research, we were able to determine the effects fertilizer and potato price changes have on grower revenue and which in-season N rates would optimize economic return following price changes.

MATERIALS AND METHODS

Potato yield and quality data from the study "Defining In-Season Nitrogen Needs for Alturas and Premier Russet" by C.D. Hiles et al. (within this proceedings book) were used in combination with constructed potato and fertilizer price changes to predict adjusted gross income and associated in-season N rates that maximize grower revenue. The in-season N study utilized rates that were below, at, or above typical rates applied to Russet Burbank in the Columbia Basin of Washington. The five rates were 0%, 25%, 50%, 100%, and 150% of what might be typical for Russet Burbank during the season (Table 1). Preplant N, P, K, and micronutrients were the same across all treatments; only the in-season N was altered. Economic results were calculated using a mock french fry processing contract for the Columbia Basin. The expense of UAN, Solution 32 between $0.20/lb N and $1.00/lb N was included in an economic analysis along with potato prices between $2.00/CWT and $10.00/CWT. More complete information on the field trial and the yield and quality data can be obtained by reading the previously mentioned Hiles et al. article within this proceedings book.

RESULTS

From the Hiles et al. study, it was determined that Alturas total yield peaked when approximately 150% of typical Russet Burbank in-season N was applied (Figure 1). This was equivalent to approximately 375 lbs N in-season and 500 lbs total season (Table 1). However, fertilizer-price-adjusted gross income peaked at rates closer to 100% of what might be typical in-season for Russet Burbank – even when considering fertilizer price changes between $0.20 and $1.00 (Figure 2). This rate was equivalent of 230 lbs N in-season and 385 lbs N total season (Table 1). The five individual curves within Figure 2 demonstrate what happens when the price of in-season N increases from $0.20/lb to

$1.00/lb between the 0% and 150% rates. At $1.00/lb, the profit-maxing N rate is around 96%. As N becomes cheaper ($0.20/lb), the profit maxing N rate moves to approximately 103% of the Russet Burbank typical. The peak income changed slightly with fertilizer price changes (Figure 2), but the peak income level at all fertilizer prices was within ±3% of the 100% level. Despite a fertilizer price increase of 500% from $0.20/lb to $1.00/lb, the fertilizer rate that optimizes income decreased by only 6%. N applications beyond 103% entered the zone of diminishing returns; the extra N needed to maximize yield was more expensive than the economic return coming from the yield increase with the >100% in-season N application. This confirms the well known concept that maximum biological yield and maximum economic yield are not always the same.

When potato prices change, the in-season N rate that provides the maximum economic yield also changes (Figure 3). In addition, as potatoes become more valuable ($10.00/CWT vs $2.00/CWT), the grower's bottom line is less affected by changes in input (N fertilizer) prices (Figure 3). When the price of potatoes is a constant $7/CWT, it is easy to visualize how the profit maxing N rate shifts as the fertilizer's price increases (Figure 4). When the price in-season N increases by 100% (from $0.40/lb to $0.80/lb), the optimum in-season N rate was reduced by 6% (Figure 4)

DISCUSSION

When input costs increase, the natural tendency is to reduce input applications as well as increase the efficiency surrounding the inputs. As the price of in-season N increases, the rate growers apply should be reduced slightly to optimize income – WITH THE EXCEPTION that the grower has already been applying the optimum rate. Herein lies the problem; how do you know the rate you were applying was the most economically feasible to start with? Even if the rate you have been applying provides profit, is the profit being maximized? Could you apply a bit more, or less, and reap a higher net return? It's possible.

To optimize revenue, growers should utilize all available crop management information coming from extension bulletins, extension personnel, consultants, professional agronomists, on-farm strip trials, updates at conferences and field days, and so on. Once growers find fertility levels that provide profit, we recommend they stick to them, regardless of fertilizer price increases. There are of course exceptions, like a $5.00/lb N price increase, or similar. For standard yearly jumps, even a 100% price increase, growers are better off bargaining with buyers for higher potato prices than playing the fertilizer version of Russian roulette.

As input costs increase, growers should do their best to optimize application and rate efficiency by using soil and petiole tests, avoiding nutrient losses via leaching and volatilization, accurately calibrating and maintaining application equipment, and reducing the use of unproven, "feel good" products commonly referred to as "Snake Oil".

TAKE HOME MESSAGES: 1) don't skimp on in-season N or other fertilizer at today's potato prices, even if the price of fertilizer doubles; 2) do your best to find the application rate that provides the best economic return; 3) seek information updates routinely; and 4) strive for efficiency in applications and in determining plants needs.

Table 1. Preplant, in-season, and total season nitrogen for 2007 and associated in-season N expense for five rates of in-season N applied to Alturas

Treatment as a % of standard	Preplant N + soil resid.	Fertigated in-season N	In-season N From Phos applications	Total in-season N	Total Season N	In-season N Fert expense ($0.80/lb)
%	----------lbs/A----------					
0	125	0	30	30	155	0
25	125	58	30	88	213	46
50	125	115	30	145	270	92
100	125	230	30	260	385	184
150	125	345	30	375	500	276

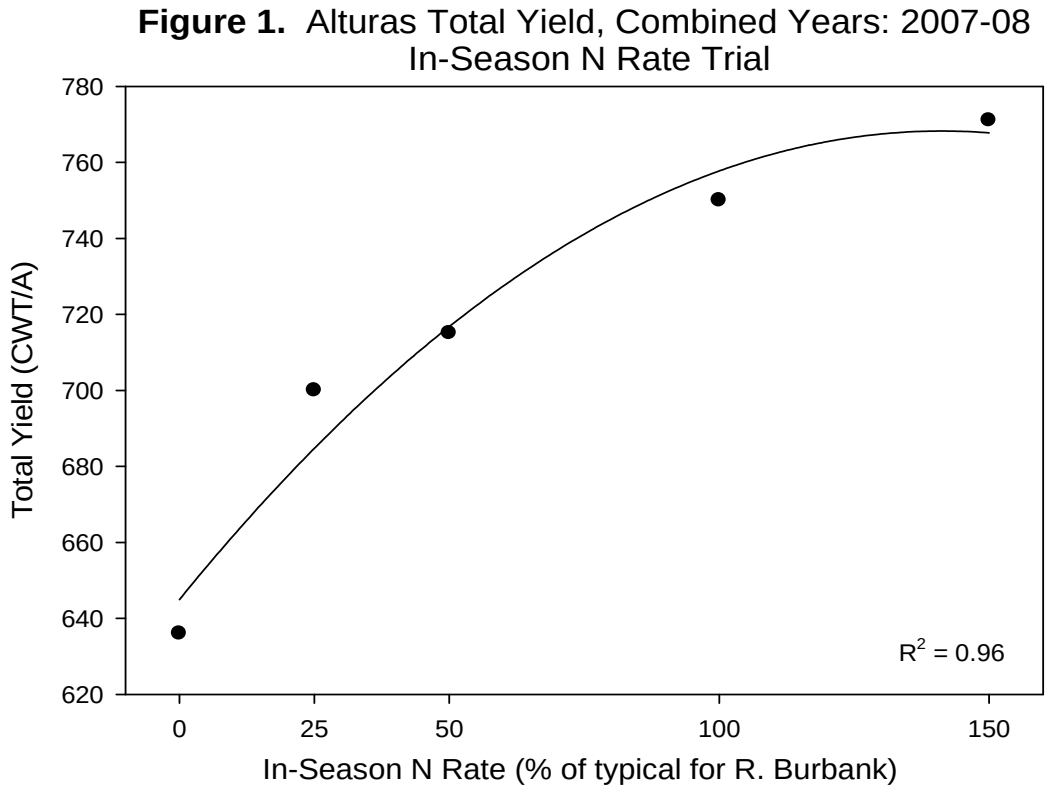

Figure 2. Alturas Adjusted Gross Income Across Different In-Season N Rates When UAN Solution 32 is priced at $0.20, $0.40, $0.60, $0.80, and $1.00/lb.

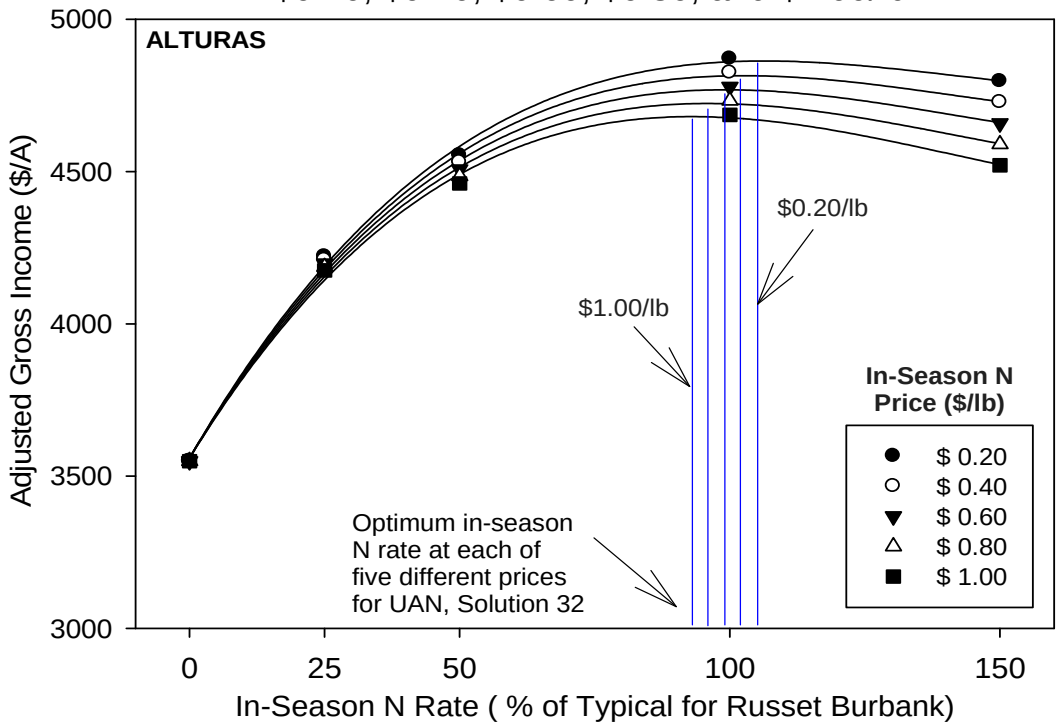

Figure 3. Profit Maxing In-Season N Rates as Fertilizer Price Increases from $0.10/lb to $1.00/lb and Potatoes Increase in value from $2/CWT to $10/CWT

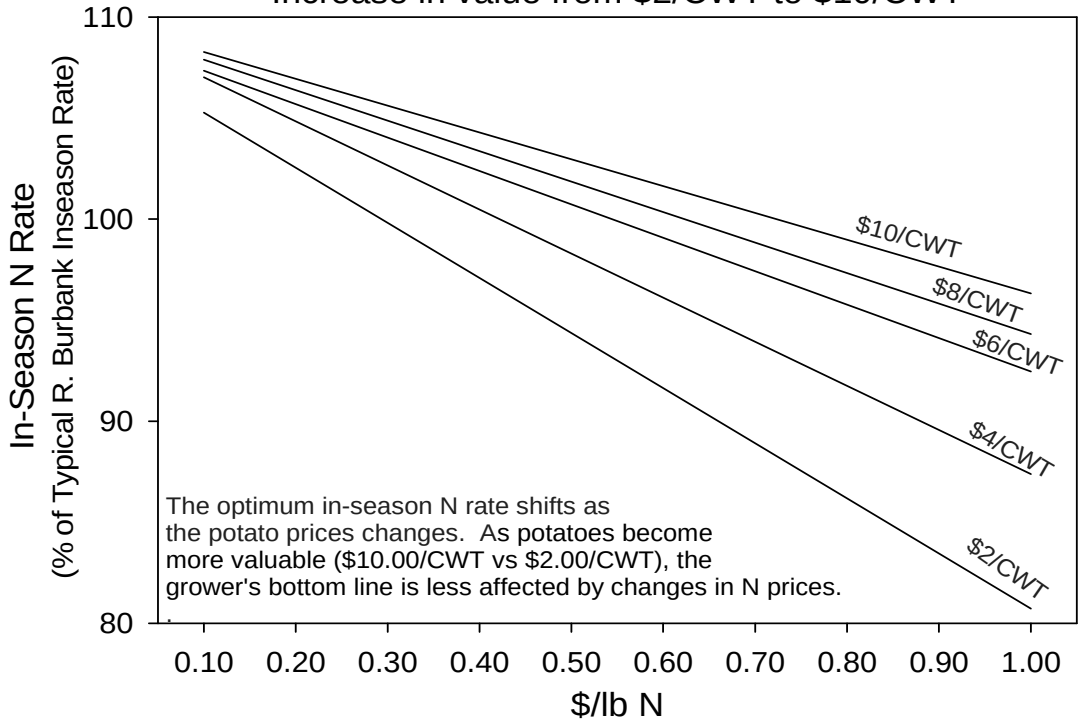

Figure 4. Alturas Profit Maxing In-Season N Rates as Nitrogen Fertilizer Prices Increase