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# Point Injection of N Shines in Sugarbeet Trials

## Wyoming researchers provide economic analysis comparing broadcasting with point injection and knife banding.

***Summary:*** *Point injection returned $966/A above fertilizer and beet hauling costs while broadcasting and knife banding returned $899 and $872, respectively. Profit maximizing N rates were 187 lbs/A for point injection, 187 lbs/A for knife banding, and 220 lbs/A for broadcasting. The goal of maximizing profits returned the greatest income above fertilizer and beet hauling costs. Maximizing root yield returned the least income above fertilizer and beet hauling costs and required the most N. Maximizing sucrose or recoverable sucrose yield used fertilizer levels that fell between those of maximizing profit and root yield, plus returned income above fertilizer and beet hauling costs.*

Sugarbeet producers face unique challenges in N fertilizer management because of the relationships among root yield, crop quality, and price. Top sugarbeet yields require high N rates, but excessive N supply decreases root sucrose content. Sugarbeet payments are based on tons of sugar delivered, and sucrose yield is determined by both root yield and sucrose content. Sucrose yield increases as N rates increase, reaches a maximum sometime before root yield reaches a maximum, then falls because of declining sucrose content and the plateau of root yield. Excessive N rates, therefore, not only increase fertilizer costs but also reduce economic return. Nitrogen management is thus more challenging for sugarbeets than for many other crops in which modest N excesses have little effect on crop quality.

A second important challenge in N management is the environmental hazard that results from improper N use. High N rates and intensive irrigation used in sugarbeet production in the western US can produce large N leaching. Shallow soils and high water tables, common in many irrigated valleys, make N leaching an environmental concern as well as an economic loss. Such threat to profit margins plus increasing environmental concerns merely amplify the importance of better N management. Precision N placement can help sugarbeet producers do a better job managing economic and environmental resources.

Objectives of this three-year study were to evaluate the economic efficiency of N application options, using broadcasting, knife banding, and point injection. A secondary objective was to examine the most profitable rate of N application for sugarbeets, depending upon the producer's goal and method of application.

### Maximizing return

Optimal N rate, root yield, and costs from our field studies are shown in Table 1. Sucrose yield, gross revenue, and net

Table 1. Optimal N rate, root yield, and costs for three N placement methods on sugar beets, Van Tassell et al., University of Wyoming, 1991-93.

| | Broadcast | Point injection | Knife banding |
|---|---|---|---|
| Optimal N rate--lbs/A | 220 | 187 | 187 |
| Root yield--tons/A | 27.0 | 28.5 | 25.8 |
| Fertilizer/application costs--$/A | 65 | 56 | 55 |
| Beet hauling costs--$/A | 64 | 67 | 61 |

return are shown in Figure 1.

Using mean values in the response function, economic optimum N rates were similar for point injection and knife banding and greatest for the broadcasting system. N rates represent those that would earn the most profit per acre. These rates are averages over the three-year study, and the optimum would vary under specific environmental conditions.

Root/sucrose yield and accompanying gross revenue were greatest under the optimal N rate for point injection, and were least under knife banding. Fertilizer and application costs were similar for point injection and knife banding.

Point injection produced superior sugarbeet performance and the greatest gross and net returns of the three placement methods. In spite of considerable equipment costs, point injection produced $67/A more revenue above fertilization and beet hauling costs than broadcasting, and $94/A more than knife banding. Fertilization costs were highest for the broadcasting system because of a higher optimum N rate and high application cost. An increase in N price would increase the advantage of precision placement.

Optimal N and associated returns for all production goals are summarized in Table 2. As economic theory would indicate, the optimal N rates required for obtaining maximum root yields, sucrose yields, and recoverable sucrose yields are higher than the rates obtained when maximizing profit. Maximizing recoverable sucrose yield requires more N than the profit maximizing rate, but net returns are similar.

Nitrogen fertilization rates under the four management goals were almost always less for point injection and always more for broadcasting, with returns over fertilizer and beet hauling being greatest for point injection.

The optimum N rate for each of the four goals changed less under point injection than for knife banding or broadcasting. Range in optimum N rate under the four management goals was 187 to 200 lbs/A for point injection, 187 to 224 lbs/A for knife banding, and 220 to 266 lbs/A for broadcasting.

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Table 2. Associated profit rate for each management goal under alternative fertilization methods, Van Tassell et al., University of Wyoming, 1991-93.

| Goal | Broadcast | Point injection | Knife banding |
|---|---|---|---|
| Root yield | | | |
| N rate--lbs/A | 266 | 202 | 224 |
| Return--$/A | 883 | 964 | 859 |
| Sucrose yield | | | |
| N rate--lbs/A | 248 | 200 | 209 |
| Return--$/A | 983 | 964 | 867 |
| Recoverable sucrose yield | | | |
| N rate--lbs/A | 241 | 197 | 205 |
| Return--$/A | 896 | 965 | 869 |

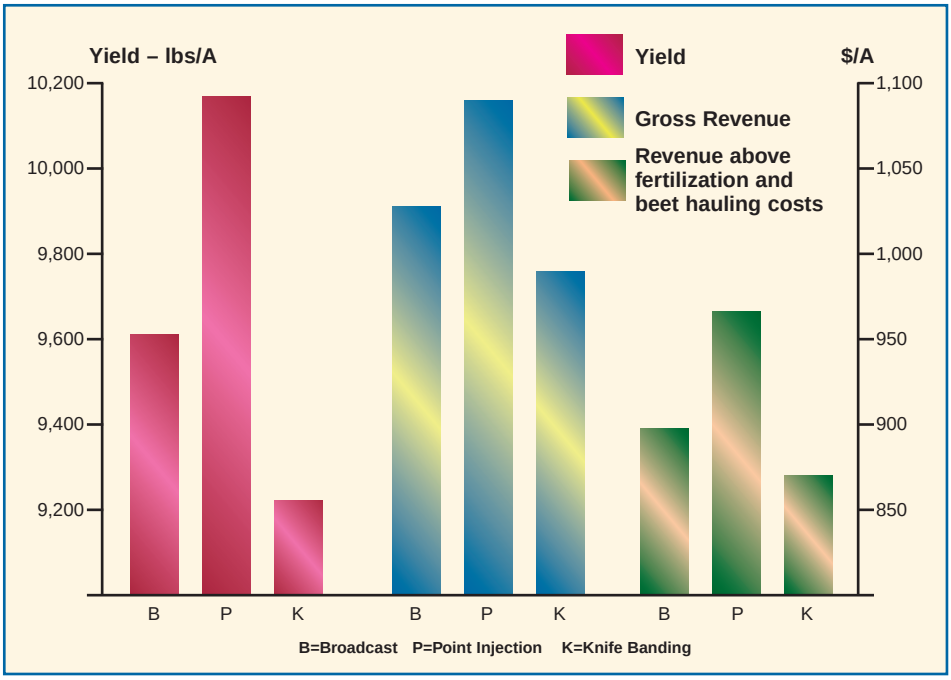


Figure 1. Sucrose yield and gross/net revenues from economic optimum N rate for three placement methods on sugarbeets, Van Tassell et al., University of Wyoming, 1991-93.