

Corn Silage Following First-Cut Alfalfa: A Forage Production Alternative?

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Introduction

Corn silage is occasionally double cropped with first-cut alfalfa in the north central region of the US. With this system, corn is planted after first-cut alfalfa is harvested. This practice is of greater interest to growers with old or winter-injured alfalfa stands and limited alfalfa supplies. However, little information is available on forage yield and economic return of corn silage following first-cut alfalfa. This study was designed to: (1) evaluate forage yield and economic return of the corn silage following first-cut alfalfa system, (2) compare economic return from the alfalfa/corn silage double-crop system with returns from single-crop corn silage and four-cut alfalfa systems, and (3) determine the economic sensitivity of these systems to changes in soybean meal (SBM) and corn prices.

Materials and Methods

Field studies were conducted in Michigan in 1987 and 1988 to provide validation data for a longer-term computer simulation study. The experimental design was a randomized complete block with four replications. The forage production systems evaluated were: single-crop corn harvested as silage (Treatment C), alfalfa harvested four times at early to mid-bloom (Treatment A), and corn silage following first-cut alfalfa (Treatment AC).

Field studies were established in existing alfalfa fields following recommended production practices. Field operation, fertilizer, herbicide, and corn seed costs were summed for each system (Treatments C and AC). Land and alfalfa establishment costs were not included as variable costs since the crop was already available. Forage quality was determined with near-infrared reflectance spectroscopy. Market values (\$/ton) of alfalfa and corn silage were determined as the cost of purchasing the same amount of crude protein (CP) and total digestible nutrients (TDN) in the form of SBM and corn

grain. Prices of \$240/ton for SBM and \$2.53/bu for corn grain were used to reflect the long-term SBM dry matter (DM) to corn grain DM price ratio of 2:1. Gross margin (\$/acre) for each treatment was calculated as market value times yield minus the selected variable costs of production.

Field data were used to validate the crop models using DAFOSYM (The Dairy Forage System Model) in predicting yields for this type of double crop application. DAFOSYM submodels were used to simulate crop growth using 1987 and 1988 East Lansing, Michigan weather data. Yields were simulated for Treatment C with the DAFOSYM corn growth submodel which used the CERES-Maize model, version 2.1. Yield and quality in Treatment A were simulated using the DAFOSYM alfalfa growth submodel which was based on the ALSIM 1, level 2 model from Cornell University. Alfalfa yield and quality and corn yield in Treatment AC were simulated using the respective alfalfa and corn models. Alfalfa growth was simulated as in Treatment A for the first cut. Available soil moisture predicted by the alfalfa model following the first cutting was carried into the corn submodel as the available soil moisture at corn planting. Market values and gross margin were determined as for the field study.

The DAFOSYM submodels were validated by comparing measured gross margins with predicted values. Studies in 1987 and 1988 provided six data pairs. A correlation (r) of .84 gave good support for the validity of the DAFOSYM submodels. Based on the accuracy of these predictions, a simulation was undertaken to evaluate these forage production systems over 26 years of East Lansing, Michigan weather.

Results and Discussion

Simulated forage yield and gross margin for the three forage production systems were determined

for the 26 weather years. Treatment C was the forage production system with the highest gross margin in 16 of the 26 years and with the highest average gross margin (\$433/acre). Treatment A had the highest gross margin in 6 of the 26 years and Treatment AC had the highest in only 4 of the years. The 26-year average gross margin was \$387/acre for Treatment A and \$320/acre for Treatment AC.

Corn silage yield in Treatment AC averaged less than half of that in Treatment C. Economical yields from the corn silage following first cut alfalfa system were only attained during long, warm and wet summers. This type of weather pattern does not frequently occur in Michigan. The poor performance of corn in Treatment AC was consistent with other observations of the yield depressing effects of a forage legume preceding corn in a double-crop system. Reduced yields of corn following perennial legumes in most years is attributed to low early season precipitation and to the legume's use of soil moisture. High yielding legume crops grown in the spring decrease soil moisture content at corn planting time which often causes severe drought stress for the corn crop.

A sensitivity analysis was performed to determine how the forage system comparisons

were affected by SBM and corn prices. Historic extreme SBM:corn price ratios of 3:1 and 1:1.5 were used. Within this range of price ratios, the number of years in which the doublecrop system had the greatest gross margin of the three systems ranged from 2 to 4 years out of 26. Therefore, the economic benefit of double cropping corn silage after first cutting alfalfa was not sensitive to feed prices, and this system was economically beneficial in very few weather years. Comparison of Treatment C and Treatment A was highly sensitive to SBM:corn price ratios. A low SBM:corn price ratio favored Treatment C in 22 of the 26 years, while a high SBM:corn price ratio favored Treatment A in 23 of the 26 years.

Conclusion

Producer interest in double cropping corn silage after first-cut alfalfa increases when forage supplies are limited and alfalfa stands have been injured by winter weather. The alfalfa/corn silage double-crop system was less profitable than single-crop corn silage and/or four-cut alfalfa in at least 22 of 26 weather years. Although the alfalfa/corn silage double-crop system has been successful in other areas, it cannot be generally recommended as an economic alternative for forage production in Michigan.