

Rationale & Feasibility of Breeding Alfalfa for Improved Establishment Under Corn Silage

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Establishment of alfalfa by interseeding into a corn silage companion crop has the potential to double first-year yields of alfalfa, increase overall forage production and the profitability of crop rotations, and decrease soil and nutrient loss from cropland. Improvements in crop management practices have greatly improved the reliability of this production system, but alfalfa stand density following corn harvest can still be suboptimal for subsequent forage production, especially if establishment occurs under wet growing conditions.

Therefore, we tested the feasibility of breeding alfalfa specifically for improved establishment under corn. In this study, surviving alfalfa plants from previous varietal evaluations under corn were assigned to five crossing groups for production of cycle-1 polycross seed and hybrid F1 seed via crossing with a male-sterile line. Corn was then planted in mid-May 2019, intensively managed, and harvested for silage in mid-September at two locations in southern Wisconsin. Within three days of corn planting, seed of parental, polycross, and hybrid alfalfa entries were drilled in rows 15-cm apart at 18 kg per hectare between corn rows according to a randomized complete block design. Subplots of each alfalfa entry were either treated with foliar-applied agrichemicals (prohexadione-calcium, fungicide, and insecticide) between late June and early July or left as non-treated controls. Alfalfa plant height, foliar health, herbage mass, and root mass were evaluated during establishment under corn, and alfalfa plant density was determined four weeks after corn harvest.

Competition from high-yielding corn silage (dry matter yield averaged 23.8 metric tons per hectare) combined with high precipitation (42% above normal) contributed to complete stand failure of all non-treated alfalfa entries. Application of agrichemicals, however, substantially improved foliar health and increased root mass, and enabled fair to good establishment of alfalfa with average stand densities of entries ranging from 57 to 147 plants per square meter. Averaged across crossing groups, polycross and hybrid germplasm respectively had 38% and 65% greater stand density than parental germplasm. Gains in stand density due to breeding were consistent across locations, providing strong evidence that plant selection and hybridization, when used in conjunction with agrichemical treatments, can be highly effective for improving interseeded alfalfa establishment during wet growing conditions. Our findings also suggest that several cycles of selection will be needed to ensure that interseeded alfalfa can be established under wet growing conditions to reliably reach target stand densities of 200 plants per square meter that are needed to maximize first year yields of interseeded alfalfa. Additional breeding work and further refinement of crop management practices will enable interseeded alfalfa to be cost-effectively and reliably established on farms for profitable forage production.