

Heterosis in Hybrid Alfalfa

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Alfalfa forage yield improvement over the last 20 years has been stagnant. Similarly, open pollinated corn varieties experienced very little yield improvement from 1860 to 1930 when corn yield improved only 2 bushels/acre in a period of 70 years. When hybrid corn technology entered the marketplace in 1930, corn yield improvement increased to 1.0 bushels/acre/year. Today, corn yield improvement continues to gain 1.8 bushels/acre/year. Hybrid alfalfa technology has the potential for yield improvement similar to hybrid corn. The success of hybrid technology in alfalfa, however, will depend on the ability to capture heterosis.

The purpose of this study was 1.) to determine if heterosis could be found in elite, hardy alfalfa germplasm adapted to the Midwest, and 2.) determine if more heterosis could be found in various germplasm sources from around the world. In this study, 363 alfalfa hybrids were produced using msSUNTRA[®] male sterile hybrid alfalfa technology. The hybrids were forage yield tested in replicated 5 feet x 20 feet plots in Clinton, WI in 2000, and/or 2001, and/or 2002.

For germplasm adapted to the Midwest, more than 87% of the hybrids exhibited positive mid-parent heterosis (Figure 1). The average mid-parent heterosis was 3.4%, which is significantly greater than 0 (p-value < 0.001). Values for mid-parent heterosis were as high as 13.1%. More than 72% of the hybrids exhibited positive high-parent heterosis yielding more than both of the parents of the hybrid. The average high-parent heterosis was 1.6%, which is significantly greater than 0 (p-value < 0.001). Values for high-parent heterosis were as high as 9.3%.

For germplasm from various regions of the world, more than 89% of the hybrids exhibited positive mid-parent heterosis. The average mid-parent heterosis was 4.7%, which is significantly greater than 0 (p-value < 0.001). Values for mid-parent heterosis were as high as 13.2%. More than 71% of the hybrids exhibited positive high-parent heterosis yielding more than both of the parents of the hybrid. The average high-parent heterosis was 0.8% (not significant). Values for high-parent heterosis were as high as 10.7%.

Germplasm from various regions of the world exhibited greater mid-parent heterosis but less high-parent heterosis than germplasm adapted to the Midwest. Specific exotic germplasm sources may exhibit enough high parent heterosis for use in elite commercial cultivar development. Significant heterosis exists in elite hardy alfalfa germplasm adapted to the Midwest and can be utilized to make superior yielding, hybrid alfalfa varieties.

Figure 1

