

Alfalfa Breeding: Yield Trial Results From Selection & Intercrossing for Forage Yield & Quality

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Two alfalfa populations were planted in a replicated field nursery in 2011. Plants were selected in 2013 and six populations were developed. From each of the two populations, ~8% of the plants were selected based on visual assessment of vigor. At second and third harvest in 2013, these selected plants were hand-harvested and the plant material was dried. From these harvested pools, the best 10-12% of the plants were selected for high yield based dry matter plant weights (Yield Select), the best 10-12% of plants were selected for high forage quality based on lab assessment of forage quality (low neutral detergent fiber and high neutral detergent soluble fiber concentrations at two harvests, Quality Select), and 10-12% of plants were selected randomly (Random Select). In addition, the two sets of plants selected for high yield were crossed together (Yield Cross) and the two sets of plants selected for high forage quality were crossed together (Quality Cross). For each of the eight populations, following one generation of seed increase, seed was planted in a trial at Ithaca NY in spring 2018. The trial was harvested three times each year (2019 – 2021). Samples for forage quality analyses were collected at each harvest in 2019 and 2020. At each sampling, plots were rated for maturity (1 to 8 scale, 1 is immature and 8 is mature). Lodging ratings (1 - no lodging and 4 - lodged) were taken when lodging was present (harvest 3 2019 and harvest 1 2020).

Total yield (tons/acre), maturity score, and lodging score were analyzed as a randomized complete block with four replications. Planned contrasts for yield, maturity and lodging were Quality Select vs. Yield Select, Yield Select vs. Random Select, Quality Select vs. Random Select, Quality Select vs. Quality Cross, and Yield Select vs. Yield Cross.

Total yield for one of five planned contrasts was statistically significant. The Yield Cross population had significantly more yield than the Yield Select average ($P=0.01039$). The Quality Cross populations did not show a similar yield increase compared to Quality Select average. Maturity ratings for three of the five planned contrasts were statistically significant. The Yield Select and the Quality Select had greater maturity scores than the Random Select ($P=0.0240$; $P=0.0312$, respectively) and the Quality Cross had lower maturity score than the Quality Select ($P=0.0050$). Lodging rating for two of the five planned contrasts were statistically significant. The Quality Select lodged more than the Quality Cross ($P=0.0434$). The Yield Select lodged less than the Yield Cross ($P=0.0072$).

Once cycle of selection for yield, for quality, and for a random selection of plants did not significantly increase or decrease forage yield or tendency to lodge. For the two alfalfa populations in this study, forage yield was improved by intercrossing two populations selected for forage yield. This yield improvement is possibly due to heterosis for yield alleles. Intercrossing two populations selected for forage quality did not show a similar response in yield improvement. Rather maturity score was improved (was less mature) by intercrossing two populations selected for forage quality possibly due to heterosis for forage maturity alleles associated with forage quality.