Genetic Variation for Agronomic Performance within a Collection of Russian Timothy Accessions

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This study investigated genetic variation, narrow sense heritability, genetic covariances, and predicted selection responses for key agronomic traits in timothy (*Phleum pratense* L.) using 96 half sib families evaluated over two years under irrigated Intermountain West conditions. Families were assessed for stand maturity, total forage yield, and major forage quality traits. Mixed model analyses detected substantial phenotypic and additive genetic variation across all traits, indicating strong potential for selection based improvement. Narrow sense heritability estimates were moderate for maturity and forage quality characteristics, while forage yield exhibited lower but exploitable heritability within this environment. Genetic covariance patterns revealed *unfavorable* relationships between forage yield and maturity, with earlier maturing families tending to produce higher yields. This inverse covariance suggests that selection for increased yield may inadvertently advance maturity unless maturity is explicitly included in a multi trait selection index. Favorable covariances were detected among several fiber and digestibility traits, supporting the feasibility of coordinated improvements in forage quality. Predicted selection responses indicated meaningful gains per cycle for maturity and quality attributes under realistic selection intensities, while improvements in yield would require more intensive or sustained selection due to its lower additive variance. Overall, the presence of significant additive genetic variation, combined with clearly defined covariance structures, underscores the potential for multi trait recurrent selection strategies to simultaneously optimize yield, maturity, and forage quality in timothy adapted to irrigated production systems of the Intermountain West.