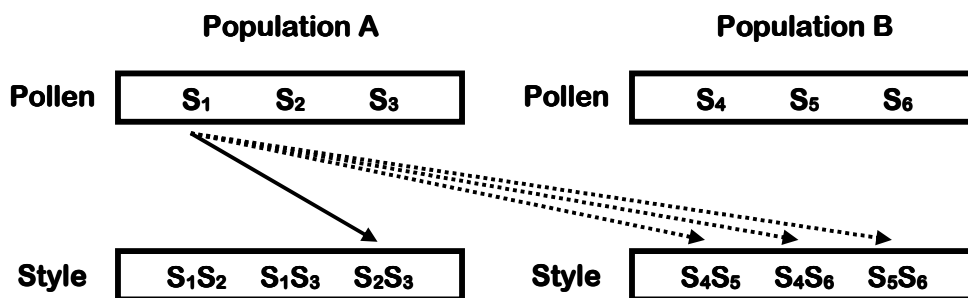


Restricting Gametophytic Self-Incompatibility Alleles in Red Clover (*Trifolium pratense*) to Increase Hybridity

**Heathcliffe Riday
USDA-ARS, U.S. Dairy Forage Research Center, Madison, WI 53706**

Red clover (*Trifolium pratense* L.) is a widely grown forage legume harvested for hay or silage, grown in pastures for grazing, and sown as a companion or trap crop. Current breeding methods in red clover for quantitative traits such as biomass yield consist almost entirely of recurrent phenotypic selection (i.e. repeated cycles of mass selection). In many species improved cultivars have been achieved through hybrid breeding methods, especially for highly non-additive traits. In red clover, hybrid methods using pseudo-self-compatibility have been studied and developed. Inbreeding depression was a major detriment to the utility of this breeding system. Population hybrids or hybridization of two heterotic randomly mated populations have been proposed as a way to achieve 50% hybrid seed while eliminating problems associated with inbreeding. A novel approach to achieving greater levels of population hybrid seed is through the restriction of the number of S-alleles per heterotic population. Theoretically, 75% hybrid seed can be achieved in a population cross by restricting each heterotic population to have three unique S-alleles.



To demonstrate the feasibility of such a scheme, S-allele restricted populations were created using backcrossing. Equal numbers of S-allele restricted individuals and check individuals from an unrestricted population were placed in a pollination cage. Halfsib seed was produced from each plant. DNA markers were used to determine if progeny were within-population or population-hybrid individuals. Percent hybrid progeny was compared to theoretical expectation for S-allele restricted and unrestricted populations.

| | % Hybrid Progeny | | Deviation from 50% Hybrid Expectation | | Deviation from 75% Hybrid Expectation | |
|--------------|--------------------------------|--------------------------------|---------------------------------------|--------------------------------|---------------------------------------|--------------------------------|
| | Normal Unrestricted Population | 3-Allele Restricted Population | Normal Unrestricted Population | 3-Allele Restricted Population | Normal Unrestricted Population | 3-Allele Restricted Population |
| Progeny Seed | 48% | 75% | ns | * | * | ns |

* Significant at $p < 0.0001$; ns - not significant

As hypothesized, 75% hybrid seed was produced in the restricted population and 48% hybrid seed was produced in the unrestricted population. Restricting populations to three S-alleles is a feasible way to increase hybrid seed production.