Breeding for Seed Yield in Crimson Clover

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Crimson clover (*Trifolium incarnatum*) seed production is almost exclusively done in Western Oregon and high seed yield in this region is necessary for the industry to adopt new varieties. Seed yield of advanced breeding lines developed outside of Oregon can be lower than well-established widely grown cultivars, such as 'Dixie'. Thus, plant breeders need to evaluate seed yield of new germplasm and develop better methods to select for high seed yield. The objective of this study was to evaluate seed yield in advanced breeding lines that were developed in North Carolina, Maryland, and New York for use in cover cropping. Replicated field experiments were conducted in Western Oregon in 2019, 2020, and 2021 using thirteen advanced breeding lines selected for improved vigor, biomass, and maturity timing. Plots were seeded in the Fall and were 6.1 meters long and 0.5 meter wide. Four replicates per breeding line or cultivar were used. The experiments included the commercial cultivars 'Dixie' and 'Linkarus' and were managed like a commercial planting. Honeybee hives were placed near the plots in the spring for pollination. Average seed yield in 2019 and 2020 ranged from 174 to 822 grams per plot. Yields in 2022 were lower, with yields ranging from 72 to 260 grams. The advanced breeding lines yielded less seed than 'Dixie' and 'Linkarus'. For example, in 2019 advanced breeding lines yielded 30-56% less than 'Dixie', in 2020 breeding lines yielded 27-56% less than 'Dixie', and in 2021 breeding lines yielded 15-64% less than 'Dixie' except for two lines, 17MDCC-Hard and 19MDCC which yielded about the same. In 2019 and 2020, 'Dixie' and 'Linkarus' consistently had heavier seeds, greater number of seeds produced, and higher harvest index. These trends were less apparent in 2021. These results demonstrate the need to improve seed yield in crimson clover.

Total seed yield can be partitioned into plant-stand density, stems per plant, inflorescences per stem, flowers per inflorescence, seeds per legume, and individual seed weight. Analysis of seed yield components, including path-coefficient analysis and structural equation modeling, can aid in determining which traits to target in efforts to breed for higher seed yield. Seed yield and seed yield components will be studied from six populations with differing seed yield from active crimson clover breeding programs. These populations consist of two high-seed-yielding cultivars 'Dixie' and 'Linkarus,' two low seed yielding breeding lines, and two half-sib crosses between 'Dixie' and the low seed yielding breeding lines. Sixty transplants of each population were planted and established near Corvallis, OR in the Fall of 2021. During the Spring of 2022, data were collected on vigor, date of first bloom, and canopy height. Plants will be harvested in the Summer of 2022 and yield components will continue to be measured and analyzed.