Temperature Requirements for Germination of Some Crimson Clover Lines

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The germination requirements of the seeds of many crop plants are critical in relation to temperature, moisture, aeration, light, and the interactions of these factors. Crimson clover (Trifolium incarnatum L.) has been considered an exception to most of these restrictions on germination, since the seeds from this winter annual crop produce successive volunteer stands through the summer whenever moisture is adequate to induce germination. Spaced-plant-rows are used in the crimson clover improvement program at State College, Mississippi, to evaluate inbred lines, plant introductions, and hand pollinated crosses. Uniform germination is especially critical in these studies since genotypes are compared for seedling vigor and developmental morphology. This report describes temperature dormancy in crimson clover seed and outlines a procedure to avoid erratic germination of seed possessing this characteristic.

LITERATURE REVIEW

Toole and Hollowell (6) reported that most seed of crimson clover will germinate when planted at any time during the summer. They found no significant difference in germination of crimson clover seed from 5 to 35°C. At a temperature of 35°C fewer seeds remained hard and at 30°C germination was slower than at 25°C and below. Hoveland (3) obtained excellent germination of crimson clover at a constant temperature of 70°F. Under a temperature regime of 40°F for 8 hours and 70°F for 16 hours germination of crimson clover was 42%.

Hard-seeded crimson clover varieties were developed to avoid excessive, early germination and to assure self-reseeding of stands in the fall (1, 2). The hard-seeded characteristic in crimson clover persisted from generation to generation once high levels of hard seed were attained by genetic selection (4). The loss of seed-coat impermeability varies greatly among species. Williams and Elliot (7) found that seed-coat impermeability of crimson clovers declined rapidly during the summer months after seed maturation.

The vernalization requirement for several winter annual legumes was demonstrated by McKee (5). Moistened crimson clover seed kept for 40 days at 0°C came into flower when subsequently planted in the greenhouse while plants from untreated seed remained in the vegetative stage.

The Association of Official Seed Analysts' rules for testing seeds prescribes a 7-day germination test for crimson clover, 50°C with a soil temperature of 33°C in the shade. In January 1965, a test was conducted on seed from inbred lines and polycrosses produced in 1964. Ninety-one lines were placed in a germinator under a temperature block to germination. Pots containing this seed were moved into a growth room under an alternating temperature of 68°F for 7 additional days. Seed that had not germinated after 7 days were considered dead.

The 61-91°F temperature treatment included 57 Dixie and 37 Chief inbred lines. The 43-70°F temperature treatment included 45 Dixie and 23 Chief inbred lines. Eighty-two lines were placed in a second germinator under alternating 12-hour temperature periods. Eighty-two lines were placed in a second germinator under alternating 12-hour temperature periods in a shaded greenhouse during the first week in September 1963. There were 6-S1, 26-Sn, 6-Ss, and 18-Sn Dixie variety and 8-S1, 22-Sn, 5-sn, and 38-Sn the Chief variety. Ten polycrossed lines of each variety were seeded at the same time. The greenhouse was 60°F at night and 95°F during the day. Relative humidity in the greenhouse varied from 29 to 90%.

In 1964, seed from 144 sources was sown in 2 growth rooms under 44°F, alternating a photoperiod of 12 hours at an intensity of 3500 f.c. South Carolina seed sources included 29 Dixie and 25 Chief inbred lines, 9 plant introductions, 40 Dixie and 33 inbred lines selected out of the Dixie variety, and 2 inbred lines selected out of the Chief variety.

Slow and erratic germination in 14 Dixie and 7 Chief inbred lines, 2 Dixie polycrosses and 2 Chief polycrosses suggested a high temperature regime for 12 hours at an intensity of 3500 f.c. Although some seed germinated at 40°F, the majority of the seed did not germinate after 7 days were considered dead.

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