

ABSTRACT OF THE THESIS

Physical Factors

Affecting

Establishment of Solidago nemoralis

on the New Jersey Piedmont

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This research was initiated in 1970 to examine the germination of Solidago nemoralis Ait. seeds and the growth and survival of seedlings and juvenile plants. The detected germination, growth, and survival responses were interpreted in terms of establishment in abandoned agricultural fields located on the New Jersey Piedmont. Seeds were collected from one large population in late October, 1970, and utilized in a series of germinator and greenhouse experiments. The germinator experiments tested the effects of light, temperature, stratification, and physiological changes in dry storage on germination; greenhouse experiments tested the effects of shade, planting depth, moisture, stratification, and after-ripening on germination, growth, and survival. Germination and survival were observed in successional fields ranging in age from 5 to 45 years.

Each of the factors considered significantly affected germination, growth, and survival. Germination reached a maximum at alternating 20/30°C night/day temperatures with an 8-hour photoperiod.

Stratification resulted in increased germination at low temperatures (5/10 and 10/15°C) such that with 120-day stratification, germination was nearly constant with temperatures from 5/10 to 25/30°C. After-ripening of seeds in dry storage together with 60-day stratification resulted in 75% germination at 5/10°C. Stratification for 30 or 60 days resulted in approximately 75% germination after three days at 20/30 or 25/30°C; seeds not stratified required two days to begin germinating and approximately seven days to reach 75% germination at the same temperatures. Germination at 20/30°C showed no after-ripening effects. Greenhouse germination was maximized with the combination of 30- or 60-day stratified seeds planted on the surface or shallowly (0.25 cm) in shaded wet soil; however, stratified seeds planted similarly in wet soil without shade germinated greater than 60%. Field germination was greater in rosette than in tall vegetation, and greater in fields abandoned for 5 to 21 years than in those abandoned for 36 to 45 years. Field germination reached its maximum in wet soil either with or without shade, a condition found in the 21-year old field.

Growth reached a maximum with stratified seeds planted shallowly in wet soil without shade, while survival reached a maximum with seeds planted shallowly in shaded wet soil; these conditions occurred in rosette vegetation to a greater extent than in tall vegetation.

Based on experimental evidence, the best site for S. nemoralis is one with some agent such as animal activity or erosion to bury the seeds approximately 0.25 cm deep; cold weather to stratify seeds over winter; moist soil in the spring, shade as among rosette leaves, and warm soil for early germination; and exposure to full sunlight and periodic moisture for maximum growth and high survival. Shallow soil or a

steep slope acting to increase soil droughtiness may decrease tree and shrub dominance and allow S. nemoralis to exist in climax vegetation. Otherwise the habitats satisfying the above criteria may occur on road banks and in abandoned fields.