Photosynthetic Area and Rate in Relation to Seedling Vigor of Birdsfoot Trefoil (*Lotus corniculatus* L.)

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A major deterrent to widespread use of birdsfoot trefoil (*Lotus corniculatus* L.), as a forage legume for pasture and hay, has been its inferior seedling vigor and, hence, the difficulty of establishing stands. Though progress has been made in enhancing vigor through breeding, the species remains one of the least vigorous of the forage legumes. Increased knowledge, then, of factors associated with seedling vigor in birdsfoot trefoil should provide a firmer basis for understanding this phenomenon and perhaps permit future improvement of vigor in this species.

Many investigators have shown that larger and more vigorous plants are produced from larger seeds (1, 2, 6, 8). It has been suggested that this effect may be associated with greater reserve carbohydrate storage in the large seeds (1). Recent investigations with subterranean clover (*Trifolium subterraneum* L.) by Black (2), however, have indicated that the quantity of reserve carbohydrate available upon emergence may have little or no influence on subsequent plant growth and that the significance of seed size lies in the fact that larger seeds produce seedlings with larger cotyledon and leaf areas. In these studies seed size, cotyledon and leaf area, and subsequent plant growth were positively correlated regardless of quantity of reserve carbohydrate available at emergence. Black (3) also showed that differential strain growth in subterranean clover could be traced to differential seed size, i.e., at a common seed size all strains possessed similar cotyledon and leaf areas per plant at any given time and grew at the same rate. Seed size effects were maintained throughout the life of this annual when not attenuated by interplant or intraplant competition (4).

Whitney (9), on the other hand, has found that, while pre-emergence growth in Viking and Empire birdsfoot trefoil was correlated with seed size, subsequent post-emergence growth diverged, such that at the end of a two-week period Viking showed a considerable superiority in dry weight per plant over Empire seedlings from seeds of the same size. Hence, differential varietal growth in birdsfoot trefoil, in contrast to subterranean clover, could not be explained satisfactorily on the basis of seed size.

The importance of cotyledon area in early seedling growth, as stressed by Black (2), is also confirmed by Henry (7), who, removing cotyledons and parts of cotyledons from Viking birdsfoot trefoil and Narrangansett alfalfa (*Medicago sativa* L.), showed a linear relationship between area of cotyledon remaining and plant dry weight six weeks after emergence. Removing both cotyledons following emergence caused a 50% reduction in plant vigor as measured by dry weight. These results emphasize the important role of the cotyledon as a photosynthetic tissue in early seedling growth.

In planning the research herein reported it was decided that an examination of the differential vigor or rate of seedling growth between Empire and Viking, nonvigorous and relatively vigorous varieties, should lead to some conclusions regarding factors associated with seedling vigor in...