THE DIFFERENTIAL MORTALITY OF
TRIFOLIUM REPENS AND PHLEUM PRATENSE
SEEDLINGS IN RELATION TO TEMPERATURE

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INTRODUCTION

Davis and Lambert \(^2\) in a study of problems of ley farming during the Second World War noted that autumn sowing of grass and clover normally led to the establishment of the grasses but the failure of the clover. The reasons were not apparent. Martin \(^10\) exposed five species of autumn-sown legumes and *Phleum pratense*, in the open over winter, after sowing them in boxes in the autumn. Emergence of the legumes was poor, and pre-emergence damping-off was suggested as an explanation. The legumes subsequently suffered heavy mortality, and this was attributed mainly to attack by *Pythium* sp. following frost damage. *P. pratense*, however, apparently did not suffer from fungal attack, and furthermore showed a marked capacity for delayed germination. Martin found neither improvement in legume establishment nor reduction in damping-off after treating the seeds with fungicide, though other workers have reported some improvement, *e.g.* Krietlow \(^8\), Jacks \(^7\).

When mortality occurs it is important to try to distinguish between losses due to direct physical effects of the environment, and losses due to the activities of micro-organisms. Harper \(^4\) \(^5\) has studied the effect of "hazard conditions" on the seedling growth of maize. He showed that combinations of high temperature and low moisture, or low temperature and high moisture, were the most deleterious. Where conditions did not entirely inhibit seedling growth but allowed it to take place slowly, mortality was mainly

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due to pathogenic attack and was prevented to some extent by fungicide treatment. It has also been shown (Harper et al.⁶) that the incidence of mortality varies with the conditions of the soil, and that the capacity of a given soil at any time for causing disease and death of maize sown in it (the "pathogenic potential") can be measured by transferring the soil to the laboratory and sowing maize grains in it under controlled environmental conditions.

It would appear from field experience, however, that the pathogenic potential of the soil will not be the same to all plant species, and differential survival from mixed sowings might be expected to result from exposure to unfavourable conditions. In order to test this hypothesis further a series of experiments was made to determine the influence of various environmental conditions on the establishment from pure and mixed sowings, of *Trifolium repens* and *Phleum pratense*.

The experiments were of three types: a) determination of the establishment of *T. repens* and *P. pratense* from mixed sowings in the field on different dates; b) an attempt to follow variation in the "pathogenic potential" of a field soil, using *T. repens* and *P. pratense* as indicator species in laboratory tests; c) an examination of the behaviour of seeds of *T. repens* and *P. pratense* in soil exposed to various controlled temperature regimes.

**EXPERIMENTAL METHODS**

a) *The influence of time of sowing on establishment in the field*

Seed of *Trifolium repens* (S184) and of *Phleum pratense* (S48) was sown at fortnightly intervals from November, 1962, to April 1963. (10 dates of sowing) in plots 1 m square. The seed of the two species was sown in mixture in equal proportions by number at a total seed rate of 30 pounds per acre. The experiment was designed to compare seed treated with fungicide with untreated seed; the treated samples were well mixed with "Ivermectan" dust, and the surplus shaken off. For each plot, 3 g of the seeds mixture was mixed with 100 g of washed sand and broadcast evenly over the soil surface. The position of each date of sowing, and fungicide treatment, was randomised within three replicate blocks. Soil temperatures at 1 cm and 5 cm depth were continuously recorded throughout the period of the experiment, and weekly soil samples were taken for the estimation of soil water content.

On 30th May, counts were made of plants and seedlings present within 9 circular 6-cm diameter quadrats in each plot.