THE EFFECTS OF DEFOLIATION AND SHADING ON ROOT GROWTH OF *LOLIUM PERENNE* L.

A thesis submitted for the degree
of Doctor of Philosophy to
Massey University

P. S. Evans

1971

ABSTRACT

The effects of defoliation, shading and dark on the growth and morphology of roots of Lolium perenne L. plants have been examined using glass fronted containers and a technique developed for measuring root lengths and numbers of apices.

A single defoliation caused a rapid drop in root elongation followed by a more gradual recovery with the most severe defoliation treatment having the greatest effect. Repeated defoliation caused a prolonged depression of root elongation but some recovery occurred. The most severe treatment resulted in considerable root death. With shading, root elongation fell over the first 8 - 10 days and then recovered to near the control level. Both defoliation and shading caused an increase in the length per unit weight of the root systems. Root elongation of plants placed in the dark fell rapidly to near zero, the effect being comparable with that of defoliating plants to 2.5 cm or less. Defoliation of plants placed in the dark caused a more rapid fall in elongation.

Supplying glucose or sucrose to the roots of plants defoliated to the extent that root elongation would otherwise have ceased maintained elongation at up to two-thirds of the level of undefoliated plants. Sucrose was marginally more effective than glucose with little difference between concentrations 1-6%. Benzyladenine and indole-acetic-acid marginally increased elongation in the presence of sucrose. Dark-treated plants responded in a similar manner to defoliated plants to sucrose. The level of soluble carbohydrates in the roots of plants defoliated or placed in the dark was seen to be low after root elongation ceased and recovered as root elongation recovered. However the level at the time most roots ceased elongating was higher than in other experiments where root elongation was near optimum. That under these conditions the addition of sucrose or glucose maintains elongation at up to two-thirds of the control level suggests that translocation of soluble carbohydrates to the root apex may be the limiting factor. This possibility is supported by the difference in levels of soluble carbohydrates in various parts of the plant following defoliation at two different times of the day. The tech-

nique used to measure soluble carbohydrates was not sensitive enough to permit analysis of the root tips and thus check the hypothesis. Apart from the requirement for soluble carbohydrates and the apparent associated translocation factor there is evidently some other factor (s) limiting root elongation of defoliated and dark-treated plants. The nature of this factor was not determined.

ACKNOWLEDGEMENTS

The guidance of Professor R. G. Thomas and Dr. E. D. Penny, Botany Department is gratefully acknowledged. Appreciation is expressed to Mr. V. J. Thomas, Applied Mathematics Division, D.S.I.R., for helpful discussion and to Mr. P. Dilks and Mr. M. H. Olsen for technical assistance. The facilities for this study were provided by Grasslands Division, D.S.I.R.

TABLE OF CONTENTS

APPENDIX PAGE

LIST OF FIGURES

LIST OF TABLES