SOME ASPECTS OF ABSORPTION, TRANSLOCATION AND METABOLISM OF TWO FOLIAR APPLIED AUXIN HERBICIDES IN GORSE (*Ulex europaeus* L.)

A Thesis

presented in partial fulfilment of the requirements for the degree

of

MASTER OF AGRICULTURAL SCIENCE

at

MASSEY UNIVERSITY

MAURICE PHILIP ROLSTON

1974

ABSTRACT

Since *Ulex europaeus* is a problem scrub weed in New Zealand hill country, glasshouse and laboratory experiments were undertaken to study factors relating to the absorption of 2,4-D and picloram and the translocation and metabolism of picloram. Any one of these parameters may be limiting the effectiveness of picloram and other auxin herbicides in the field.

Absorption was studied using *in vitro* and *in vivo* methods. Cuticular surfaces were studied using scanning electron microscopy and the contact angles of droplets were photographed using an optical microscope. Translocation patterns were observed using autoradiographs as well as by sectioning the plant and counting the distribution of radioactivity in each section. Metabolites were examined for by a radio chromatogram scan of tissue extracts seporated by descending paper chromatography.

The results obtained suggest that absorption is poor due primarily to the presence of a thick smooth layer of cuticular waxes. Environmental conditions at, and subsequent to, spraying are likely to affect absorption in the field. Drying of the spray deposits inhibits absorption; re-wetting a dried deposit with mist enhances absorption.

Additives, especially surfactants and the inorganic salts KCN and Na_2HPO_4 enhanced *in vitro* absorption. Information on the mechanism of absorption was gained from the response to light, temperature and concentration of herbicide.

Picloram was readily translocated from the treated stem to the roots. Very little re-distribution of picloram occurred. Source-sink relationships occur.

No metabolites could be detected from spines and stems. Stem tips and roots were not tested.

****

ACKNOWLEDGMENTS

I wish to gratefully acknowledge the following people who have made this study possible:

Mr. A.G. Robertson for initiation of the project and helpful guidance throughout the course of study and in the preparation of this manuscript.

Mr. R.M. Richards (Horticulture Department), for teaching me the art of making cuttings and for arranging plant propagation facilities.

Prof. R. Behrens (Minnesota) for his advice and encouragement and for supplying the ^{14}C-2,4-D.

Dr. David Penny and members of the Botany and Zoology Department for use of the liquid scintillation counter.

Dr. G.G. Pritchard, (Chemistry, Biochemistry and Biophysics Department) and Dr. Laurie Kennedy (Applied Biochemistry Division D.S.I.R.) for their help in preparing and scanning the paper chromatograms.

Dr. G.W. Mason (I.W.D., New Plymouth) for his interest in this project.

Mr. R.M. Greenwood (Rhizobium Laboratory, D.S.I.R.) for supplying rhizobia to innoculate the gorse plants.

Miss K. Kard (Physics and Engineering Laboratory, D.S.I.R.) for her cooperation and help in the scanning electron microscopy study.

Dr. David Woolley (Horticulture Department) for his encouragement and help in developing the autoradiographs.

Mrs. M. van Reenen for translating the Schicke and Linden (1963) paper.

Prof. B.R. Watkin, Mr. Alex Chu and other members of the Agronomy Department for their interest and encouragement during the course of the project.

Dr. R.W. Brougham (Grasslands Division, D.S.I.R.) who permitted me to work full time writing this manuscript during the initial months of my employment with Grasslands.

My wife, Shirley Rolston for her assistance during the project and in preparing this manuscript.

Mrs. J. Humphries for typing this manuscript, Miss M.E. Soulsby (D.S.I.R.), for preparation of the plates and the staff of the Massey Printery for the production of the figures.

Ivon Watkins Dow Ltd., New Plymouth, are thanked for the herbicide formulations they supplied; and the Dow Chemical Company, U.S.A. for the gift of 105 uc ^{14}C-picloram.

Financial assistance from the N.Z. Weed and Pest Control Society and the Farmers Union Scholarship was gratefully received.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

LIST OF PLATES

AFTER PAGE

AFTER PAGE

LIST OF APPENDICES

ABBREVIATIONS AND HERBICIDE COMMON NAMES

ai	active ingredient
amiben	3-amino-2,5-dichlorobenzoic acid
ATP	adenosine 5'-(tetrahydrogen triphosphate)
CEPA	2-chloro-ethyl-phosphoric acid
cpm	counts per minute (ie the number of cpm recorded)
2,4-D	2,4 - dichlorophenoxyacetic acid
2,4-DB	2,4-dichlorophenoxy butyric acid
2,4-DP	2,4-dichlorophenoxy propionic acid
DEF	s,s,s-tributyl phosphoro-trithioate
DCMU	3-(3,4-dichlorophenyl)-1,1-dimethylurea
dicamba	3,6-dichloro-2-methoxybenzoic acid
dichloroprop	2-(2,4-dichloro phenoxy) propionic acid
diquat	1:1'-ethylene-2',2-dipyridylium dibromide
DMSO	dimethyl sulfoxide
DNP	2,4-dinitrophenol
dpm	disintergrations per minute (ie cpm x efficiency of counting/100)
ethrel	2-chloroethyl phosphoric acid
GA	gibberellic acid
IAA	indole-3-acetic acid
IBA	indole-3-butyric acid
MCPA	4-chloro-2-methylphenoxyacetic acid
NAA	1-naphthalenacetic acid
piclorem	4-amino-3,5,6-trichloropicolinic acid
ppm	parts per million
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	2,4,5-trichlorophenoxy propionic acid (silvex)
TCA	trichloroacetic acid
ULV	ultra low volume