

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. LITERATURE REVIEW	5
A. Historical background	5
B. Upward movement of minerals	25
C. Effects of radioisotopes on plants	42
III. EXPERIMENTS WITH RADIOPHOSPHORUS (P-32)	48
A. Materials and methods	48
1. General procedure	48
2. Culture of plants	48
3. Use of P-32 and measurement of radioactivity	50
4. Leaf holder	55
5. Sources of error in counts of radioactivity	58
6. Behavior of radioisotope as index to behavior of natural element	64
7. Numbering of leaves	66
8. Control of transpiration rates	66
9. Miscellaneous	68

10. Experiments to observe uptake, accumulation and distribution of P-32 under normal greenhouse conditions . . .	69
Experiment 1	69
Experiment 2	72
Experiment 3	75
11. Experiments to test effect of changes in rates of transpiration of entire plants on rates of accumulation of P-32 in leaves	76
Experiment 4	79
Experiment 5	80
Experiment 6	82
12. Experiments to test effects of differences in transpiration rates of individual leaves on their rates of accumulation of P-32 and Ca-45	89
Experiment 7	89
Experiment 8	91
B. Results	93
1. Uptake of P-32 from nutrient solution	94

	Page
2. Course of accumulation and distribution of P-32 in leaves	97
3. Distribution of P-32 among various plant fractions	105
4. Effects of changes in rates of transpiration of entire plants on rates of accumula- tion of P-32 in leaves	107
5. Effects of differences in rates of transpiration of individual leaves on their rates of accumu- lation of P-32 (and Ca-45)	112
6. Accumulation of P-32 in leaves in absence of transpiration	115
7. Cumulative effects of low illumination on rate of accumulation of P-32 in leaves	117
8. Movement of P-32 into leaves above break in stem	122
C. Discussion	124
IV. EXPERIMENTS WITH RADIOCALCIUM (Ca-45)	137
A. Materials and methods	137
B. Results and discussion	143

	Page
V. SUMMARY	148
BIBLIOGRAPHY	151
TABLES	158
FIGURES	168