THESIS

EFFECT OF SALT IN WATER UPON PLANTS WHEN USED TO WATER GREENHOUSE PLANTS

W. S. REITERMAN

1915

THESIS

THESIS

THE EFFECT OF SALT IN WATER UPON PLANTS WHEN USED TO WATER GREENHOUSE PLANTS.

Submitted by

W. S. Beiterman

To The Horticultural Department,

Michigan Agriculture College

June, 1915.

THESIS

5-16-45

PREFACE

Many parts of Michigan are covered with extensive salt beds, which are the remains of salt lakes formed many centuries ago. The people living in these salt regions have to use water containing more or less salt in all of their work.

There are many greenhouses located in these regions. The people owning these houses are having trouble with their plants dying, and the following experiment was run to determine whether or not it was due to the salt in the water that the plants were dying.

THE EXPERIMENT.

The work of the experiment was carried onin a portion of the College greenhouse which runs east and west. It is an even-span house. The part in which the work was done is used as a carnation and crysanthimum house during the fall and winter.

A portion of a solid bed four feet wide and one hundred feet long was used. The part used was divided into seven spaces approximately four feet by four feet. Each of these spaces had eight greenhouse plants of the following varieties Snapdragoon (Antirrhinum majus), Marguerite (Chrysanthemum leucanthemum), Geranium (Geranium sanguineum), Selvia (Selvia splendens), Coleus (Coleus blumei), Heliotrope (Heliotropum peruvianum), Calla Lily (Richardia aethopica) and Petunia (Petunia argentia). These plants were placed as a dividing line between the different beds. The pots were sunk in the soil upon boards,which were used to keep the roots from growing out thru the bottom of the pots and into the soil which

was watered with a weaker solution of salt than the one they were supposed to grow in.

There was a board sunk edgewise so that it was down even with the edge of the board upon which the pots were standing. This was to keep the different strength solutions from passing from bed to the other and so spoiling the experiment.

In between each of the rows of pots were planted two rows of early beans and these were interplanted with three rows of radishes so that we might test the effect of salt upon the germination of seeds and the growth of young plants.

The first of the seven plats was watered with a solution containing one and one-half pounds of salt to the gallon of water or a sixteen per cent solution. This strength was to start with at the recommendation of prof. C. P. Halligan.

The second bed was treated with a solution containing one pound of salt to a gallon of water or a twelve per cent solution.

The next bed was watered with a salt solution in

which one-half pound of salt was dissolved in a gallon of water. This was a six per cent solution.

Upon the fourth bed a three per cent solution was used. This was made by dissolving four ounces of salt in one gallon of water.

In the fifth plot the plants wer watered with a solution containing two ounces of salt to the gallon of water or a one and one- half per cent solution.

A seventy-five per cent solution was used upon the sixth plot. This solution was made by dissolving an ounce of salt in a gallon of water.

The seventh plot was used as a check. This was watered with tap water to see that it was not the water that was killing the plants but the salt that was contained in it.

The plants were watered for the first time April, 23 1915, and were watered every day except Sunday when it was thought necessary. Due to the cloudy weather the plants did not need as much water as they would have otherwise.

THE RESULTS.

All of the plots were given the same amount of water. The plants in the first plot watered with the sixteen per cent solution died almost immediately. The Heliotrope, Coleus Salvia, and Calla Lily died after the first watering. The Geranium began to wilt after this watering but was alive at the second watering, but it was dead the third morning when the other plants were watered. The other plants in this plot, i.e. the Snapdragon, the Marguerite and the Petunia all died after the third watering.

The tops of the plants in this plot were then cut off and the pots flooded with tap water several times and then watered regurally with tap water to see if the roots were all dead. The flooding was to tryand wash the salt from the roots. The plants did not start up again.

Of the plants in the second plot watered with the twelve per cent solution the three plants belonging to the

Mint family were the first to die. These were the Selvia, the Heliotrope and the Coleus. They died after the second watering, while the Geranium and the Calla Lily lived until after the third. As in plot number one the woody plants lived the longest. They died after the fourth watering.

The plants watered with the six per cent solution did not die immediatly but where every the leaves were touched with any of the water they were burned. This was true with all of the salt solutions.

The plants all lived for nearly a week when watered with a six per cent solution, but as in the above two plots the plants belonging to the Mint family were the first to die off. The Heliotrope dying after the fifth watering and the Coleus and Selvia dying the next day. The Petunia in this plot came into flowering upon the sixth day and the flowers did not open out to their fullest width and the plant died upon the eighth day. The Calla Lily also died at this time, while the Marguerite and the Snapdragoon lived until the tenth day.

The fourth plot upon which a three per cent solut-

ion was used was watered for two weeks before any of the plants died. The first plant to die was the Heliotrope. This died at the end of two weeks. The second plant to die was the Snapdragon. This produced perfect flowers but could not live thru the drain upon its system. The Marguerite also produced flowers, acouple of days later, which were perfect, but not as large as those produced by the plant upon the check plot. The Marguerite died before it was thru flowering. Upon the seventeenth day the Coleus and the Selvia were both dead. At the end of the third week the Calla Lily, Ceranium and the Petunia were dead.

The plants in the fifth plot where they were watered with a one and one-half per cent solution all lived for over a month. The first plant in this plot to die being the Geranium. This plant was in flower. The Marguerite second and the Snapdragoon third. They came into flowering in this order. The Coleus was next followed by the Heliotrope and the Selvia. At the end of the fifth week the Petunia sent out flowers but these only opened up a little way and then dropped off and

the plant died.

This was the first plot in which and of the seed germinated.In this three bean seeds germinated but the young plants were killed before they had thier perminate leaves. A few of the radishes also germinated, but all but a few of these died. Those which lived grew very slowly.

In the last plot where salt was used the plants lived until the sixth week at the end of which time all the plants but the Petunia, the Calla Lily and the Marguerite were dead and these had begin to die.

All but six of the eighteen bean seeds planted came up, but three of these died before they had their perminent leaves, while the rest were misshapened and slow growing. The radishes had about sixty per cent of the seed germinate. Half of these died and the rest grew very slowly.

In the check plot the plants all grew well. Of the sixteen bean seeds planted all but two germinated and grew. About eighty per cent of the radishes came up.

The plants in this plot needed watering oftener

than did those which were watered with a salt solution.

The plants that were watered with a smaller amount of salt in the water first begin to show the effects by having the lower leaves turn yellow and then dropping off.

That salt is not always injurious unless applied continuously is shown by the result derived by the experiments of many of the experiment station workers. They in most cases applied the salt to the soil directly and not thru the medium of the water.

L. L. Harter (1) showed that barley and wheat grown in an alkaline soil of which the principle salt was common salt modified the leaves to fit the envirement, i. e. the cuticle thickened and the cells became smaller. Transpiration was also lessened.

A. D. Hall (2) in some conclusions given in 1909 on the secondary action of manures in the soil states that "soluable potash manures and common salt may also injure the tilth of heavy soils thru the production of a little soluable alkali by the interaction of a carbonate of lime in the soil. The

remedy for this is to apply it in conjunction with superphosphate."

I. G. McBeth and H. C. Wright (3) came to the conclusion that "Nitrification in the soil is inhibited by carbonate, chlorides and sulphates, the former having the strongest effect and the latter the least effect."

E. Laurent (4) states that salt when applied lightly tends to cause some plants to have a long slender root growth.

A. Rasele (5) found that common salt worked unfavorably as a fertilizer, especially when applied to legumenous plants. The exception to this being the lupines where salt was advantageous. In his work ten grams of salt were used to eleven and onh-half kilograms of soil.

In an experiment to test the effect of salt upon plants J. Kuijper (6) used salt solutions varying from 0.025 per cent to a 4 per cent solution. This was used upon coffee gocoa and other plants. It was found that the plants were injured with a solution varying from 0.05 per cent to 1.05 per

cent.

J. A. Voëlcker (7) found that the seeds of barley when soaked in a salt solution were injured, this injury was increased with the strength of the solution.

An experiment was made by F. B. Guthrie and R. Helms (8) to see what effect salt had upon the germination of seeds. They found that germination was effected by an 0.05 per cent solution and that it was prohibitted by an 0.20 per cent solution. Growth was effected by a solution containing between 0.05 per cent of salt and one containing 0.15 per cent of salt. Growth was entirely prevented by a solution containing 0.80 per cent of common salt.

THE CONCLUSIONS.

1. Salt in water will kill plants if applied for a long enough time. It makes no difference how small the amount of salt.

2. Plants are more susceptable to the effects of salt than are the same plants when they are not in bloom.

3. The more woody the plant the greater amount of salt it can stand.

4. Plants watered with a salt solution do not require watering as often as do plants watered with water not containing salt.

5. Seeds that germinate before the salt is above a certain point in the soil will grow until the salt reaches a per cent at which the plants are killed.

6. Seeds will not germinate in as strong a solution of salt as the plants will grow in.

THE BIBLIOGRAPHY

(1) L. L. Harter; U. S. Dept. of Ag. Bureau of Plant Industry, Bulletin No. 134 pp. 22

(2) A. D. Hall; Journal of the Royal Agricultural Society, England No. 70 (1909) pp. 19-35.

(3) I. C. McBeth and R.C. Wright; Abstracts in Science, New Series, Vol. 35(1912) No. 897, P. 392.

(4) E. Laurent; Bulletin of Agriculture, (Brussels) Vol. 19 (1903), No. 5, pp. 630-647. Pls. 2.

(5) A. Ruschle; Journal Landw, Vol. 60 (1912) No. 4 pp. 305-365.

(6) J. Huijper; Dept. Landb. Suriname, Bulletin No. 28, 1912, pp. 25-31.

(7) J. A. Voelcker; Journal of the Royal Agricultural Society., No. 62 (1901) pp. 317-334, figs. 2.

(8) F. B. Guthrie and R. Helms; Agricultural Gazette, New So. Wales, No. 14 (1903) No.2 pp. 114-120.