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DR. CHARLES HESS. I think you have taken a very difficult subject and have generalized many cases to a point where I feel your explanations are of questionable use and sometimes questionable accuracy. I would like to see you take these theoretical approaches and work out a practical use for them In other words suggest a soil mixture which will have the proper drainage and a fertilization program which will provide the proper nutrients.

DR BAUMGARTNER It might be very well. In the last eight years I have been working on a production basis with nursery superintendents and people who do not understand, because of their interest and their efforts, in an altogether different direction It is a matter of transplanting the significance of some of our important technical material to rule-of-thumb or common language. It is a most difficult thing to do.

MODERATOR JOHNSON: Thank you It was a stimulating talk that should create some arguments, but I think we had better defer them until after the lunch period, since we are now exactly on time.

Another subject connected with the soil problem, a subject dear to the hearts of many of us in the Midwest and adjoining parts of Canada, is iron chlorosis. Dr Brown is with the U.S D.A. Agricultural Research Service at Beltsville, and he will address us on this problem of iron chlorosis.

Dr John C. Brown presented his address on "Genotype of Rootstock as a Factor in Plant Nutrition with Emphasis on Iron Chlorosis." (Applause)

GENOTYPE OF ROOTSTOCK AS A FACTOR IN PLANT NUTRITION WITH EMPHASIS ON IRON CHLOROSIS

JOHN C. BROWN
Soil and Water Conservation Research Division
U S Department of Agriculture
Beltsville, Maryland

Chlorosis is a general term which denotes a yellowing in plants, a condition related to a large number of abnormalities. The more specific term, iron chlorosis, refers to a "chlorosis" which can be alleviated by providing the plant with suitable iron compounds. This disorder is particularly prevalent on calcareous soils where it is difficult to keep iron in forms which are available for all plant growth. It may occur on neutral or slightly acid soils, especially where so-called acid-loving plants such as azaleas, rhododendrons, and blueberries are grown. Growth medium, fertilizer, organic matter, and water are all contributing factors to this yellowing or iron deficiency (1). Soil and/or plant treatment for control is often difficult, but can be achieved by the care-

ful and persistent gardener. Where possible, most satisfactory results will be obtained by choosing plants that are chlorosis resistant.

Several thousand observations of chlorosis have been made in the southern Great Plains area on 183 species and varieties of plants (3) These observations include a wide variety of ornamental trees, shrubs, vines, and perennials, along with fruits and fields of sorghum, buffalo and blue grama grass Thorne and Wann (5) tested the susceptibility of 32 different species of shrubs and 10 different species of trees to iron chlorosis and found a great deal of variability between species. The fact that plant species differ in their susceptibility to iron chlorosis (1) indicates that in addition to an external medium effect there must also be an internal plant difference affecting the absorption and translocation of iron. As iron supply becomes limiting, competitors with iron in the absorption process become more important as possible causes of iron chlorosis

Absorption of other elements is known to be dependent upon plant species or variety. Pope (4) found that when Utah 10B celery, a variety susceptible to a magnesium deficiency, is crossed with Summer pascal, a non-susceptible variety, F2 plants are obtained in the ratio of 3 non-susceptible to 1 susceptible The susceptible variety is a less efficient absorber of magnesium than the nonsusceptible variety.

Grafting or budding chlorosis-susceptible varieties on chlorosis-resistant rootstock is one of the methods of treatment suggested to prevent and to control iron chlorosis Grafting labrusca grape varieties on vinifera grape rootstock has been particularly successful as a method of correcting iron chlorosis in American grapes (6). Many European (vinifera) varieties exhibit a high degree of resistance to iron chlorosis. When labrusca rootstock, chlorosis-susceptible variety, were used in southwestern Europe to combat phylloxera, an insect pest, numerous crops failures resulted because of iron chlorosis.

PI-54619-5-1 soybean (PI), susceptible to chlorosis, are inefficient and Hawkeye soybean (HA), nonsusceptible to chlorosis, are efficient in their ability to absorb and translocate iron from a given nutrient medium. PI soybeans develop an iron chlorosis on most naturally calcareous soils and on solution cultures containing less than 5 ppm inorganic iron Iron chlorosis has been induced in PI soybeans by increasing the phosphorus and copper concentration of a given nutrient culture. In contrast, HA soybeans were nonchlorotic when grown under each of the above conditions. Both the HA soybean and the vinifera grape may be called efficient absorbers of iron.

Approach grafts have shown that the rootstock of the PI and HA soybeans are regulatory to the absorption and translocation of iron from a growth medium (2) Grown on a growth medium of limited iron supply, PI-top on PI-root was chlorotic, HA-top on HA-root was nonchlorotic, PI-top on HA-root was nonchlorotic, and HA-root develop chlorosis. The HA-rootstock absorbed and translocated more iron to the tops of the plant than PI-rootstock. This difference in iron absorption is genetically controlled (7) and a knowledge of the mechanism involved is believed to be fundamental to an understanding of iron absorption by plants.

Iron was inactivated internally in PI soybeans by the combined effects of phosphorus and calcium in nutrient culture, which was separated from the plant's source of iron by the use of a split-root technique. In contrast, iron was absorbed and remained mobile in HA soybeans under the same conditions of growth and element concentration Thus, genotype of rootstock is an important controlling factor in the absorption and utilization of iron from a growth medium.

Mineral nutrition, as affected by genotype of rootstock, is a subject worthy of more attention. It should be of particular significance to the plant propagators if they are to grow and develop plants adaptive to the varied growth media which are experienced in disseminating their product to the field.

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MODERATOR JOHNSON: Thank you. Dr. Brown By my watch we have one minute for possibly one or two questions.

MR JACK HILL (D. Hill Nursery Company, Dundee, Illinois): Would it be possible to construct imperical rules regarding these nutritional difficulties, or would it be necessary to run down and analyze each plant or each species, before general rules could be laid down?

DR. BROWN: My reaction to that question is that I believe that a nurseryman should be aware of where his material is going, or specifically the type of the soil his customer has. If you are selling in the Midwest, i.e , Oklahoma, Kansas, and on west, you should be very concerned as to whether or not your species is susceptible to this chlorosis.

MR HILL: How can you tell or predict this?

DR. BROWN: That is a thing that has to be worked out I think in growing plants, as far as the growth medium is concerned, I would not recommend the use of high phosphate levels. It has been our experience that high phosphate does not help the growth too much. You have to have some, but you don't need a lot of phosphorus in the growth medium. You do need calcium. I noticed one comment

about using ground rocks as a propagation medium I think one must be very careful in using ground rock for propagating plants, because it has been our experience that in some areas you get a batch which will not root anything Analysis of these showed a very high molybdenum content. If you have good sand and are getting good results I would stick to the sand, because I believe you should not use just anything as a growing medium, particularly ground rock.

MR W. A. CUMMING (Morden, Manitoba) What are the possibilities in apples, for instance, in getting genotypes of rootstocks that will tolerate these conditions you have described?

DR. BROWN: I think there is very great promise in this area I think that we are generally looking for something that is disease resistant and we forget the importance of nutrition in selecting genotypes

MODERATOR JOHNSON: I think we had better wind it up. I want to thank all the speakers of their cooperation in keeping within the allotted time and for their excellent papers The meeting is recessed until 1:30 P.M this afternoon.

The session adjourned at twelve-five o'clock.