MINNESOTA STATE FLORISTS' Bulletin

Agricultural Extension Service | Institute of Agriculture
University of Minnesota | St. Paul 1
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NEW HORTICULTURAL GREENHOUSES

Funds were provided at the recent session of the State Legislature for the construction of greenhouses to supplement existing facilities on the St. Paul Campus. At the time of this writing the plans have been assigned to a St. Paul architectural and engineering firm. No further information is available at the present time.

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NEW DEVELOPMENTS IN IRON CHELATES

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For many years, some plant species growing on soils high in lime content have often been subject to a yellowing of the foliage. In some instances the yellowing has been sufficiently severe to result in limited growth and often terminates in the premature death of the plant. Many species of horticultural plants are affected such as strawberries, raspberries, rose bushes, many tree fruits and even several tree species commonly used in windbreaks. In some towns of the Red River Valley area the yellowing may be observed in one or more plant species around many homes. Even though the plants survive, growth is not normal and the plants appear unhealthy during the entire growing season.

During the summer of 1956, experiments were carried out on chlorotic soybeans and flax plants in fields from Sibley to Marshall counties. The treatments consisted of several different forms of chelated iron as well as other iron compounds, all applied to the soil at rates to supply 10 pounds of iron per acre.

The application of the chelated iron compounds corrected the chlorotic condition and within 10 days maintained a healthy green color until maturity. Yields of flax were increased from 5 bushels per acre on untreated soils to 10 bushels of flax per acre where the chelated iron was applied to the soil. Similarly soybean yields were increased from 5 to 15 bushels per acre. The non-chelated iron treatments produced essentially no beneficial effect on vegetative color or on yields

The first chelated iron compounds developed corrected the chlorotic vegetative condition of susceptible plant species growing on acid or neutral soils containing limited amounts of available iron. However, these compounds were generally ineffective for a similar condition if the soils contained appreciable amounts of free lime.

Apparently the high lime soils often immobilized the iron present in the earlier chelation compounds. Additional research during the past few years has resulted in the development of a number of new chelation compounds. They can hold the added iron in the soil for some time in a form relatively available to plant species apparently unable to extract the naturally occurring iron from such soils.

Three of the effective chelated iron compounds tested (R. A. 157, R. A. 159, and APCA) are still not commercially available. The fourth, DTPA, is sold in Minnesota. In addition, a few other chelated iron compounds for use on high lime soils are now commercially available. Trade names and further information can be supplied by the authors or by the editor of this publication.

In 1957, much lower rates of chelated iron will be used, since there was some evidence of iron toxicity in some of the treated flax and soybean plants. Also the 1956 rates would cost about one hundred dollars per acre, which would be impractical for application to field crops.

However, the results obtained are already most promising for horticultural plants where relatively small soil areas of relatively high value plants are involved. Woody perennials probably will respond much more slowly than the annuals. Since several forms of chelated iron are now commercially available, it is suggested that some of these be tried where chlorotic vegetation due to iron deficiency is a problem.

Most chelated iron compounds vary from 4 to 10 percent iron. Soil applications of chelated iron varying from a pinch per flower pot to a small handful worked into the soil around an ornamental shrub could be well worth the effort.

Do not look for any rapid change in the woody perennial growth since it requires some time for the chelated iron to be carried down into the soil and be taken up by the roots. Applications early in the spring are also advised, since it is then the plant is growing rapidly and most in need of minerals.

Apply the treatment early, work it well into the soil, and do not hestitate to sprinkle well with water if dry weather follows the chelated iron application to the soil.

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pH - ITS IMPORTANCE IN GREENHOUSE SOILS

O. Wesley Davidson*

The purpose of this article is to assist greenhouse operators to understand the significance of pH tests made on their soils. Some growers appear to attach too much importance to pH determinations while others are inclined to ignore them unduly.

The degree of acidity of a soil influences the growth of plants in it because of the effect on the solubility and availability of nutrients and of toxic substances in the soil, and on the functioning of roots. These influences often are complex, involving many factors such as the rate of loss of nutrients, the activity of disease organisms, the functioning of nitrifying bacteria and the physical condition of the soil.

Keep pH in a Favorable Range

No plant has to be grown at any one particular pH value. Instead, plants

* Condensed from New Jersey Plant and Flower Growers Assoc. Bul. Vol. II, No. V. September 1952.

flourish best when grown in soils maintained within a favorable range of pH. A favorable range for one plant, however, may not be the most favorable for another. Nevertheless, soil reactions close to pH 6.5 appear to be most favorable for the majority of plants. At this reaction, all nutrients are available and the efficiency of their utilization by the plants is high. Even so, it is impractical and undesirable to attempt to maintain a soil at just pH 6.5. Instead, efforts should be made to keep the reaction between 6.0 and 7.0 in soils relatively high in organic matter and intensively fertilized. In such soils variations of several tenths of a pH unit occur frequently, due to temporary accumulation of acids, and usually are of no practical significance. In these soils, moreover, small portions that are strongly acid may be found only a fraction of an inch from portions that are alkaline in reaction. A well-mixed sample of soil fails to show these variations, even though they exist generally in the field as well as in the greenhouse.

It is fortunate that variations in pH occur within each small portion of soil in our benches and pots. By means of these variations in pH, plants are assisted in obtaining a balanced supply of nutrients. Iron and manganese, for example, are much more available to roots in soil having a reaction of 6.0 or below than they are in similar soil at pH values as high as 7.0. In contrast, phosphorus and molybdenum are usually more available in soil at 7.0 than at 6.0. The effect of watering or rain on soils is similar to mixing, in that it tends to make the reaction of the soil uniform - vertically at least.

An increase or a decrease of several tenths of a pH unit within a favorable range does not indicate a need for treatment. A gradual increase in acidity as revealed by successive tests, e.g., a drop in pH from 6.6 to 6.3, then to 6.1 and to 5.9 -- indicates a need for liming. On the other hand, if a soil were sampled when it was somewhat drier than usual and the pH test showed that it had decreased from pH 6.6 to 5.9 it does not necessarily follow that lime is required. If a nutrient analysis were made on the latter soil, and if it were found to contain liberal amounts of nitrates, it is very likely that a good watering that caused some leaching would restore the pH to 6.5 or higher.

Liquid Fertilizers Usually Acidify

There is an important exception to the explanation given in the preceding paragraph. Where one is fertilizing liberally with ammonium sulfate, for example, rapid decreases in pH may occur, especially in soils that are inherently acidic. Each pound of ammonium sulfate used in such soils will create somewhat more acidity than can be neutralized by a pound of limestone. Nearly all liquid fertilizers are acid forming and their frequent use, therefore, may result in a drop in pH unless corrected by the use of limestone.

Representative Sampling is Important

The importance of collecting representative samples of a soil should be emphasized. To do this usually requires sampling a bench in 8 or 10 or more places. A representative sample should consist of fairly uniform cores of soil extending from the surface to the bottom of the bench. The cores, in other words, should not comprise mainly the upper portion of soil, but should be representative of the whole depth.

When it is desirable to change the pH of a greenhouse soil, it is important to realize that these soils have been specially fortified with organic matter through the incorporation of sod, manure or peat, or through the use of organic mulches. Because of this, these soils have the capacity to utilize liberal applications of limestone without danger of overliming. It is seldom advisable to apply less than 5 to 8 pounds of pulverized limestone per 100 square feet of soil in beds or benches. Applications of as little as 2 to 3 pounds of limestone, or as little as 1 pound of sulfur per 100 square feet in an effort to change pH values by a few tenths are of doubtful practical significance.

Relative Acidifying or Alkalinizing Power of Various Fertilizing, Liming, or Acidifying Materials Rated in Terms of Commercial Limestone (Calcium Carbonate) as 1.0

Material	Acidifying	Aklalinizing
Dolomitic Limestone	...	1.1
Hydrated Lime (Calcite)	...	1.4
Hydrated Lime (Dolomitic)	...	1.7
Sodium Nitrate	...	0.3
Calcium Nitrate	...	0.2
Potassium Nitrate	...	0.2
Ammonium Nitrate	0.6	...
Ammonium Sulfate	1.1	...
Mono-Ammonium Phosphate	0.6	...
Di-Ammonium Phosphate	1.1	...
Urea	0.8	...
Sulfur	3.1	...
Ferrous Sulfate	0.2	...
Aluminum Sulfate	0.5	...

Acidifying and Alkalinizing Materials

In an effort to clarify the influence of various fertilizing, liming and acidifying materials on the reaction of greenhouse soils, the above table was prepared. It shows, for example, that 1 pound of dolomitic limestone is equivalent in neutralizing, or in alkalinizing, capacity to 1.1 pound of ordinary calcite, or high-calcium limestone. Similarly it shows that, unlike the ammonium forms of nitrogen, a pound of sodium nitrate assists in raising the pH of a soil about as much as 0.2 pound of limestone. In contrast to these materials, a pound of ammonium nitrate will develop sufficient acidity to require 0.6 pound of limestone for neutralization. One pound of sulfur will gradually decrease the pH of a soil to such an extent that 3.1 pounds of limestone would be needed to neutralize that acidity. One pound of aluminum sulfate will quickly acidify a soil to a degree requiring 0.5 pound of limestone. Stated another way, a pound of aluminum sulfate will acidify a soil about as much as a half a pound of limestone will raise the pH.

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CHANGE

A previous issue of this bulletin stated that Research Bulletin 786 of the Ohio Agricultural Experiment Station entitled Carnation Crop Control was available for a nominal fee. Single copies are now available free of charge from the Mailing Room, Ohio Agr. Exp. Sta., Wooster, Ohio.

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GIBBERELLIC ACID*

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An amazing new chemical, gibberellic acid, may prove to be a very valuable tool for greenhouse flower production. Gibberellic acid is now available to greenhouse growers; but specific recommendations for application to individual crops will have to wait until research being conducted at many university experiment stations is completed and results are known.

Japanese scientists studying a "foolish seedling" disease of rice isolated several chemical compounds which have been named gibberellins. Studies have demonstrated that the response of plants is similar to the various gibberellin compounds, one of which is gibberellic acid.

In the "foolish seedling" disease, rice plants grow so rapidly in length that they grow themselves to death. The disease occurs as a result of infection by the fungus Gibberella fujikuroi. It is this fungus that produces the chemical compounds known as the gibberellins. The chemicals and not the fungus cause the stems of rice plants to grow rapidly in length. For application to crop plants, the gibberellins are produced in pure culture in the same way as antibiotics like penicillin are produced.

Some very dramatic effects on plant growth have been observed following treatment with gibberellic acid. The most obvious response has been an increase in stem elongation. Four weeks after application at rates as low as one part per million, geraniums, dahlias, poinsettias, roses, salvia, asters and petunias were three to four times taller than untreated plants. Some plants also increased in fresh and dry weights as a result of treatment with gibberellic acid.

Other plants, gladiolus in particular, did not respond to gibberellic acid applied to the base of the plants or when corms were soaked for 17 hours. Only a very slight increase in stem length occurred with evergreens such as white pine and spruce after treatment.

The effect of gibberellic acid applied in a lanolin paste on several floricultural crops is presented in Table 1. This information is reprinted from a paper published by Marth, Audia and Mitchell, research workers at the USDA Research Laboratory at Beltsville.

The greatest response to treatment with gibberellic acid occurs in young plants or stems just beginning to elongate. As plants mature, the effect of a given dosage decreases. The type of crop determines the need for single or repeated applications of the chemical.

Wittwer and his co-workers at Michigan State University report that dwarfism in many crops can be eliminated by treatment with gibberellic acid. Bush beans develop twining vines and climb like pole beans. Dwarf varieties of peas grow taller than the tall varieties. The dwarf strains of dahlias would probably lose their low growing habits and develop into tall plants similar to the many garden dahlias grown for cut flowers.

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* Taken from Pennsylvania Flower Growers Bul. 75, April 1957.

Table 1.--Responses of Some Floricultural Crops to Gibberellic Acid

Plant Tested	Concentration and Method of Treatment	Duration of Experiment (days)	Percent Increase in Stem Length Over Checks	Observed Differences Between Treated and Untreated Plants
Ageratum (Blue Cap)	1% lanolin, stems	27	44	Pronounced increase in number and length of lateral shoots.
Dahlia (Dwarf variety)	1% lanolin, stems, roots	42	80	Stem treatment: flowers opened 7 to 10 days earlier, treated stems thicker. Treatment of dormant roots ineffective.
Geranium	0.125, 0.25, 0.5, 1% lanolin, stems	45	191-225	Flowers of treated plants opened 1 week later; elongated stems as thick and sturdy as untreated ones.
Gladiolus (Spotlight)	1% lanolin, applied to sheath leaves; 1, 10, 100ppm, soak (17 hrs.) Corms	60	0	No apparent responses.
Hydrangea (Todi)	0.5% lanolin, stems	14	100	Accelerated stem growth on cuttings.
Petunia (Purple Prince)	1% lanolin, stems	23	61	Treated plants blossomed more profusely and 10 days earlier than untreated ones.
Poinsettia (Barbara Ecke)	0.125, 0.25, 0.5, 1% lanolin, stems	44	77-125	0.25% paste resulted in tall marketable plants. Leaves and bracts widely separated by long internodes at the higher concentrations.
Salvia (Dwarf variety)	1% lanolin, stems	30	150	Treated plants blossomed 7-10 days earlier.
Snapdragon	1% lanolin, stems	24	50	Lateral branches developed at all nodes of treated plants. No branching of controls.

Several biennial crops such as carrots, beets and cabbage require a cold treatment before they will flower and produce seed. It has been possible to bypass this cold treatment and induce flowering by treating these plants with gibberellic acid. At Michigan State University, the flowering of stocks (Mathiola incana) has been hastened as much as 2 to 5 weeks, and some varieties flowered at temperatures above 60° F. This high temperature normally prevents the flower initiation of stocks.

At the Beltsville Open House in January, research by Stuart indicated that the cold treatment necessary for breaking dormancy in Hydrangeas may be eliminated by applications of gibberellic acid. This possibility has not been completely proven experimentally and therefore cannot be suggested for commercial use. A report by Kofranek at the University of California indicated that stem elongation and earlier flowering of China asters occurred following treatment with gibberellic acid. Normally the stems of asters will not elongate unless the daylength is longer than 15 hours or the temperatures are above 70° F. Asters treated with gibberellic acid developed long stems and flowered at cool temperatures and under short day conditions.

These growth responses from gibberellic acid are phenomenal. Present information, however, is limited to a few reports and observations on flower and vegetable crops. The rates and frequency of application, the effects of temperature, light and humidity, and the exact state of plant development for optimum effects on plant growth need to be worked out. Research workers are agreed that optimum conditions of light, temperature and mineral nutrition will be necessary to get maximum effect from the chemical. AS WITH ANY NEW MATERIAL FOR WHICH EXPERIMENTAL RESULTS ARE NOT COMPLETE, IT SHOULD BE USED WITH CAUTION ON A SMALL SCALE TO SEE WHAT IT WILL DO.

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<u>BEES</u>*

Importance:--The honey bee and the silkworm are the only two insects that have been domesticated and their activities directed so that the products resulting from their life process are valuable to man. In addition to producing about 400,000,000 pounds of honey and 15,000,000 pounds of beeswax, honey bees and some 5,000 species of wild bees are responsible for the pollination of a large number of our fruit, flower, vegetable and other plants. It is estimated that honey bees are responsible for about 80 percent of the flowers pollinated by bees and it is reported that bumble bees alone are worth tens of millions of dollars to the American farmer annually for their work as plant pollinators.

However, these habits of pollination sometimes conflict with the desires of the flower grower, especially the snapdragon grower who wishes to prolong the life of the blooms by preventing pollination, or who wants to control the pollen parent.

Habits:--Except for an occasional colony of honey bees that may have established their nest in a tree or some similar place, most of the honey bees that visit a greenhouse come from someone's apiary. If this occurs, every effort should be made to get the apiarist to move his bees out of the range of the greenhouse, which means a mile or more.

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* Condensed from <u>Edco News Letter</u> Vol. 7, No. 5, Nov. 26, 1956.

Other bees that sometimes cause trouble in greenhouses are bumble bees, carpenter bees and miscellaneous solitary bees. The habits and life history of bees vary greatly. In general, bumble bees select well protected places either above or below ground, frequently in abandoned mice nests.

Another bee that may be found in and around greenhouses is the large carpenter bee, Xylocopa Virginica. This is a large insect resembling a bumble bee in size and somewhat in appearance, being frequently mistaken for it. This bee builds its nest in solid wood, and sometimes excavates a tunnel a foot in length which it divides into several cells in which the young are reared. Although many of these bees may build their nests in the same area, they are really solitary bees that do not have a caste system like the honey bees and bumble bees.

Control:--At the Maryland Short Course in February, Fred Winkler, the well known snap breeder of Washington, D.C., told of an interesting method of reducing the number of bees that interfered with the controlled pollination of his snapdragons. He used a greenhouse DDT bomb in his wooden potting and storage sheds, aiming it particularly at the rafters where the carpenter bees have been boring holes to make their nests.

Bombing infested greenhouses with DDT would undoubtedly kill all bees present at the time of bombing, and leave enough residue on the plants to kill those flying in on successive days, but sunlight breaks down the DDT and the bees are attracted to newly opened flowers unprotected by the DDT deposit.

Bombing with parathion and with dithio bombs should also kill any bees that are present at time of treatment as well as most other insects, but the residue would not be effective for as long as that from a DDT bomb. However, the parathion has some residual repellent action.

Spraying with rather heavy applications of DDT should also reduce the number of bees present. If found, nests of bumble bees should be destroyed in the vicinity of greenhouses and hives of bees should be moved away from the greenhouse area.

TABLESPOONS OF FUNGICIDES FOR USE IN GALLON LOTS OF SPRAY*

FUNGICIDE	POUNDS PER 100 GALLONS ½	1	1½	2	4	6	8
	Level Tablespoons to Use in 1 Gallon of Spray						
Captan 50% WP	3/8	3/4	1 1/8	1½			
Chloranil 96% WP(Spergon)	½	1	1½	2			
Copper Sulfate(snow)	1/6	1/3	½	5/8	1¼	1 7/8	2½
Dichlone 50% SP(Phygon)	1/3	2/3	1	1 1/3			
Ferbam 76% WP	5/8	1¼	1 3/4	2½			
Fixed Copper 50%	¼	½	3/4	1	2		
Karathane or Mildex	1/3	2/3					
Maneb 70% WP	¼	½	3/4	1			
Omazene	½						
Spray Lime	½	1	1½	2	4	6	8
Thiram 75% WP	3/8	3/4	1 1/8	1½			
Wettable Sulfur(Dry)	¼	½	3/4	1	2	3	
Zineb 65% WP	1/3	2/3	1	1 1/3			
Ziram 76% WP	5/8	1¼	1 3/4	2½			

SMALL AMOUNTS OF LIQUID FUNGICIDE

Number of Gallons of Fungicide Recommended for 100 Gallons of Spray	Number of Tablespoons to Use in 1 Gallon of Spray
12	32 (1 pint)
10	26 3/4 (4/5 pint)
1	2½

STREPTOMYCIN FORMULATIONS

Number of Teaspoons per Gallon of Different Trade Names to make a 100 p.p.m. Solution

Agri-mycin 100 15% WP	1½
Agri-Strep 29.5% WP	3/4
Miller Antibiotic Streptomycin Spray Powder 8.5% WP	2½
Ortho Streptomycin Spray 17% WP	1½
Phytomycin 20% liquid	½

* Taken from Recommended Fungicides 1957 p. 67
Penn. State Uni. Extension Publication (mimeographed)

HARALD THOMPSON

The passing of Harald Thompson of Rochester on April 9 was a loss to the florist industry, not only in Minnesota, but throughout the world. Harald was well known for his many accomplishments and well respected for his sincerity, humility and high ideals.

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In this Issue

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Skuli Rutford, Director

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