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FORCING HEAD LETTUCE: SOILS AND FERTILIZERS

F. H. HALL AND S. A. BEACH.

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*Connected with Fertilizer Control.
†Connected with Second Judicial Department Branch Station.

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BULLETIN NO. 146.

FORCING HEAD LETTUCE: SOILS AND FERTILIZERS.

F. H. HALL.

Soil problem stated.

Indoor lettuce forcing is yearly becoming a more important industry. Preparing the soil is its most laborious operation. Aches and pains, lame backs and blistered palms, have been gained in the shoveling, mixing and sifting which the varied compounds of loam, sand, clay, peat, manure and chemicals have needed; but little exact knowledge has been acquired. The amounts of the ingredients and even their character have been largely dependent upon the theories of the different forcing-house men and the compounds have been as varied as the growers are numerous. To ascertain definitely, if possible, what influence the texture of the soil has upon the character and yield of lettuce, the Station has carried on a series of experiments in the forcing house shown in Plate I.

Conditions.

For the first crop the south side bench and south middle bench were used; for the second and third, the north and south side benches; and for the fourth crop, to prevent the somewhat uneven distribution of moisture owing to rapid drying over the hot water pipes along the sides of the house and to permit sub-watering, new, deeper benches in two rows through the center of the house were used. In all cases the greatest care was taken to secure plants of equal vigor at the start; three plats, each growing from 20 to

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*This is a brief review of Bulletin No. 146 of this Station on Some Experiments in Forcing Head Lettuce, by S. A. Beach. Any one specially interested in the detailed investigations will be furnished, on application, with a copy of the complete Bulletin; and the name of any one who so requests will be placed on the Station mailing list to receive future bulletins, popular or complete as desired.

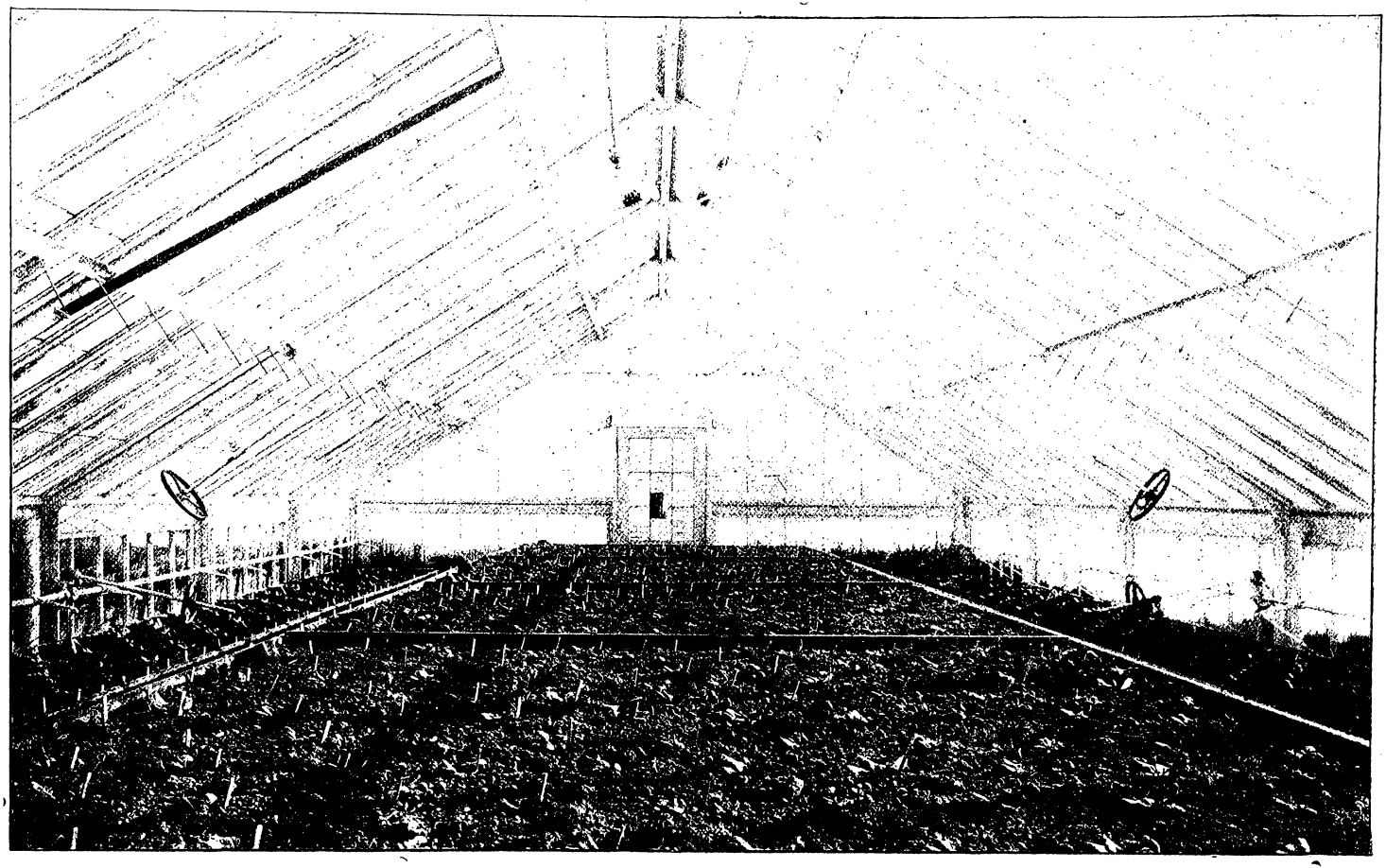

PLATE I.—LETTUCE FORCING HOUSE.

32 plants, were allotted to each soil; and plants on each soil had an equal share in light, heat, moisture and fertilizers. Head lettuce only was used, so the results must not be considered to apply to loose growing varieties. Loose lettuce might have done better on a different soil from that best suited to the variety tested; for on the light sand and manure mixture of one set of plats the head lettuce grew large and loose.

Crop I. In previous forcing work with lettuce a soil mixture composed of one part, by bulk, of sharp, unscreened lake sand, one part of stable manure and three parts of composted and well rotted clay loam sod and stable manure had given good results; so this was taken as a basis for Crop I. On one set of plats it was used as given, with 26 per ct. of sand; on another set the sand was increased to 42 per ct.; and on the third set to 52 per ct. Each soil contained many times as much nitrogen, potash and phosphoric acid as the lettuce could remove; so they could be counted equal in fertility.

There proved to be little difference in yield upon the three soils; but upon that containing 42 per ct. of sand the lettuce was slightly earlier than upon either of the others.

Crops II and III. In the next series the three sets of soil contained 32 per ct., 65 per ct. and 85.5 per ct. of sand. The loam in this crop was from clay loam sod as before, but it contained more sand and gravel. It had not been composted with manure; so more and somewhat richer manure was added in mixing—15.5 per ct. in each case—and liberal applications of sulphate of potash, acid phosphate and nitrate of soda were applied to all plats in equal amounts. In case of the last soil it will be noticed that sand and manure alone were used; and upon this soil the large, loose heads of lettuce of rather poor texture previously mentioned were grown. The larger size of the heads of these plats did not compensate for the firmness and better general appearance of the heads grown on the more compact soils; and the slight difference between the two soils containing loam was in favor of that containing less sand and more loam—the more compact soil. Crop III followed this upon the same soils, with the addition of more commercial fertilizers. The advantage in combined yield and quality of lettuce was with the more compact soils.

Crop IV. In Crop IV both clay loam, similar to that already tested, and sandy loam, were used; one set of plats was devoted to each loam alone, one set to each loam and half as much manure, and one set to a soil made up of one part clay loam, two parts manure and three parts sand. All received liberal supplies of soluble chemical fertilizers so that probably the principal role of the manure used was to lighten up the soils. The relative amounts of fine and coarse matter in the clay loam, the sandy loam and in a soil much used by Boston growers are represented in Plate II. The sandy loam, alone, gave better and slightly heavier lettuce than the clay loam alone; but of the two soils with one-third manure the clay loam gave much superior lettuce, earlier maturity and heavier yields than the sandy loams, or than any other soil tested with this crop. Of the two sandy loam soils the one lightened by manure gave poor results, as its texture was too loose for perfect capillary action; the lettuce was small, late and injured by tip burn. The addition of the manure to the clay loam gave the best results, as stated above, but loosening the texture more than this by the addition of sand proved injurious to the crop.

Results. Considering all the crops, then, it seems that the best results in forcing head lettuce, other conditions being equal, will come from the use of a soil of rather compact texture, containing a good proportion of fine sand, clay and silt, and moderately lightened with fairly well rotted horse manure.

First fertilizer test. At the same time with the soil tests of Crops II and III and using as a basis the most compact soil of that test—the one containing 52.2 per ct. of clay loam, 32.3 per ct. of sand and 15.5 per ct. of manure—a fertilizer experiment was carried on to test the relative merits of stable manure with and without acid phosphate and sulphate of potash and to ascertain the effect of increasing amounts of nitrate of soda. Upon one set of plats no chemicals were added, the manure furnishing the only fertilizing ingredients; in another set 600 lbs. per acre of acid phosphate and 400 lbs. of sulphate of potash were added; in a third, these chemicals were reinforced by 133 1-3 lbs. of nitrate of soda;

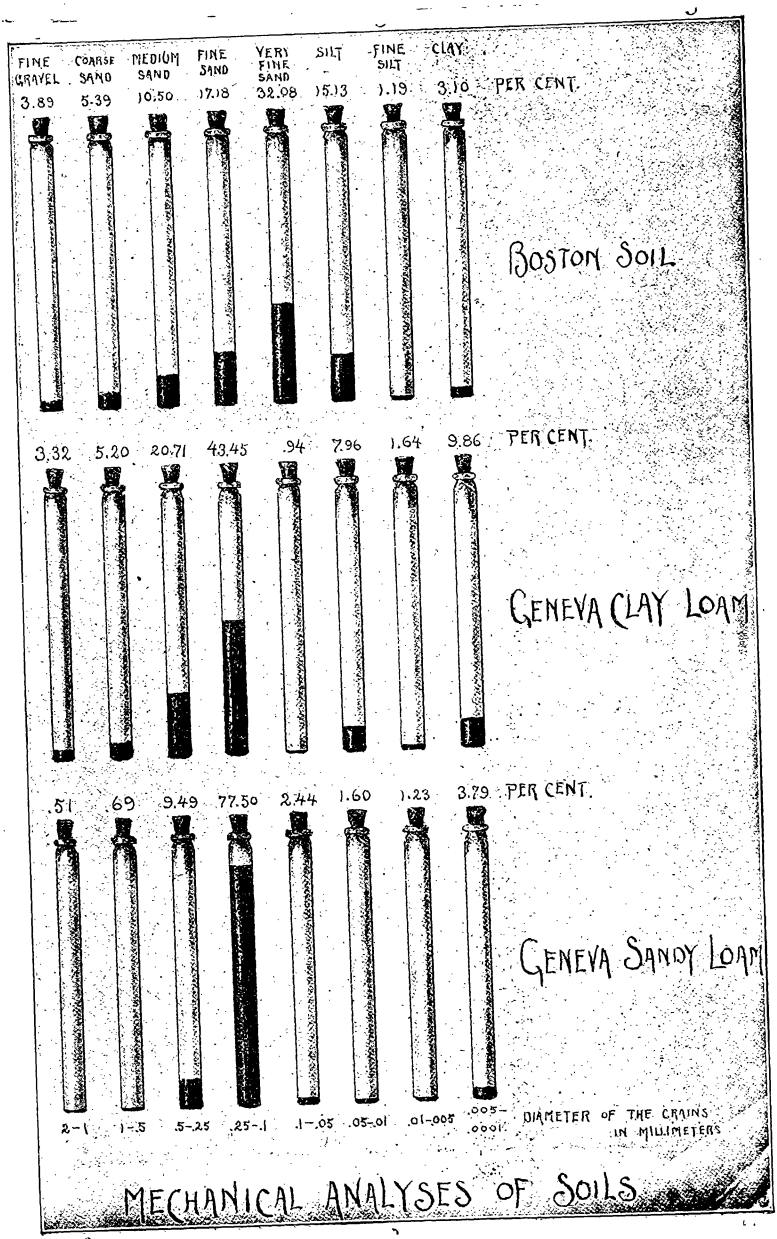
FINE GRAVEL
COARSE SAND
MEDIUM SAND
FINE SAND
VERY FINE SAND
SILT
FINE SILT
CLAY
3.89 5.39 10.50 17.18 32.08 15.13 11.19 3.16 PER CENT.
BOSTON SOIL
3.32 5.20 20.71 43.45 .94 7.96 1.64 9.86 PER CENT.
GENEVA CLAY LOAM
.51 .69 9.49 77.50 2.44 1.60 1.23 3.79 PER CENT.
GENEVA SANDY LOAM
2-1 1-.5 .5-.25 .25-.1 .1-.05 .05-.01 .01-.005 .005-.0001 DIAMETER OF THE GRAINS IN MILLIMETERS
MECHANICAL ANALYSES OF SOILS

PLATE II.

and in a fourth, by twice this amount of nitrate. When these crops were removed, the experiment was continued on the same soils, the fertilizer applications being repeated, except that the nitrate of soda was reduced to 100 lbs. and 200 lbs. In every case the fertilizers were practically thrown away; as there was no appreciable difference between the plats with and without the phosphate and potash in the first test; only a slight gain in weight and a retarding of maturity in the second test; while "In neither test did the use of nitrate of soda on the soils already well supplied with stable manure result in sufficient improvement of lettuce to encourage its use in this way."

Second fertilizer test.

Fertilizer tests were also carried on with Crop IV to test the advantages of commercial fertilizers alone, stable manure alone and combination of the two. Each of the plats in the soil test recived 600 lbs. per acre of acid phosphate, 400 lbs. of sulphate of potash and 366 lbs. of nitrate of soda; two of them contained no manure and three were made up of one-third manure. To these five plats there were added, for the fertilizer test, plats without fertilizers and containing respectively two-thirds sandy loam and one-third manure; two-thirds clay loam and one-third manure; and one-sixth clay loam, one-half sand and one-third manure. Comparing the plats which received commercial fertilizers without stable manure with those which received stable manure without commercial fertilizers we find that upon the sandy loam soils the commercial fertilizer plats did better than the stable manure plats; but the reverse was true upon the clay loam soils, for the lettuce on the stable manure plats was larger, less affected by tip burn and much earlier than it was on the plats receiving commercial fertilizers. It is evident that the same factor enters here that influenced the soil tests, and that texture, rather than source of food supply, is the cause of the difference. On soils which received both fertilizers and manure but little gain could be found in earliness or yield over those soils which depended upon manure alone for their sustenance. In some cases there was less tip burn upon the soils containing commercial fertilizers; but this difference was slight. In general it may safely be said that with one good supply of plant food it is a waste to supplement it with another. On sandy loams probably commercial fertilizers are best; on clay loams the lightening of the soil by stable manure gives that the preference.