

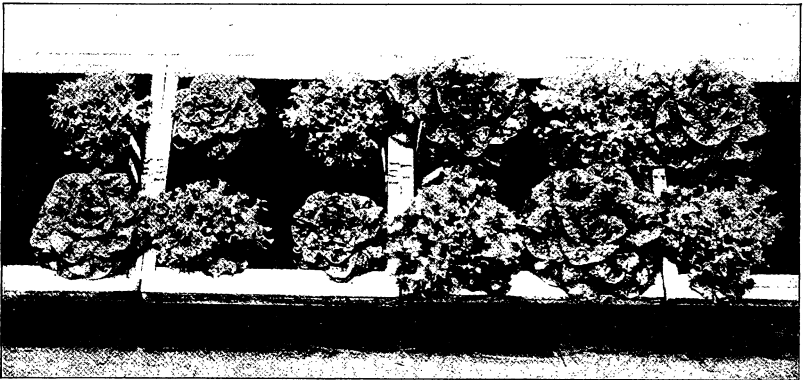
POPULAR EDITION.

BULLETIN No. 208.

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New York Agricultural Experiment Station.

GENEVA, N. Y.



SANDY LOAM.

CLAY LOAM.

COMMERCIAL FERTILIZERS AND 20 PER CT. MANURE.

FERTILIZERS FOR FORCING LETTUCE.

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

PUBLISHED BY THE STATION.

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Address all correspondence, not to individual members of the staff, but to the NEW YORK AGRICULTURAL EXPERIMENT STATION, GENEVA, N. Y.
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* Connected with Fertilizer Control.

† At Second Judicial Department Branch Station, Jamaica, N. Y.

¶ Absent on leave.

POPULAR EDITION*

OF

BULLETIN NO. 208.

FERTILIZERS FOR FORCING LETTUCE.

F. H. HALL.

Wasteful methods. In intensive agriculture there is often a tendency to waste plant food. This has been proved true, as regards the use of commercial fertilizers in field culture, by Station tests with potatoes and onions.

A similar waste of stable manure in forcing lettuce was indicated in Bulletin No. 146 and seems to be proved by tests recently made. In the field culture tests, except in a very few instances, no direct injury was caused by supplying extra plant food. There was merely a loss of profit from failure to obtain sufficient crop increase to pay for the additional quantity of fertilizer. In lettuce-growing under glass, however, especially on sandy loam soils, the use of more than an inch and a half or two inches of manure on the soil was not only wasteful of manure but *lowered* the yield of lettuce.

The manure, nevertheless, is essential to the production of vigorous, quick-maturing lettuce. Chemical fertilizers cannot replace it, even though used in abundance.

Conditions of tests. These experiments, like those in Bulletin No. 146, were carried on in the south forcing house at the Station, where light, heat and moisture can be kept uniform for all the plants. The lettuce was

*This is a brief review of Bulletin No. 208 of this Station, on Stable Manure and Nitrogenous Chemical Fertilizers for Forcing Lettuce, by S. A. Beach and H. Hasselbring. Any one specially interested in the detailed account of the investigations will be furnished, on application, with a copy of the complete bulletin. The names of those who so request will be placed on the Station mailing list to receive future bulletins, popular or complete as desired. Bulletins are issued at irregular intervals as investigations are completed, not monthly.

grown in wooden boxes holding nearly 1,800 cubic inches of soil, four plants to each box. Rawson Hothouse, a head lettuce, was grown alone the first season, but for the last two seasons two plants of a loose lettuce, Grand Rapids, were grown in each box, with two plants of the head lettuce. Two soils were used, a sandy loam and a clay loam, each formed by composting sod grown on sand or clay, and made uniform by thorough mixing. Three boxes filled with each soil were left as checks each year, three received no manure and four received $33\frac{1}{3}$ per ct. by bulk of horse-stable manure, fine and thoroughly mixed. The soil in two of the latter boxes was compacted; in two left loose, settling only by its own weight. Other boxes received 5 per ct., 10 per ct., 15 per ct., or 20 per ct. of manure, by weight the first season, by bulk the two following seasons. The soil was not changed, so that the cumulative effect of the fertilizers could be traced. All boxes except those left as checks and those receiving $33\frac{1}{3}$ per ct. of manure, were supplied with acid phosphate at the rate of 600 lbs. per acre, with sulphate of potash, 400 lbs., and with materials supplying about 100 lbs. of nitrogen per acre. The nitrogen was applied in different forms, in sets of three boxes each; in dried blood, 1,000 lbs. per acre, nitrate of soda, 600 lbs., dried blood (850 lbs.) and nitrate of soda (100 lbs.) in combination, and sulphate of ammonia, 480 lbs.

The results, so far as effectiveness of the chemical fertilizers is concerned, are best shown by comparing the unmanured boxes with those containing 5 per ct. of manure. This percentage of manure means, for the first crop, when the amount was taken by weight, a depth on the soil of about four-fifths of an inch; for the second and third crops, when taken by bulk, less than half an inch.

The figures in the table do not represent definite quantities but show ratios between the average weight of plants on the check boxes and the average weight of those without manure and with 5 per ct. of manure, respectively.

SUMMARY OF RESULTS WITH COMMERCIAL FERTILIZERS WITHOUT
MANURE AND WITH FIVE PER CT. OF MANURE.

Treatment.	Check ¹ = 1, treated plants =			
	On clay loam		On sandy loam	
	With head lettuce.	With loose lettuce.	With head lettuce.	With loose lettuce.
CROP OF 1898-1899:				
Commercial fertilizers without manure	2.67		2.52	
Commercial fertilizers with 5 per ct. manure ² . .	12.83		3.80	
CROP OF 1899-1900:				
Commercial fertilizers without manure	2.28	1.98	1.78	2.64
Commercial fertilizers with 5 per ct. manure ² . .	6.28	4.63	23.89	12.89
CROP OF 1900-1901:				
Commercial fertilizers without manure	1.66	1.73	1.36	1.36
Commercial fertilizers with 5 per ct. manure ² . .	4.43	7 00	3.02	2.67

¹ The value of the check varies with the different crops and with the different soils.

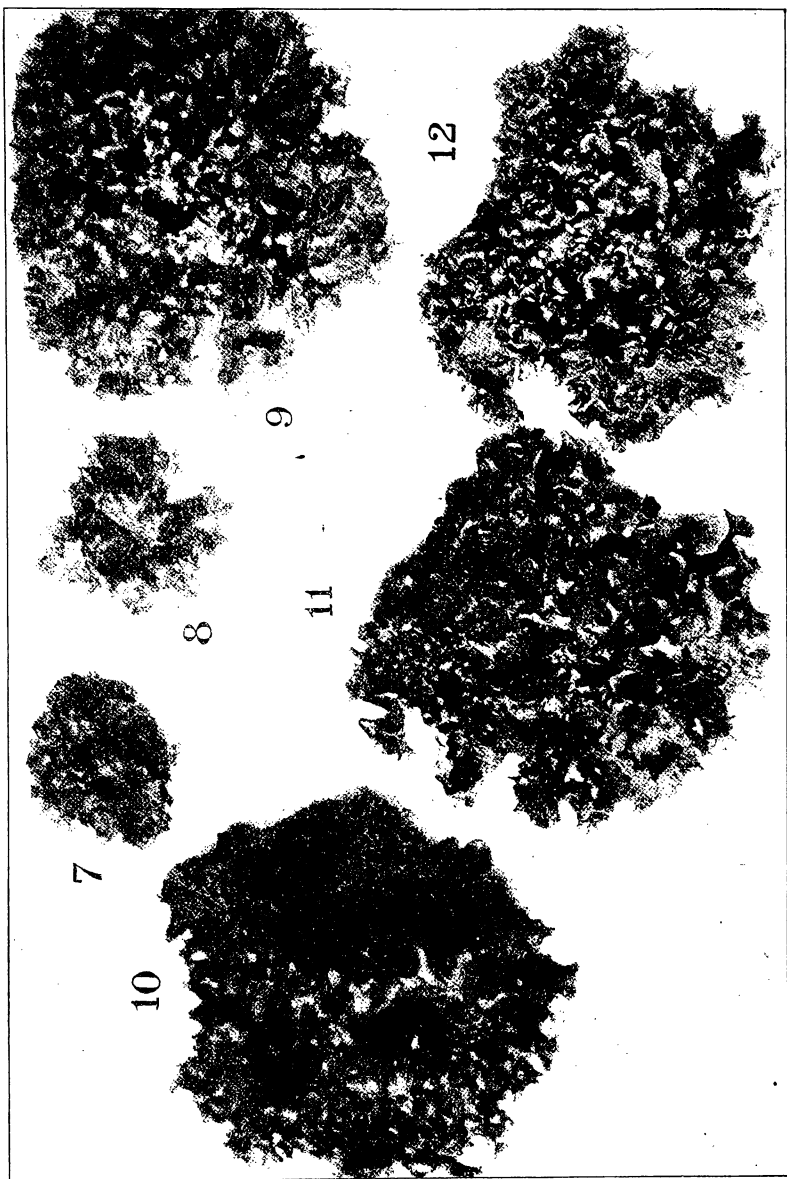
² The manure was added to these portions of soil at the rate of 5 per ct. by weight for the first crop and 5 per ct. by bulk for succeeding crops.

The use of these commercial fertilizers without manure resulted in a decided increase in yield over crops on untreated soil, but in every trial they proved inadequate for bringing a crop to maturity in sufficiently short time to be profitable. "The best crops were grown where the soil was fertilized with stable manure."

The use of 5 per ct. of manure with the fertilizers always resulted in a very great increase in yield, as shown in the table. With this small amount of manure, dried blood gave better results as a source of nitrogen than either nitrate of soda or sulphate of ammonia.

Increasing the percentage of manure applied did not induce corresponding increases in yield. For example, on clay loam the use of 5 per ct. of manure for the first crop gave an increase of 10.19 points over the boxes without manure, 10 per ct. gave a further increase of only 2.87 points, 15 per ct. added

**Manure
wasted,
and worse.**



only 0.38 point, and 20 per ct. increased the yield but 1.25 points over the 15 per ct. application. On the last crop, when the cumulative effect of the manure was greatest, the 5 per ct. application raised the yields threefold, 10 per ct. made but slight increase, 15 per ct. gave lower yields than 10 per ct. ; and the 20 per ct. boxes yielded less than those receiving 5 per ct. On sandy loam the evidence against the use of large quantities of manure was even more striking, as will be seen in Plate I.

Where large amounts of manure were incorporated in the soil for forcing lettuce the yield was increased by compacting the soil. This shows that unfavorable effects which follow excessive applications of manure may be caused in part, at least, by thereby loosening the soil so much as to put it in an unfavorable mechanical condition for the lettuce plant.

The clay loam used in these experiments has always proved superior to the light sandy loam for forcing lettuce. The comparison is made in the figure on the cover and in Plate II.

The experiments justify the following practical

Conclusions. suggestions: (1) In forcing lettuce, manure should be used in addition to chemical fertilizers.

(2) "When soils similar to those under test are used for the first time for forcing a crop of lettuce, much more manure may doubtless be used with profit than would be profitable where manure has been used abundantly with previous crops.

(3) "Where the use of manure is continued year after year on soil originally not rich enough to force good lettuce the optimum amount may be expected to decline first towards 10 per ct., eventually to approach 5 per ct.

(4) "Repeated applications of excessive quantities of manure to the same soil are not good economy. Manure is thus wasted and the yield may be reduced.

(5) "The amount of manure which may be used with good economy in forcing lettuce varies with the character of the soil and of the manure, and also with the differences in prices received for fancy lettuce and ordinary lettuce. For these reasons no definite amount can be recommended."



FIG. 1. ON SANDY LOAM.

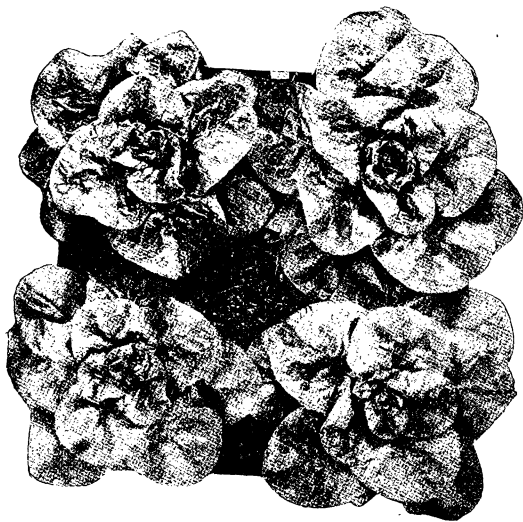


FIG. 2. ON CLAY LOAM.

PLATE II.—COMMERCIAL FERTILIZERS
WITH 20 PER CT. MANURE.

(Photographed about three weeks before harvesting.)