Garlic Bulb Studies

effect of day length, temperature during growth, and storage temperature on Early and Late varieties

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Garlic is one of the oldest cultivated crops—and California produces some 80% of all that is grown in the United States—but there have been few studies on its development under field conditions.

To obtain background material for cultural studies on garlic as a crop plant certain investigations were undertaken at Davis.

In an effort to determine the effect of day length on bulbing, pots containing sprouted cloves of Late garlic were placed under 18- and 11-hour days. Ten plants were used under each.

The plantings were made late in January in a greenhouse, and temperature was kept near 70° F day and night.

Two months later, the plants under long days were bulbing, those under short days were not. When the plants under long days were nearly mature and the tops were drying, those under short days were green and showed no evidence of bulbing.

In another test, the Early and Late varieties were each grown on two-day lengths in two greenhouses. One was held at 40–50° F—40° F at night and 50° F during the day—and the other at 50–60° F—50° F at night and 60° F in day time.

The long-day lots were lighted from 6 p.m. until 10 p.m.; the short-day lots were covered with black cloth from 6 p.m. until 10 a.m. the following day.

The cloves were planted in flats on February 20. Each lot had 18 cloves, but in the Early variety about half of these failed to germinate so that these lots were small.

Data from this experiment indicate that, within the limits of the day lengths and temperatures used, long days and high temperatures favor bulbing. Bulbing in Late garlic, as compared to Early, appears to be delayed by both short days and low temperatures.

Bulbing was compared between garlic grown in the field, and in a cool and a warm greenhouse. The cool greenhouse had a temperature of 40° F at night and 50° F during the day; the warm greenhouse had a temperature of 50° F at night and 60° F in daytime.

Cloves of Early and Late garlic were stored at 32° F from August 21 until planting. The Early variety was field-planted November 8, the Late variety December 5, and both varieties were planted in the greenhouses November 21. The plants in the two greenhouses were grown under natural day length.

The differences in bulbing among the lots of Early garlic must be attributed almost entirely to temperature. The earlier planting of the field lots tend to decrease the observed differences, but it is doubtful if this effect would be large, especially late in the season.

For the Late garlic, bulbing began more quickly in the warm than in the cool house, but the differences disappeared as the plants matured. The lot grown in the field was the slowest to start bulbing, but as it was planted 15 days later than the plants grown in the greenhouse, the difference in bulbing as the plants began to mature was quite small.

On the basis of the tests, it would seem that the bulbing of commercial garlic occurs in the spring in response to lengthening days and increasing temperatures.

Plantings in southern areas may bulb earliest because of higher temperature, in spite of the longer days in areas farther north. Since bulbing of Early garlic seems more responsive to temperature than the bulbing of Late garlic, warm weather late in the spring may have more effect on maturing. Varietal differences in earliness could also depend in part on rate of development after conditions have become favorable for bulb initiation.

Bulbing in garlic may also be affected by the storage temperature of the bulbs prior to planting.

Bulbs of five clonal lines of Early garlic were placed in storage on October 1 at the following temperatures:

32° F—ranging from 31° F to 34° F
40° F—ranging from 38° F to 44° F
50° F—ranging from 50° F to 52° F
60° F—held essentially constant

The bulbs were removed December 18. Approximately one-third of all cloves had sprouted at all temperatures except 32° F. Thirty to 60 cloves of each clone were planted in the field, and five cloves from each temperature were planted in the 40–50° F greenhouse and five in the 50–60° F greenhouse.

In the 50–60° F house, plants from cloves stored at 32° F were mature on May 3, the 40° F bulbs were nearly mature, the 50° F bulbs had partly dry tops, the 60° F bulbs were upright and green, and showed little evidence of bulbing. By May 27 the 50° F storage lot was mostly mature, and by June 18, though the tops of the 60° F lot were still up, they were drying and the bulbs were fairly well formed.

Plants grown in the 40–50° F greenhouse likewise showed earliest maturity from cloves stored at low temperatures, but development in all lots was slower than in the 50–60° F house.

The fieldgrown plants showed much less effect of storage temperature than

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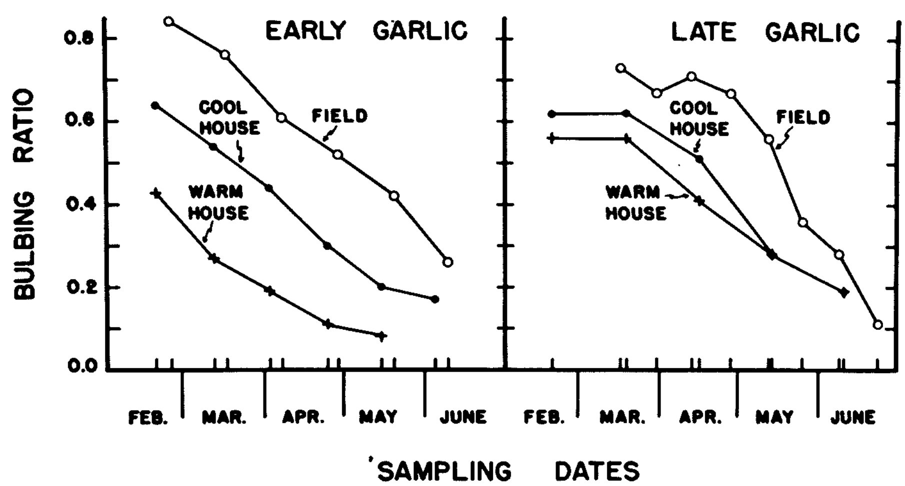
Bulbing of Early and Late garlic grown in the field at Davis, and in a cool and warm greenhouse, all under natural day length. Bulbing ratio is indicated at the left of the graph; values below about 0.5 indicate definite bulbs.



STRAWBERRIES

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4. D-D—dichloropropene-dichloropropane mixture—100 pounds per acre applied in May 1950 in irrigation water to living plants.

In June 1950 the growth of the strawberry plants in plots treated with CBP-55 was markedly better than the growth of plants on untreated plots. The split 30-gallon treatment was superior to all others.

Eight samples of one pint of soil were taken from each plot at two depths—0″ to 6″ and 6″ to 12″—to determine the effect of the treatments upon the nematode population.

The results of these treatments indicated that the nematode control obtained with the split treatment of 30 gallons of CBP-55 per acre was superior to the other treatments. Plant growth in this treatment was also better than in other treatments or the untreated plots.

The single applications of 20 and 30 gallons per acre applied by chisel produced plants much superior to those grown on untreated plots, but inferior to those grown on the 30-gallon split treatment.

In early 1951 additional experimental plots were established on a portion of the field. The plots in this test which received split applications were treated with half the material applied by chisel, then the soil was plowed and the other half applied by chisel. The remainder of the field was treated by the grower with CBP-55 at the rate of 30 gallons per acre in a similar split application.

These plots were sampled in August 1951. In addition to soil samples strawberry rot samples were collected. Nematode counts were made and recorded. The results are shown in the preceding table.

Average Number of Root-Lesion Nematodes Per Pint of Soil and Per Gram of Root in Treated and Untreated Plots.

Treatment	Ave. no. nematodes per pint of soil	Ave. no. nematodes per gram of root
CBP-55 30 gal. per acre split application	2.5	6.7
D-D 20 gal. per acre single application	10.8	7.7
D-D 40 gal. per acre single application	4.1	12.8
D-D 80 gal. per acre split application	0.0	0.0
CBP-55 10 gal. per acre split application	23.9	16.9
Untreated	59.5	89.5

Subsequent observation of the plant growth in the treated plots and in the remainder of the field indicated that satisfactory nematode control was obtained with CBP-55 at the rate of 30 gallons per acre and D-D at 40 and 80 gallons per acre.

It is believed that the control of the root-rot disease in the 80 gallons per acre D-D treatment was comparable to that obtained in the 30 gallons per acre split CBP-55 treatment.

A considerable improvement in plant growth was also observed in the 40 gallons per acre single application of D-D. The improvement in these latter plots is attributed to control of the nematodes involved in the root-rot complex.

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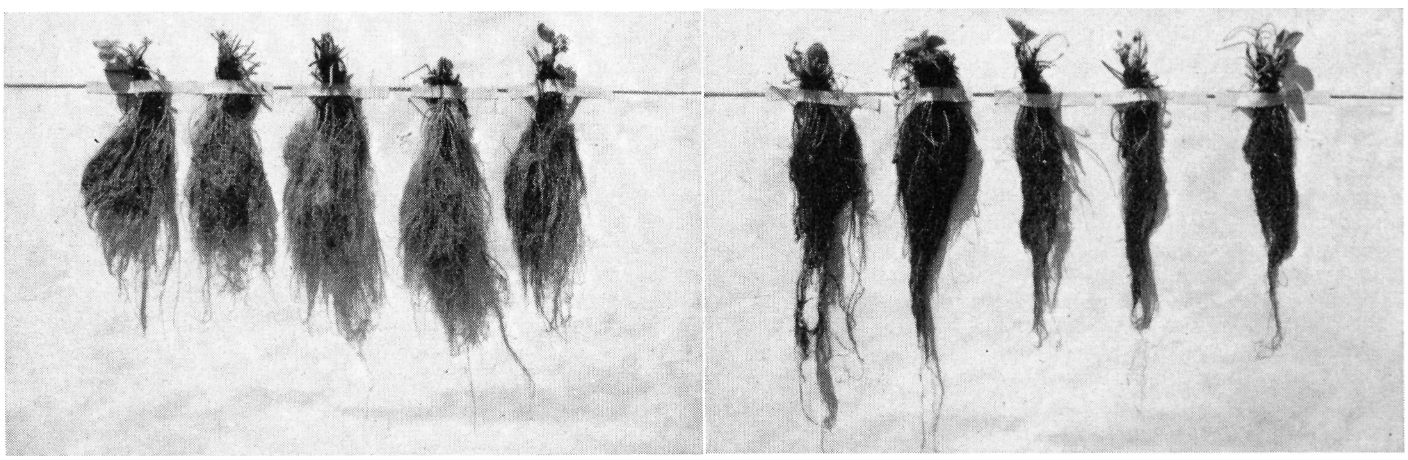
The above progress report is based on Research Project No. 1354-C.



Roots of strawberry plants, *left*, grown in soil treated with CBP-55 at the rate of 200 pounds per acre; *right*, in untreated soil.

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plants in the greenhouses. Only the 60° F storage lot was distinguishable in top growth. No significant effect of storage temperature on bulbing could be detected.

In other field tests, Early and Late garlic were planted after storage of 32° F and 50° F. For both varieties, the plants from cloves stored at 32° F began to bulb most quickly. However, by May 19 for the Early garlic, and by June 8 for the Late, differences in bulbing were no longer evident.

In still another field test, differences in earliness resulting from storage temperature persisted until harvest. Late garlic was stored at 32° F, 50° F, and in an open shed, then planted in the field on January 13. The plants from bulbs stored at 32° F grew most rapidly and matured about one week before those from bulbs stored at 50° F. The shed-storage bulbs produced plants which matured a few days later than the 50° F storage plants.

The tests showed that clove storage temperatures may have a definite effect on bulb formation in greenhouse plantings. But the effect of low-temperature storage on field plantings was always slight. This might be expected, since field plantings are subjected to two to three months' low temperature in the field before temperatures and day length become favorable for the initiation of the garlic bulbs.

Storage temperature has an additional influence on garlic growth as it affects clove dormancy. Freshly harvested garlic will not sprout readily if field planted and irrigated. Experiments indicate that storage temperatures have a marked effect on this dormancy. What relation there may be between the effect of storage temperature on dormancy and its effect on time of bulbing and maturity still has to be explored.

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The above progress report is based on Research Project No. 1175.