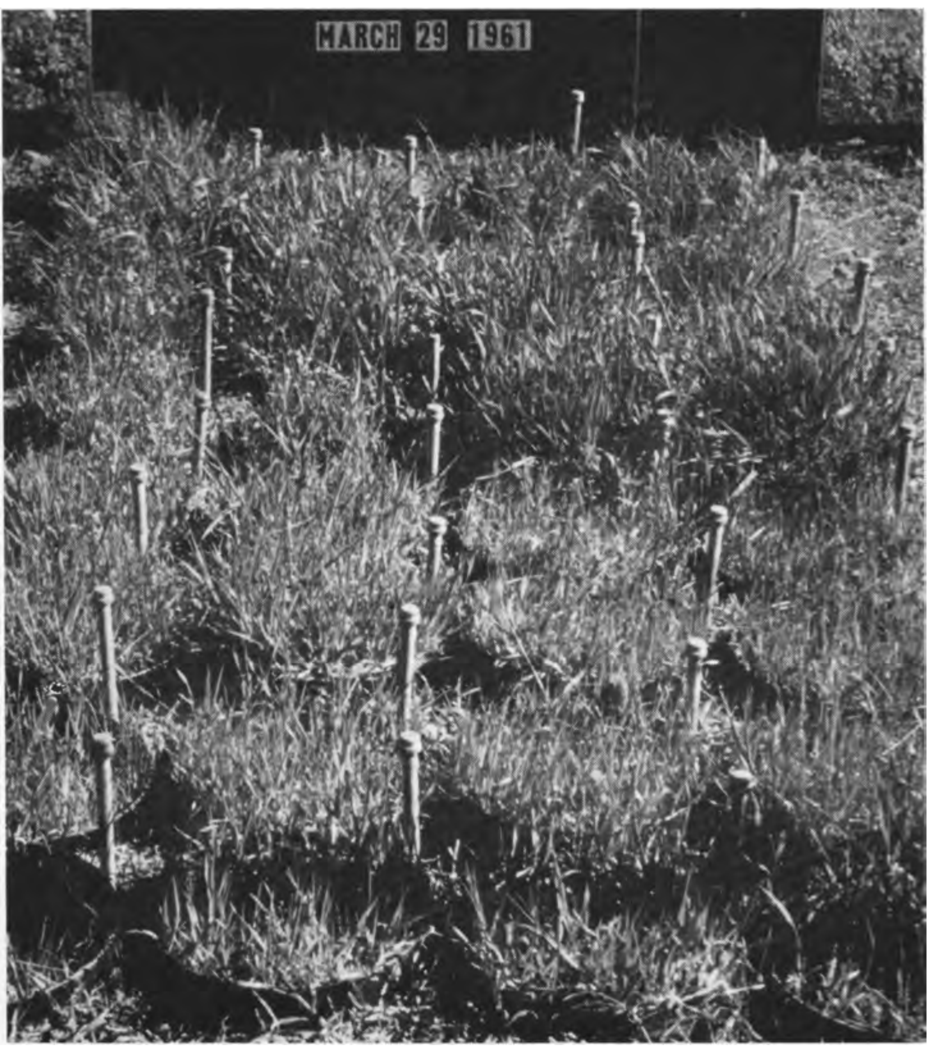
No differences in temperatures or growth of soft chess were observed in tests at 800 and 1,700 foot elevations, as indicated in photos. Differences were apparent at the 3,000 foot elevations, as discussed in this report.



Effect of Soil Temperatures and Nitrogen Fertilization on

SOFT CHESS

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Previous tests have shown that nitrogen applied to California's annual rangeland increases the length of the grazing season by increasing the growth of grass during the winter. However, recent studies at the Hopland Field Station covering a two-year period indicate that growth rate of the common annual grass, soft chess (Bromus mollis), increased very little when the average soil temperature dropped below 45°F. Grass fertilized with nitrogen showed the greatest increase in growth compared with unfertilized grass when the average soil temperature was between 47° and 55°F. When the temperature went above 55°F, the difference between growth of fertilized and unfertilized grass decreased.

THE AVERAGE winter temperature of many agricultural soils in California is about 45°F. The Hopland Field Station has an average winter soil temperature of 50°F at the 800-foot elevation and 40°F at 3,000 feet—making it well situated for a study of the relation between soil temperature and growth of soft chess at two elevations as affected by nitrogen fertilization. Yield and nitrogen content of fertilized soft chess was also studied during the first and second seasons of this experiment.

In the testing procedure, 55 pounds of Sutherlin loam was passed through a 5-mm screen, mixed with seven quarts of fused vermiculite and then buried in 32 five-gallon cans at each of three elevations—800, 1,700 and 3,000 feet above sea level. Drainage holes ⅛ inch in diameter were punched in the botton of each container and covered with a layer of fused vermiculite before the soil was placed in the cans. An empty five-gallon can from which the leachate could be pumped was sealed to the bottom of each soil-filled can. At frequent intervals during the rainy seasons the water was pumped from the bottom cans to keep the soil well-drained.

Nitrogen (as urea) was applied to 16 of the cans at 0 (check), 40, 80, and 160-pound rates per acre on October 15, 1959. Each treatment was replicated four times at each elevation. The cans were also fertilized with 500 pounds per acre of single superphosphate to insure adequate levels of phosphorus and sulfur. The additional 16 cans at each elevation were not seeded with soft chess, or treated with nitrogen, until the following year.

On September 26, 1960, all 32 cans at each location were seeded with soft chess and fertilized again with single superphosphate. Cans that had been fertilized with nitrogen in October, 1959, received no additional nitrogen, so that the carry-over in the 1960–61 season could be measured. The cans not treated with nitrogen in 1959–60 were given treatments of 0, 40, 80, or 160 pounds per acre of nitrogen. In 1961 the cans were irrigated during the dry, warm weather so that growth would not be reduced by moisture stress, as it was in the late spring of 1960. Since the soil in cans did not dry out in 1961, the grass at the lowest elevation continued to grow later in the season with little difference in plant maturity on June 2, when all the plants were harvested. Each year the plant material was dried and weighed, and the nitrogen content was determined.

Elevation differences

Since growth and temperature at the 800- and 1,700-foot elevations did not differ significantly, only data from the 800- and 3,000-foot elevations were compared. Nighttime minimum air temperatures averaged only about 2°F warmer at 800 feet than at 3,000 feet, but daytime air temperature maximums averaged about 10°F warmer at the lower elevation. Soil temperatures over the five-month growing period, both night and day, averaged about 6°F warmer at the 800-foot elevation than at 3,000 feet. Each year about 10 inches more rain fell at the 3,000-foot elevation than at 800 feet.

Average soil temperature at the 6-inch depth is given at the bottom of graphs 1 and 2 for the intervals between dates at which plants were measured. Treatments with 40 and 80 pounds of nitrogen per acre gave intermediate growth rates between the untreated check and the 160-pound rate. Only the last two treatments are compared in graphs 1 and 2.

1960 tests

Graph 1 shows the relation of soft chess height to soil temperature at the 6-inch depth through the 1960 growing season. During the cool period of 1960 (January to March 8 with an average temperature of 48.9°F at 800 feet), the unfertilized grass grew at the rate 0.70 mm per day and fertilization with 160 pounds of nitrogen per acre increased growth by 48%. The average soil temperature at 3,000 feet was 42.5°F, and fertilization with nitrogen increased growth by 36%.

During the period March 8 through 25, the average temperature at 800 feet was 55.3°F, and fertilization with 160 pounds of nitrogen per acre increased the growth rate by 187%. The average soil temperature at 3,000 feet was 50.1°F, and the growth rate of grass fertilized with nitrogen was increased by 58%.

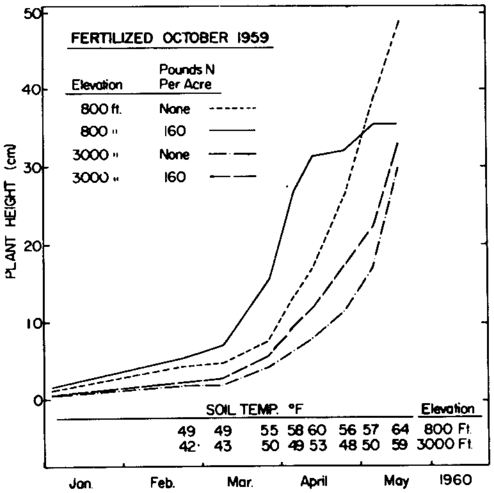
During the period, March 25 to April 5, when the average soil temperature was 58°F at 800 feet, nitrogen fertilization increased the growth rate 98%. At 3,000 feet, the average soil temperature was 48.8°F and fertilization with 160 pounds of nitrogen per acre increased growth rate 114%. After April 5, when moisture became limiting, the effect of fertilization on plant height, as related to temperature, was obscured.

Total yields

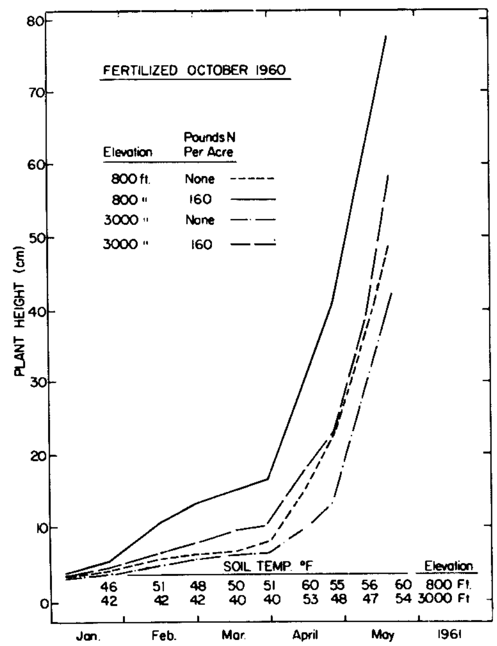
Total yields increased in pots fertilized with nitrogen but were no doubt somewhat limited by lack of moisture late in the season. The per cent nitrogen in the grass fertilized with 40 pounds of nitrogen per acre decreased, compared with that in unfertilized plants. The application of 80 pounds of nitrogen increased the nitrogen concentration at 800 feet, but not at the higher elevation. A significant increase in the nitrogen concentration occurred at both elevations, if 160 pounds of nitrogen per acre was applied. Elevation had no apparent effect on total nitrogen uptake in 1960.

Elevation was a factor in determining the stage of growth reached by the grass at any particular time. During the winter, the plants at 800 feet were larger than those at 3,000 feet. They came into boot, flowered, and set seed about two weeks before those at the higher elevation. Nitrogen fertilization had little effect upon plant maturity except in the spring of 1960 when cans were not irrigated. In this case, cans that had been heavily fertilized utilized the available soil moisture more rapidly causing earlier maturation of the fertilized plants.

GRAPH 1—THE RELATION OF SOFT CHESS HEIGHT TO SOIL TEMPERATURE AT THE 6-INCH DEPTH DURING 1960 GROWING SEASON AS AFFECTED BY NITROGEN FERTILIZATION.



GRAPH 2—THE RELATION OF SOFT CHESS HEIGHT TO SOIL TEMPERATURE AT THE 6-INCH DEPTH DURING 1961 GROWING SEASON AS AFFECTED BY NITROGEN FERTILIZATION.



1961 tests

The relation of soft chess height to soil temperature at the 6-inch depth through the 1961 growing season is shown in graph 2. With the average soil temperature of 48.7°F at 800 feet from January to March 20, 1961, the unfertilized grass grew at an average rate of 0.48 mm per day and fertilization with 160 pounds of nitrogen per acre increased growth 222%. In contrast, with an average soil temperature at 3,000 feet of 41.4°F, unfertilized grass grew at the rate of 0.40 mm per day and fertilization with nitrogen increased growth 77%.

The average soil temperature during the first half of April, 1961, was about 60°F at 800 feet. A cooler period occurred during the last half of April (soil temperature averaged 55°F), and the first part of May (soil temperature averaged 56°F); then temperatures increased to an average of 60°F during the latter part of May. The growth rate of the grass during April and May averaged 10.7 mm per day where no fertilizer was applied and 12.0 mm per day where 160 pounds of nitrogen were applied—an increase of 12%. Average soil temperatures at 3,000 feet were 6° to 9°F cooler for the four intervals measured during April and May, 1961, as shown in graph 2. Growth rate was 7.3 mm per day for the unfertilized grass, and increased 34% where nitrogen was added.

Yields increased with each increment of nitrogen when the cans were irrigated in 1961. Yields were greater at 800 feet than at 3,000 feet. The per cent of nitrogen in the grass decreased as the rate of nitrogen applied in 1960 increased, due to heavier top growth rather than from a decrease in nitrogen uptake. At the 800-foot elevation, an average of 29% of the nitrogen applied to the soil was found in the tops of the plants. At 3,000 feet, only 18% of the applied nitrogen was present in the tops. Nitrogen efficiency may have been reduced due to more leaching at the higher elevation during the 1960–61 season. Total nitrogen uptake at the two elevations was not significantly different in the 1959–60 season. More total rain fell in 1960–61 than in 1959–60. The supplemental irrigation in April and May of 1961 may have contributed to the leaching of nitrogen. Carryover effects of nitrogen into the second year after application were small compared with the effects during the first season after application.

Conclusions

Nitrogen fertilization generally increases winter growth of grasses but when winter soil temperatures drop below 45°F, growth is very slow with relatively little effect from fertilization. Grass fertilized with nitrogen showed the greatest increase in growth (compared with unfertilized grass) when the temperature ranged from 47 to 55°F. When the temperature went above 55°F, the difference between growth rates of fertilized and unfertilized grass decreased. At comparable temperatures, plant growth was more rapid during April and May than during January and February—probably because the days were longer, the light intensity was greater and plant development was more advanced.

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LANDSCAPE TREE EVALUATION PROGRAM

A LANDSCAPE TREE evaluation program coordinated by the Department of Landscape Horticulture, University of California Agricultural Experiment Station, Davis, is now underway with the cooperation of city or county park and street personnel in many areas of the State.

During the summer of 1960, several city park officials were interviewed from a 17-page questionnaire about the performance of Southern Magnolia (*Magnolia grandiflora*). Many of the questions asked during the interviews were unanswered, and many answers were inconclusive. These results indicated that very little exact knowledge is available in the State about even such common trees. Results also suggested that a long-range performance evaluation study was needed if significant improvements in landscape trees were to be achieved.

Subsequently, a cooperative study with city and county personnel responsible for park and street trees was proposed and four organizational meetings were held in the fall of 1960. Specifications were established for cities and counties to follow in planting and maintaining the so-called "candidate trees" on which personnel of the University of California will make the long-range performance evaluations.

The program involves annual invitations to participate in the study which are sent to each county and to all cities in the State having a population of at least 5,000. A Candidate Tree Request form is included with these invitations. On the cut-off date (December 17, 1962, for the trees planted in 1963) the candidate trees were allocated to cities and counties that had returned requests.

For the 1963 candidate trees, participants sent orders for their allocations direct to the nursery supplying the trees. By doing so, most of the trees were delivered during the week of January 21. This relatively early delivery period resulted in most of the trees being planted while still dormant, and ahead of the rainy season.

Candidate trees have been planted both in parks and along streets, but experience has indicated that street plantings may be more representative of the cultural practices that a tree would ordinarily receive in most of the situations where it might be used. Participants are also encouraged to plant each kind of tree in one location rather than dispersed throughout the community.

At the end of the growing season, the performance of candidate trees is evaluated. This includes determinations of height and trunk diameter, pest incidence, foliage quality, and hardiness, all of which reflect genetic and environmental differences plus cultural variabilities. Homeowner watering practices will probably always be a serious, and uncontrollable, cultural variability in the program.

An advisory committee was recently organized with principal membership including six participants from throughout the State, plus representatives of the nurserymen and landscape architects. This committee will meet once or twice annually to review program developments and to make recommendations on policy matters, including the selection of each year's candidate trees.

In 1961, the first year in which the program was operational, 54 trees each of a clone of the ginkgo (*Ginkgo biloba* 'Autumn Gold') and an Australian box (*Tristania laurina*) were planted in 11 participant locations. The next year, 192 trees of bronze loquat (*Eriobotrya de-*