# Polyethylene Over Strawberries

## strawberry bed covers markedly influence soil temperature and earliness of fruit in Orange and San Diego county tests

**Victor Voth and R. S. Bringhurst**

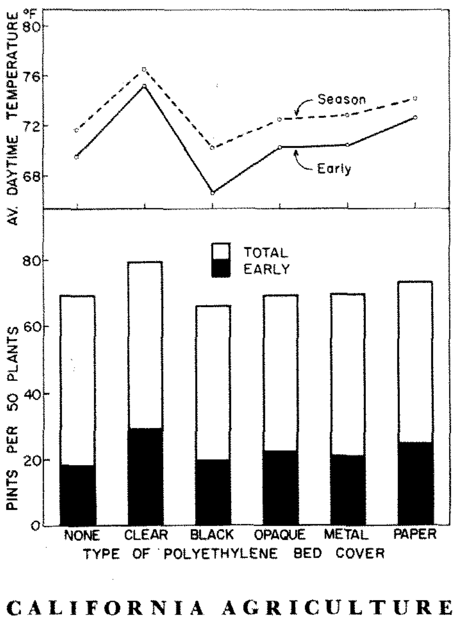
**Thin sheets** of polyethylene are used extensively to cover strawberry beds by southern California growers who report that covered beds have less fruit rot, cleaner fruit, and in many instances earlier production when compared with uncovered beds. Varying degrees of weed control are also realized.

The polyethylene sheets—30″–36″ wide—are placed on the raised beds at pruning time in January or February. The plastic is slit over each plant and the plant crown is brought through the film by hand so that the soil is covered but the plants protrude as shown in the photograph. The sheets are perforated every 2″ on the square to permit drainage. Most growers use clear—transparent—polyethylene but sometimes black or other types are used.

Plants do not behave the same when the clear material is used as they do when black is used. Whether the performance differences were due to soil temperature differences was investigated during the 1958 harvest season.

Replicated plots were established on winter plantings of the Lassen variety at Torrey Pines in San Diego County and at the South Coast Field Station near Santa Ana in Orange County. Beds covered with clear, black, opaque, metallic and polyethylene impregnated paper were compared with bare beds. Daytime soil temperatures 3″ below the soil surface were recorded with clinical thermometers at hourly intervals from 8:00 a.m. to 5:00 p.m. one day a week at each location from February through July. Plot yields were obtained from March through July.

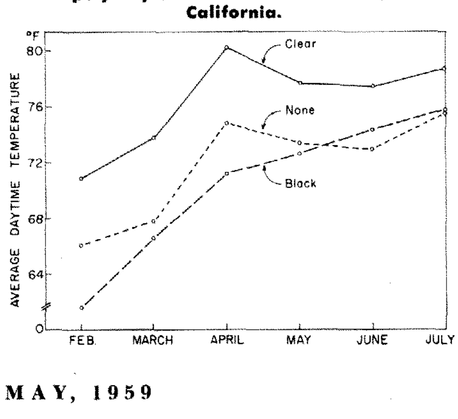
**Comparison of average soil temperatures—broken line graph, *upper*—and fruit production—bar graph, *lower*—of Lassen strawberries on beds covered with various polyethylene covers. Early temperature = average for February, March and April. Early production = fruit harvested by May 20.**




**Strawberry plants are brought through slits in polyethylene bed covers by hand.**

Temperature differences among the various bed treatments were highly significant according to the analysis of variance. The differences were due primarily to the very high average temperature recorded under the clear polyethylene and the very low average temperature recorded under the black polyethylene, as shown in the upper portion of the graph in the first column. The temperature differences between clear and black were particularly great during February, March and April; the months during which earliness is influenced. The temperature data for both locations are pooled in both graphs because there was no significant difference between locations.

**Average monthly soil temperatures of uncovered strawberry beds compared with clear and black polyethylene covered beds in southern California.**




The difference in soil temperature under different bed covers was because transparent polyethylene permits the radiant heat from the sun to penetrate directly into the soil, warming it much as a greenhouse is heated on a sunny day. In contrast the other materials, particularly the black, effectively shade the soil so that soil temperatures may be actually lower than soil temperatures in uncovered beds.

Earliness of fruit production was determined on the basis of the quantity harvested by May 20. The differences—highly significant as determined by the analysis of variance—are due primarily to the higher early yield on the beds covered by clear polyethylene. There was a highly significant difference between locations but the data for both locations were pooled in the graph because the ranking of the treatments was the same for both locations and the differences were in magnitude, not order.

Although the total yield was greatest for the clear polyethylene, the differences between this and the other treatments were not significant. This is essentially what might be predicted where soil temperature influences the rate at which a given flower develops and sets fruit but does not influence the number of flowers that develop and set fruit.

The polyethylene bed covers were also compared on summer plantings and second year beds of Lassen as well as on winter plantings, summer plantings, and second year beds of the Shasta and Solana varieties. In every case the results were the same as those for Lassen winter plantings. Beds covered with the transparent polyethylene were considerably earlier in production than the beds not covered or beds covered with the other materials, particularly the black polyethylene.

The durability of the black material is considerably better than any of the others and can easily be carried through two harvest seasons. The clear polyethylene deteriorates more rapidly but has in some instances been carried for two years. The other materials used in these experiments were intermediate in durability. The polyethylene impregnated

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## NEMATODE

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The nematode counts in Tests I and II are comparable, but may be as much as 50% below actual populations because later observations showed that the soil contained about as many females as were attached to the roots when they were washed.

The two tests indicate that the optimum temperature range for sugar-beet nematode larvae is relatively narrow, 70°F–80°F. Activity was significantly lower at 65°F and below and also at 85°F and above. In Test II, where 500 larvae were introduced, the final population level at 70°F was not as high as it was at 75°F and 80°F. Where 5,000 larvae were added, the resulting nematode population apparently exceeded the maximum supportable by the plant size. In this case, plant size rather than temperature limited the population increase, and the final population at above 70°F did not exceed the final population at 70°F.

Unfortunately, in the date-of-planting tests it was not possible to arrange harvest dates to allow each planting exactly the same number of growing days. However, past experience in this experimental plot has shown that beets heavily infested with sugar-beet nematode do not make continued satisfactory growth.

The soil temperature records show that an average maximum of 70°F is not reached in the test area until May; and that it was 77°F–78°F during June. The yield records show that planting dates in January and February were the latest with which 18 tons per acre or more were obtained. With later dates the yields were reduced more than 50%. As the temperature control tests indicate that 70°F is near the minimum requirements for activity of sugar-beet nematode larvae, it appears that sugar beets may become well enough established to produce economical yields if sufficient growth can be made before soil temperatures reach the 70°F level. However, it does not indicate the maximum production in such fields, because the nematode undoubtedly caused some reductions of yields in the early plantings.

The date-of-planting tests indicate that the lower soil temperatures in the early growing season favor beet germination and growth—but not nematode hatching, migration, and invasion of roots—and that 2–3 months of beet growth when soil temperatures are below 70°F results in significant yield increases on nematode-infested land.

*D. J. Raski is Associate Nematologist, University of California, Davis.*

*R. T. Johnson, Director of Agricultural Research, Spreckels Sugar Co., Spreckels, California, participated in the studies reported.*

## STRAWBERRIES

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paper tore so easily that it was extremely difficult to apply.

Salt accumulation is apparently more of a problem where the beds are not covered than where they are covered. At the end of the harvest season, soils from the various beds compared in the experiments were tested for relative salt concentration. Soils from beds not covered had salt concentrations more than twice as high as the soils from the covered beds. Soil surface evaporation apparently contributes greatly to salt accumulation in raised beds.

The results of these experiments indicate clear polyethylene should be used if early fruit production is desired, but it is doubtful whether the black material should ever be used. On the other hand, perhaps the black is the better material if early fruit production is not important, and weed control is of primary concern.

The use of any of the materials will generally result in a higher gradeout of sound, clean fruit than can be realized from uncovered beds, particularly early in the season when rains are anticipated.

*Victor Voth is Associate Specialist in Pomology, University of California, Davis, located at the South Coast Field Station, Santa Ana.*

*R. S. Bringhurst is Associate Professor of Pomology, University of California, Davis.*

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## COTTON

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mean a market for an additional 2.64 million bales of cotton. The 1950–1957 drop reflects in some degree the recession in 1957 and 1958. California and United States cotton growers will get a part of the market back if consumers do restore at least a portion of the cut in per capita use. The fact that rayon and acetate also had per capita use declines in 1956 and 1957 suggests that an important portion of the total decline in United States per capita cotton consumption may reflect the 1957–1958 economic recession.

Even if United States per capita cotton use does not increase from 1957 levels, the projected United States population growth in the 15 years between 1959 and 1975 can mean an increase of 2.5–3.5 million bales in the domestic market for California and United States cotton. The higher cotton use level would be associated with the higher population growth rates. This addition to the market takings would expand further in direct ratio as United States consumers increase their per capita use. Thus the total gains could amount to 4.0–5.5 million bales by 1975.

Growers can be more optimistic about per capita use recovery from the temporary impacts of a recession than about the chances of recovering cotton markets lost to competing synthetic fibers. The consensus of researchers studying cotton marketing and prices is that it is extremely difficult to recover a market for United States cotton, once it is lost, whether the successful competitor is foreign cotton in the foreign market or synthetics in either the foreign or the domestic market.

Cotton growers have already lost sizeable segments of the United States market as industry uses very little cotton now to produce automobile tires, and consumes greatly reduced amounts for bags and containers. Another indication of this problem is that United States production of synthetic fibers increased from the equivalent of about 0.5 million bales in the early 1930's to over 5.0 millions in the middle 1950's—a gain of 10 times—but not all of this growth represents lost cotton markets; much nylon, for example, goes into noncompeting uses. Similar unfavorable long-term shifts also have occurred in foreign markets, where both foreign cotton and synthetics compete with United States cotton.

Price support provisions of the new 1958 cotton legislation offer an important opportunity to cotton growers and the rest of the industry. The expected drop in United States domestic prices will improve the competitive position of cotton relative to synthetic fibers in the United States market. A drop of 3¢–5¢ will make cotton considerably more attractive compared with rayon and acetate, and should aid cotton to share importantly in the increased market demand as population and the national product grow.

Cotton growers should not expect too much increase in market takings in the next few years, however, regardless of lower prices accompanying the currently effective cotton price support program.

Lower domestic cotton prices are essential, however, to enable cotton to get its share in future market expansion. Synthetics will continue to take markets from cotton unless cotton prices are competitive and to be competitive they must be lower than 1958 United States prices. The 1958 legislation promises to lower cotton prices and improve cotton's competitive position in 1959, but the synthetic industry will offer sharp competition in research, efficiency and cost cutting, and market promotion.

United States cotton producers also may be able to obtain a share of market growth in foreign countries, but the immediate prospects for the domestic mar-