

The Effect of Rain and Applications of Fungicides and Insecticides on the Catfacing of Strawberries

G. EDW. MARSHALL, Purdue University

Strawberries which are distorted, which ripen unevenly or have irregularly spaced seeds when the fruits are ripe, are said to be "catfaced." For the purpose of this study, all fruits which had any disfigurement to prevent them from being U. S. Number 1 grade, with the exception of size, rot or chewing insect damage were included in the category. During a portion of the harvest period in some years, as many as 45 per cent of the berries are catfaced.

Figure 1 shows the extent of catfacing in 1952 and 1953 crops. The periods of heaviest distortion do not occur at the same time each year.

In an attempt to find the most important cause of catfacing, 19 plots have been used for sprays and observation. The crop on each of these has been counted and graded and these results are made up from a record of 126,605 berries. In addition, the study included blooms tagged to determine the length of the period between the time the bloom opens and the ripening of the berry therefrom, the effects of rot organisms found growing in newly opened blooms, and the effects of thrips on the blooms.

Aside from leads developing through this project, from time to time different workers in the field have mentioned several prime causes of catfacing. Those affording the greatest probabilities and concerning which little is known are:

1. Feeding by tarnished plant bugs.
2. The role of thrips and leaf rollers.
3. The effects of frost injury.
4. The extent to which rot organisms cause malformation of the berries.
5. The extent to which rain effects berry growth.

1. Over a period of four years feeding on strawberry fruits or blooms by the tarnished plant bug, *Lygus lineolaris*, has never been observed here. However, since claims have been made that they catface berries our studies have given consideration to the control of this insect, one which has pretty largely defied control in peaches. However, Anderson et al. (1) using DDT obtained excellent results in control on alfalfa grown for seed production. These plant bugs feed on and damage many plants and as a single example of the type of injury they do might be cited in Weaver and Olson's (5) article on the control of Lygus bugs in chrysanthemum production with DDT. Sabadilla, a material most effective in the control of Lygus bugs, stink bugs and other plant bugs was used in southern Indiana in nine dust applications during bloom. Figure 3 shows that the reduction in catfacing, brought about by such numerous dust applications, was not practical. This is another indication that tarnished plant bugs damage berries but little, if any.

2. Daily counts of thrips (*Frankliniella tritici*) and (*F. fusca*) activity, show that while a few thrips are present early in the season, there is a tremendous increase in population beginning about a week after the

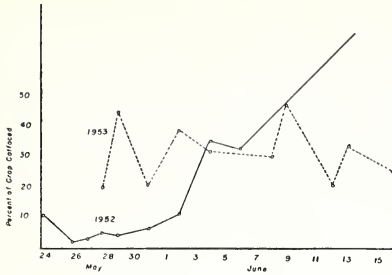


Figure 1. Percent of crop catfaced on each picking date from untreated plantings of Cremal strawberries.

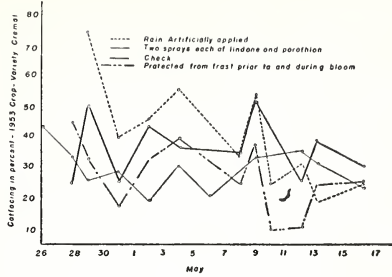


Figure 2. Effects of rain, sprays and frost on the catfacing of strawberries.

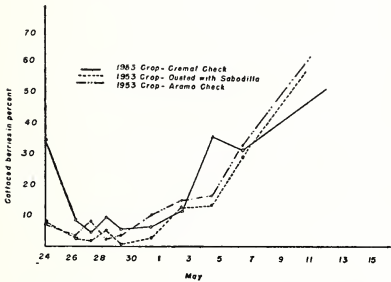


Figure 3. The effects of 9 sabadilla dusts applied during strawberry bloom period to control catfacing.

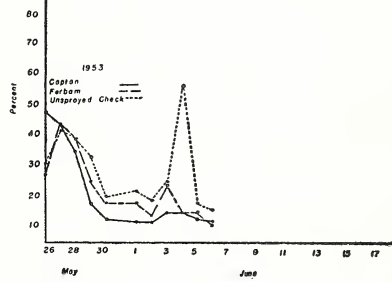


Figure 4. Percentage of catfaced berries in Aroma for every picking day of the 1953 season.

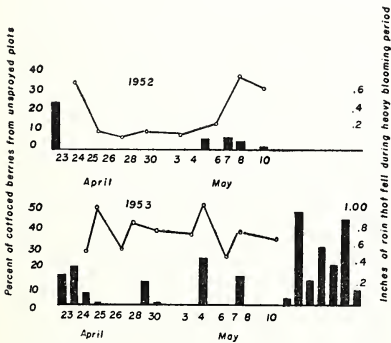


Figure 5. The relationship between rainfall at blooming time and catfaced berries at harvest for 1952 and 1953. Black bars represent the amount of rain during bloom period. Black lines represent the percentage of catfaced berries and are placed in correct position above bars to show how much rain fell on the blooms which produced the percentages of catfaced berries shown.

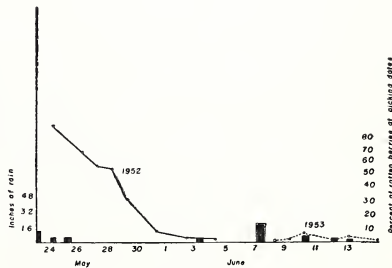


Figure 6. Rains and the incidence of rot in Cremal strawberries during picking season at Orleans. Black columns represent rainfall and amount during picking season in 1952. Barred column represents the only rain that fell during picking season in 1953. Black line represents the amount of rot in 1952. Dotted line represents amount of rot in 1953.

first blooms open, and continuing until late in the blossom period. This build-up coincides with the hatch of the strawberry leaf roller, *Ancyliis comptana fragariae*. Since both these insects enter the blossom buds before they open, there is some basis for the belief that during the last of the blooming period, when the population is highest, these species and thrips in particular, not only catface more fruits than at any other time, but also prevent setting of the berries. Observation has proven that the leaf roller causes malformed berries though the only point proven about thrips is that they prevent berry setting. Nevertheless the two species probably account for some of the increase in catfacing which sometimes takes place at the last of the picking season. Two sprays each, of lindane and parathion, were applied alternately during bloom and spaced to cover that period. After these sprays, no leaf roller larvae could be found. These four sprays did not eliminate thrips, though they did reduce them to small numbers. Ewart and Elmer (2) reported excellent control of fruit scarring caused by thrips on oranges and lemons by the use of two sprays containing $\frac{1}{2}$ lb. of actual dieldrin per acre. Kauffman and Stevenson (3) found that although three or four well timed sprays of toxaphene on cotton did not eliminate thrips, such applications did result in an increase of almost 500 pounds of seed cotton per acre. Though results were based on population counts rather than crop data, of several materials used, Paren-cia and Cowan (4) report the best control by spraying with toxaphene. Figure 2 of this work shows that two sprays each of lindane and parathion as measured by a reduction in catfacing, was probably worth the effort and reduced the amount of catfacing 10 to 15 per cent over much of the picking season.

3. In an attempt to determine whether or not frost may injure or catface strawberries, beginning at the time the blossom buds were growing out of the crown, a row was covered by a roof set on sides eight inches high. Each night this covering was placed over the berries and each day it was removed. This prevented exposure of the plants to frost and freezing temperatures; Figure 2 shows that this was of little use as a preventative for catfacing.

4. Fungus growths were observed to develop at the base of the receptacle in some newly opened blooms. In many cases, the stamens, pistils, and often some of the sepals were affected. These blooms were tagged and the berries developing from them were observed periodically. Usually such berries grow with an indentation or crease in the sides of the berry because when some of the flower parts are destroyed, pollination is not complete, seeds fail to develop, and the resulting fruits are misshapen. Following attacks of the flower parts by fungus, in many instances, rot developed as these berries were ripening. If this is the condition that leads to catfaced berries the blooms of which were attacked by rot, it is reasonable to assume that so few blooms would be thus injured and later affected by fungus as to be of no consequence in the total crop. However, a series of quadruplicated plots of approximately 1/120 acre each were sprayed with Captan and Ferbam for control of diseases. Three sprays were put on (May 1, 11 and 21), the first at the time the first blooms were opening, the second 10 days later, and the last 10 days after the second. As shown in figure 4

this treatment resulted in a reduction in the number of catfaced berries.

5. The question of rain in the catfacing of strawberries was a lead which developed through our strawberry irrigation work at this station. Its effects were discovered quite by accident after a row of berries in bloom had been watered every day (by use of a sprinkling system) to determine whether or not such a practice would result in an increase in rot development. As harvest counts were taken, the effects of water on the catfacing of berries became quite evident. Later studies in which water was dripped on the newly opened blooms at intervals of approximately five minutes proved that such blooms will not develop normally, if at all. Figure 1 shows that the period of heaviest catfacing does not occur at the same time each year. This graph poses the question as to the cause of the difference in the time of the most catfacing with respect to the picking season. Figure 5 comes as near answering this question as any that might be prepared. It shows for 1952 and 1953 the amount of rainfall that occurred during the heavy blooming period and how each heavy rain resulted in an increase in catfacing at ripening time. On the other hand figure 6 shows that rain during ripening time has very little effect on catfacing.

Figure 2 shows how heavy the catfacing can be made to be when rainfall is artificially applied. The untreated check plots were second in the number of catfaced berries as compared with those receiving artificial rain. The plots which received four insecticide applications during the blooming period produced a crop relatively low in catfaced berries. The plot protected from frost produced only a few catfaced berries but this may be because the covering which protected the plots from frost also prevented any rain from falling on the blooms. Figure 4 shows the effects of three sprays of Captan and Ferbam applied during the blooming period in reducing the number of catfaced berries. Ferbam, however, impairs the quality of the ripened fruit and should not be used commercially. Reference has been made earlier to figure 3 which shows the effects of nine Sabadilla dusts in the reduction of catfacing. Thus, from our studies to date, it appears that rainfall may cause the greatest amount of catfacing whereas on years when the population of leaf roller and thrips is heavy, they may cause a considerable amount of crop damage. Rot organisms appear not to be as important as either of these other factors. Nevertheless, aside from rotted berries which are a total loss, rot organisms may cause considerable catfacing in wet years or during years or in patches where the incidence of rot is great, and by reference to figure 4, it would seem that fungus control reduced catfacing as much as 12 to 15 per cent.

Literature Cited

1. ANDERSON, D. L., L. D. JANES, H. T. REYNOLDS, R. F. SMITH, and J. E. SWIFT. 1952. *Lygus* Bugs on Seed Alfalfa. California Agric. Vol. 6, November, page 3.
2. EWART, W. H., and H. S. ELMER. 1952. Dieldrin for Thrips. California Agric., Vol. 6, Sept., page 15.
3. KAUFFMAN, WILLIAM, and W. A. STEVENSON. 1953. Value of Early-Season Control of Thrips on Cotton in the Santa Cruz Valley of Arizona. Jour. Econ. Ent. 46 (6) 1111-1112.
4. PARENIA, C. R., JR., and C. B. COWAN, JR. 1953. Field Tests with Sprays for the Control of Thrips and the Cotton Fleahopper. Jour. Econ. Ent. 46 (4) 633-638.
5. WEAVER, C. R., and C. J. OLSON. 1952. Chrysanthemum Crop Production. Ohio Research, Vol. 37, March-April, page 26.