THE INFLUENCE OF CERTAIN ORGANIC SPRAY MATERIALS ON THE INTERNAL STRUCTURE AND PHOTOSYNTHETIC ACTIVITY OF PEACH FOLIAGE

by

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INTRODUCTION

It has been shown that certain inorganic spray materials reduced the rate of photosynthetic activity behavior of apple leaves, Christopher (1935), Clore (1936), Heinicke (1938) and Pickett and Birkeland (1942). Pickett and Birkeland (1942) studied the influence of a combined spray of liquid lime-sulphur and lead arsenate on the internal structure of apple leaves. Heinicke (1938) studied the effect of a lime-sulphur 1-40 spray on the rate of photosynthesis of an entire ten-year-old Baldwin apple tree.

The comparatively recent introduction of Chlordane and Fermate as spray materials raises the question as to whether the rate of photosynthetic activity of the plant might be affected by these organic spray compounds. The desirability of spray materials used on fruit trees depends not only on their value in disease or insect control but also on their physiological effect on the tree. Thus the purpose of this study was an attempt to determine (1) whether the organic spray materials had an effect on the internal structure (2) whether the organic spray materials affected the rate of photosynthesis (3) whether these variations, if found, are directly correlated in the peach foliage.

LITERATURE REVIEW

General Structure of Leaf

Haberlandt (1928) stated that the palisade mesophyll is considered the most important photosynthetic tissue of the leaf. The upper epidermis of the leaf is always underlain by a one to many-layered palisade-tissue. The originally prismatic photosynthetic elements show a marked inclination to become cylindrical, so that the radical walls are particularly liable to separate from one another. This feature is partly connected with the necessity for the presence of air-spaces in immediate contact with the photosynthetic cells. A small group of from 2 to 10 palisade-cells converge at their lower ends so as to form a little fan-shaped group resting upon a single underlying cell, the upper end of which is correspondingly dilated in a funnel-shaped manner. The obvious inference is that these supporting elements are collecting-cells, which receive the photosynthetic products from all the members of a group of palisade cells, and transmit them more or less directly to the main channels of translocation.

The intermediary tissue, which constitutes the physiological link connecting the photosynthetic tissue with the efferent channels, is represented by the familiar spongy parenchyma. It lies beneath the palisade layers, and generally consists of elements provided with a number of tangentially directed branches, constituting so many supply-pipes, through which the synthetic products are conveyed from the palisade tissue to the ultimate branches of the vascular reticulum. The spongy parenchyma contains some chlorophyll and is capable of photosynthetic activity in a minor degree. It also acts as the principal ventilating tissue of the leaf by virtue of the numerous air spaces.

Eames and MacDaniel (1947) stated that the photosynthetic tissue between the upper and lower epidermises consists typically of thin-walled parenchyma known as mesophyll. This tissue usually forms the larger part of the substance of the leaf. The cells of the mesophyll show great variation in shape and arrangement, but in general, they are grouped in two classes: the palisade parenchyma or palisade cells, and the spongy parenchyma or spongy mesophyll. In the former the cells are elongated and more or less cylindrical and arranged in one or more regular, relatively compact layers near the ventral of the leaf with the long axis of the cells perpendicular to the leaf surface.

The palisade cells, which in transverse sections of leaves appear to be closely packed together, are really usually separated from each other or at least exposed to air space over a part of their surface. In many species, these elongated cells are joined end to end to form filaments which connect with the upper epidermis at one end and with the bundle sheath at the other. In leaves that stand more or less vertically or hang in a drooping position, palisade parenchyma may occur on both sides. A frequent modification of the columnar palisade cell is the cone-shape type, which lies with its larger and against the epidermis.

In the spongy parenchyma, the cells lack regularity in shape and are arranged loosely, so that a large part of their surface is exposed to the gases in the intercellular space. Some cells are irregular in shape, with radiating arms connecting with the arms of similar cells, thus making an irregular network of green tissue. The varying internal structural conditions in the leaf are advantageous to the function of photosynthesis. These are, in part, the exposure of a large number of chloroplasts to sunlight, the exposure of a large cell membrane surface to the intercellular space where interchange of gases takes place. Such an arrangement of the cells in relation to each other and to the vascular bundles makes it possible for the products of photosynthesis to be removed rapidly and the cells supplied with water and mineral nutrients.

Differentiation of Dorsiventral Leaves

According to Haberlandt (1928), the differentiation of palisade cells is always initiated by the appearance of active anticlinal division in approximately isodiametric mother-cells, and the palisade cells never arise from the mere elongation of isodiamtric meristem elements. These partitions appear at different stages of development in different plants.

Mounts (1932) stated that the cell layers begin to differentiate into epidermis, palisade and spongy mesophyll in

Vitis vulpina L. and *Catalpa bignonioides* Walt. when the blade is from 5 to 8 millimeters long.

Avery (1933) worked with tobacco plants and found that cell divisions cease first in the epidermis, followed by the spongy mesophyll, and then in the palisade. Layers in the palisade and spongy mesophyll were multiplied in a plane parallel to the surface of the leaf. When the leaf was 1/80 to 1/75 of its final size, the cells of the palisade mesophyll began to acquire their characteristic shape.

Factors Affecting the Anatomy of Leaves

Light. Eames and MacDaniels (1947) stated that the number of palisade layers and the density of the cell structure in those layers depend largely, either directly or indirectly, upon light intensity.

Bergen (1904) found that sun leaves of evergreen angiosperms were thicker than the shade leaves; the cells next to the epidermis were larger in the sun leaves. Sun leaves were usually narrower than shade leaves in proportion to their length.

That the leaves of sunflowers, water pepper and castorbean had a better development of mesophyll and were thicker when grown in full sunlight than when grown in shade was found by Penfound (1931, 1932).

McDougall and Penfound (1928) stated that leaves from dense shade were thinner, had more surface, with fewer palisade cells than leaves of the same plant in maximum sunlight.

Clements and Long (1935), working with Helianthus, found that the palisade tissue consistently composed more than 50 percent of the leaf thickness, and that the greater the percentage of illumination, the greater the thickness of the leaf. The leaves of Cornus florida L. were somewhat thicker on the south side than on the north side of the same tree was reported by Shank (1938). He also found that leaves were thicker and somewhat smaller in the open than in the wood.

Weaver and Clements (1938) stated that leaves from the interior of a lilac bush or the crown of a linden or a hard maple tree are much thinner than those exposed to full sunchine. Shade results in thin leaves often with a single layer of palisade cells and loosely arranged chlorenchyma. A variety of plants grown under 1 to 20 percent light developed only one layer of palisade tissue; those under 70 percent had 2 distinct layers.

Position of Leaf. Cowart (1935) reported that the thickness of leaf decreases from the base toward the median portion of the shoot and then increases from that point to the apex of the shoot.

Soil Moisture. Clements (1904) found that the looser arrangement and thinner structure of the mesophyll cells were caused by increase of soil moisture. The leaves of sunflower, castorbean, and water pepper were found thicker when the plants were grown in soil of high water content than when grown in soil of low water content. The number of rows of palisade and spongy cells was constant under all soil moisture conditions, but deeper the palisade and spongy mesophyll was the result if grown in soil of higher water content.

Nutrition Supply. Lutman (1934) worked on rape plants and showed that the length of palisade cells shortened when any variation was made from a complete nutrient solution, and buckwheat showed even greater variation than rape.

Factors Affecting the Rate of Photosynthetic Activity of Leaves

According to Miller (1938), the factors that influence the rate of photosynthetic activity of leaf may be divided into external factors and internal factors. The external factors that affect photosynthesis are the carbon dioxide supply, light, temperature, water supply, and numerous other factors essential to the general growth and vigor of the plant. The known internal factors that play a part in the process are the chlorophyll content and the protoplasmic factors.

Pickett (1934) stated that orchard grown Livland leaves have a more extensive intercellular space than orchard grown Delicious leaves and apparently these differences are reflected in the photosynthetic behavior of the two varieties. He suggested that the more open mesophyll of the orchard grown leaves may be one of the contributing factors in enabling them to be more active in carbon dioxide assimilation than those of greenhouse grown leaves.

Heinicke and Childers (1936) reported that the average rate of apparent respiration per hour of an entire apple tree during the night period amounts to considerably less than 10 percent of the average hourly rate of apparent photosynthesis during the day. The rate of apparent photosynthesis during the day, however, may be depressed 20 to 30 percent by respiration.

It was reported by Waugh (1939) that under fairly uniform external condition, the rate of assimilation of apple leaves is irregular. He thought that internal factors play a significant part in the assimilation of the apple leaf.

Effect of Spray Materials on the Photosynthesis of Leaves

Hoffman (1935) stated that lime-sulphur residues on foliage decreased the rate of photosynthesis. The decrease in the rate of photosynthesis was much more than offset by any increase that took place in the rate of respiration. He thought that there seems to be a tendency for the sprayed leaves to show a slightly greater rate of apparent respiration than the unsprayed trees.

That floatation sulphur may cause a reduction in carbon dioxide assimilation of the apple leaves was reported by Christopher (1935).

Heinicke (1938), using a lime-sulphur 1-40 spray on an entire ten-year-old Baldwin apple tree, found that during the 5 days after the first spray on July 6 to 7, the foliage of the sprayed tree was only about one-half as active as during the proceeding 6 days, while at the same time the check tree showed a slight increase in average daily rate.

Heinicke (1938) found that finely divided sulphur dust, compared with lime-sulphur solution, has relatively little influence on the rate of photosynthesis of the leaves of an entire tree.

Southwick and Childers (1939) studied the effect of 4-6-100 Bordeaux mixture on the rate of photosynthesis and transpiration of Stayman apple leaves using the method, which was used by Heinicke and Hoffman in 1933, for carbon dioxide analysis. The majority of the leaves received 1,000 to 5,500 foot candles of light depending on their distance from the light source and shading from other leaves. Three applications of Bordeaux were made at two-to five-day intervals under temperature conditions of 50, 60, 70, 82 and 100 degrees Fahrenheit. At temperature levels of 70, 82 and 100 degrees F. there were reductions in photosynthesis of 9 to 14 percent after the third application. When the spray residue was carefully removed from the leaf surface with moist cotton there was complete recovery in photosynthesis.

Pickett (1948) reported that 50 percent wettable D.D.T. (dichlorodiphenyl-trichloroethane) appeared to have its major effect on the respiration of the young peach leaves, in which case a marked increase in respiration was apparent. On leaves which appeared to be fully mature and completely functional, D.D.T. seemed to have a depressing effect.

Murphy (1939), using lime-sulphur (1-40), Cupro K (3-100), Coposil (3-100), Bordeaux (6-8-10) on ten 5-year-old vigorous Montmorency cherry trees, found that no significant differences of total photosynthate (corrected photosynthesis) existed among the means of the Coposil, Bordeaux and lime-sulphur sprayed leaves, and thus, any variation could not be definitely attributed to any effect of the sprays themselves.

Pieniazek and Christopher (1944) reported that apparent photosynthesis is reduced by Fermate and by lauryl pyridium chloride on apple leaves.

Effect of Spray Materials on the Internal Structure of the Leaf

Pickett and Birkeland (1942), using liquid lime-sulphur and lead arsenate as a combined spray, applied on different varieties of apples under greenhouse and field conditions, found that the spray materials used shocked or checked normal cell development with each application consistently throughout the growing season in both greenhouse grown and field grown leaves for all varieties tested. The development of the palisade tissue in leaves which were ten weeks old before they received a spray application was checked in growth to a level between the unsprayed and regularly sprayed leaves. The ratio of the internally exposed surface to the external surface (R value) and total depth of palisade layers of unsprayed leaves were much greater for any variety and location than for the corresponding sprayed leaves. They also concluded that the R value and total depth of palisade layers of leaves ranked in ascending order: York, Jonathan, and Wealthy for any treatment, location, or year.

Quantitative Method Used in Determining the Rate of Photosynthetic Activity of Leaves

Sachs (1884) is recognized as the first to use the dry weight method in determining the rate of photosynthesis of leaves. He removed one-half of an attached leaf, along the midrib of the leaf blade, from the plant at the beginning of the experiment in determining the dry weight of this severed portion. The other half of the leaf, after exposure to light for a given period, was removed and treated in the same manner for dry weight determination. This method is sometimes called "half-leaf method". The increase of dry weight of a given area of leaf in an experiment is indicated that a certain amount of carbohydrate has been formed in photosynthesis. Sachs noticed that the gain of dry weight does not represent the total gain of carbohydrate produced in photosynthesis. He thought that translocation of products from the leaf takes place during the period of photosynthesis, while a certain amount of carbohydrate is utilized in respiration, which proceeds simultaneously in the process.

In order to obtain the corrected rate of photosynthesis, he added the loss of dry weight during the night period to the gain of dry weight in the same unit leaf area found during the day.

To eliminate the errors due to irregular veins and the lack of symmetry in the halves or portions of the leaf, Ganong (1908) designed a leaf punch for removing circular leaf discs with an area of one square centimeter or a diameter of 1.128 centimeters.

Miller (1938) used the dry weight method in determining the corrected rate of photosynthetic activity of Dwarf Yellow milo under field conditions at Garden City, Kansas.

Spoehr (1926) believed that the correction of translocation and respiration in determining the rate of photosynthesis is necessary.

Pickett (1937) studied the photosynthetic behavior extensively on apple varieties by different methods and stated that no entirely satisfactory method for determining the rate of photosynthesis has been devised. The reasons for this are obvious. Concomitant with the phenomenon of photosynthesis are the processes of respiration and translocation, making it difficult, if not possible, to measure accurately the first and exclude the effects of the latter two.

MATERIALS AND METHODS

On April 3, 1948, 12 one-year-old trees each of Belle of Georgia, Halehaven, and Golden Jubilee varieties of peach were planted in the horticultural garden northeast of Dickens Hall. The trees were spaced 48 inches apart in three rows (each row for one variety) in equilateral triangular arrangement. The trees were divided into 3 blocks and each block consisted of 12 trees, 4 trees of each of the 3 varieties. Except the Chlordane treated tree of the Golden Jubilee variety in Block I and both the Chlordane and Fermate treated trees of the same variety in Block III, showing bacterial spot disease on the leaves, all were healthy and vigorous in growth.

Determining Photosynthetic Activity

Nearly 72 days after leaf buds started to grow, on July 6, 9:00 a.m., trees in Block I received the first spray. The first application of spray on Block III was on July 21, and July 31 on Block II.

Each of the 4 trees of the same variety in the same block was treated at random with either one of the treatments namely, 50 percent wettable D.D.T. (dichloro-diphenyl-trichloroethane), (1 and 1/2 lbs. per 100 gallons of water); Chlordane (1 lb. of actual Chlordane per 100 gallons of water); Fermate (3 lbs. per 100 gallons of water); and Check (untreated). In order to spray the whole tree thoroughly and prevent any contamination of spray to the adjacent trees, a burlap shelter was placed around each tree while it was being sprayed.

About 44 1/2 hours after the trees were sprayed, the first 100 Ganong leaf-punch discs were taken from each tree in the same block. A single punch was made on each of 100 different leaves, along the median portion of the shoots, from the same tree at each time. Samples were collected from the opposite sides on the same leaves twice daily; 5:30 a.m., 3:30 p.m., and put in weighed vials which were then quickly stoppered, weighed, placed in an electric oven at 100 to 104°C., and dried to constant weight.

The dry weight gain during the day is employed in determining the apparent rate of photosynthesis. The assumption was made that respiration and translocation proceed at the same rate during daylight hours as they do during the night. Thus, the loss in dry weight during the night was added to day gain in obtaining the total gain, or the corrected rate of photosynthetic activity.

Internal Structure of Leaves: Collecting and Imbedding

Trees, treatments, and spray schedules used in this study were the same as those used in the foregoing experiment in determining the rate of photosynthesis. The leaves selected were from the terminal part of the new shoots and which were sprayed when they were young, half-opened blade with light color. Leaves were sprayed at weekly intervals. Six samples were taken from 6 different leaves on the same tree of each variety one week after the third spray.

Portions of leaves collected for microscopic study were about 1 by 2 centimers in size, located near the midrib and mid-way between the basal and apical regions. These leaf pieces were placed in vials containing F.A.A. (formalin-aceto-alcohol) killing and fixing solution. In preparation for infiltration and embedding in paraffin, the samples were washed twice with 70 per-cent ethyl alcohol and then dehydrated with different percentages of tertiary butyl alcohol (Johansen, 1940) as shown in the following scheme:

Approximate % of total alcohol	50	70	85	95	100
a. Distilled water	50	30	15		
b. 95 % ethyl alcohol	40	50	50	45	
c. Tertiary Butyl alcohol	10	20	35	55	75
d. 100 % ethyl alcohol					25

Only one slide was made from each leaf piece and all of them were cut in cross sections of 10 microns thickness. The total depth of palisade cells (P value) was directly measured with a calibrated eyepiece micrometer in a microscope. The value of the total depth of palisade cells on each section was the average of 20 readings made from the 20 individual locations.

A Planting Map of Peach Trees in Horticultural Garden

	G_1	G_2	G_4	G_3	G_4	G_2	G_1	G_3	G_3	G_4	G_1	G_2
H_1	H_3	H_4	H_2	H_1	H_4	H_3	H_2	H_3	H_2	H_4	H_1	
	B_3	B_4	B_2	B_1	B_1	B_2	B_4	B_3	B_3	B_2	B_1	B_4

BLOCK I BLOCK II BLOCK III

B_1 Trees of Belle of Georgia were treated with Fermate.
B_2 Trees of Belle of Georgia were treated with Chlordane.
B_3 Trees of Belle of Goergia were treated with 50 percent wettable D.D.T.
B_4 Untreated Belle of Georgia trees.
H_1 Trees of Halehaven were treated with Fermate.
H_2 Trees of Halehaven were treated with Chlordane.
H_3 Trees of Halehaven were treated with 50 percent wettable D.D.T.
H_4 Untreated Halehaven trees.
G_1 Trees of Golden Jubilee were treated with Fermate.
G_2 Trees of Golden Jubilee were treated with Chlordane.
G_3 Trees of Golden Jubilee were treated with 50 percent wettable D.D.T.
G_4 Untreated Golden Jubilee trees.

PRESENTATION OF DATA

On July 8, 11, 12, 1948, leaf discs were collected from trees in Block I for determining the rate of photosynthesis. The dry weight of total gain (total amount of day gain and night loss) is presented in Tables 1, 2, and 3, showing a result with fluctuation between treatments and varieties.

The amount of total gain of dry weight among treated and untreated trees of Belle of Georgia is shown in Table 1. It indicated that the Fermate treated tree only produced 15.30 grams of dry weight, and is considered to be the least total gain as compared with an amount of 19.99 grams as the highest gain from the untreated tree. With the amount of 18.11 grams for the D.D.T. treated tree and 19.62 grams for the Chlordane treated tree, they are considered to be intermediate class having the total gain comparatively higher than the tree sprayed with Fermate but lower than the amount produced by the untreated tree.

In Table 2, the data indicated that the tree sprayed with D.D.T. had the highest total gain of dry weight (21.90 grams) as compared with the lowest total gain (16.62 grams) from the untreated tree respectively.

In regard to the data shown in Table 3, for the variety of Golden Jubilee, it is found that the highest yield of dry weight (18.95 grams) falls on the tree which was sprayed with Fermate. On the contrary, the untreated tree had only 14.98 grams of total gain of dry weight and is considered as the lowest rate of photosynthetic activity in this group. The amount of total gain of dry weight (16.07 grams) found on the D.D.T. treated tree is not greatly different from the total amount (16.74 grams) which was gained by the Chlordane treated tree.

According to the data shown in Tables 1, 2, and 3, the temperature seems not a factor affecting the variation of the total gain of dry weight among the three peach varieties used in this experiment. It is obvious that the temperatures during these days were fairly constant.

Table 1. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application, variety-Belle of Georgia. Block I.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams) Day gain	Night loss	Total gain of dry wt. (grams)	Temperature Max. (F.)	Mean (F.)	Character of day
D.D.T.	July 8 5:30 AM	44.89						
	3:30 PM	49.71	4.82			88	78	cloudy
	July 11 5:30 AM	45.23		4.48	9.30			
	3:30 PM	48.45	3.22			85	77	cloudy
	July 12 5:30 AM	42.86		5.59	8.81			
	3:30 PM	47.39	4.53	10.07	18.11	87	77	cloudy
			12.57					
Check (untreated)	July 8 5:30 AM	44.93						
	3:30 PM	50.30	5.37			88	78	cloudy
	July 11 5:30 AM	44.60		5.67	11.04			
	3:30 PM	49.09	4.49			85	77	cloudy
	July 12 5:30 AM	44.63		4.46	8.95			
	3:30 PM	47.72	3.09	10.13	19.99	87	77	cloudy
			12.95					
Chlordane	July 8 5:30 AM	45.75						
	3:30 PM	49.95	4.20			88	78	cloudy
	July 11 5:30 AM	44.62		5.33	9.53			
	3:30 PM	49.44	4.82			85	77	cloudy
	July 12 5:30 AM	44.17		5.27	10.09			
	3:30 PM	48.65	4.48	10.60	19.62	87	77	cloudy
			13.50					
Fermate	July 8 5:30 AM	46.51						
	3:30 PM	49.81	3.30			88	78	cloudy
	July 11 5:30 AM	45.03		4.78	8.08			
	3:30 PM	48.20	3.17			85	77	cloudy
	July 12 5:30 AM	44.15		4.05	7.22			
	3:30 PM	47.52	3.37	8.83	15.30	87	77	cloudy
			9.84					

Table 2. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Halehaven. Block I.

Treatment	Date and time 1948		Dry wt. (grams)	Gain or loss in dry wt. (grams) Day gain	Night loss	Total gain of dry wt. (grams)	Temperature Max. (F.)	Mean (F.)	Character of day
D.D.T.	July 8	5:30 AM	42.16				88	78	cloudy
		3:30 PM	47.75	5.59					
	July 11	5:30 AM	41.82		5.93	11.52	85	77	cloudy
		3:30 PM	46.93	5.11					
	July 12	5:30 AM	41.66		5.27	10.38	87	77	cloudy
		3:30 PM	45.52	3.86	11.20	21.90			
				14.56					
Check (untreated)	July 8	5:30 AM	43.97				88	78	cloudy
		3:30 PM	48.37	4.40					
	July 11	5:30 AM	43.00		5.37	9.77	85	77	cloudy
		3:30 PM	46.33	3.33					
	July 12	5:30 AM	42.81		3.52	6.85	87	77	cloudy
		3:30 PM	46.53	3.72	8.89	16.62			
				11.45					
Chlordane	July 8	5:30 AM	40.93				88	78	cloudy
		3:30 PM	46.13	5.20					
	July 11	5:30 AM	40.50		5.63	10.83	85	77	cloudy
		3:30 PM	44.33	3.83					
	July 12	5:30 AM	40.34		3.99	7.82	87	77	cloudy
		3:30 PM	46.53	6.19	9.62	18.65			
				15.22					
Fermate	July 8	5:30 AM	43.39				88	78	cloudy
		3:30 PM	47.66	4.27					
	July 11	5:30 AM	41.91		5.27	9.54	85	77	cloudy
		3:30 PM	46.93	5.02					
	July 12	5:30 AM	41.98		4.95	9.97	87	77	cloudy
		3:30 PM	46.20	4.22	10.22	19.51			
				13.51					

Table 3. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Golden Jubilee. Block I.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
D.D.T.	July 8 5:30 AM	44.32				88	78	cloudy
	3:30 PM	47.86	3.54					
	July 11 5:30 AM	42.45		5.41	8.95	85	77	cloudy
	3:30 PM	46.35	3.90					
	July 12 5:30 AM	43.13		3.22	7.12	87	77	cloudy
	3:30 PM	46.72	3.59	8.63	16.07			
			11.03					
Check (untreated)	July 8 5:30 AM	44.75				88	78	cloudy
	3:30 PM	47.81	3.06					
	July 11 5:30 AM	42.55		5.26	8.32	85	77	cloudy
	3:30 PM	46.17	3.32					
	July 12 5:30 AM	43.13		3.04	6.66	87	77	cloudy
	3:30 PM	46.72	3.50	8.30	14.98			
			10.18					
Chlordane	July 8 5:30 AM	44.28				88	78	cloudy
	3:30 PM	48.86	4.58					
	July 11 5:30 AM	43.23		5.63	10.21	85	77	cloudy
	3:30 PM	46.61	3.38					
	July 12 5:30 AM	43.46		3.15	6.53	87	77	cloudy
	3:30 PM	46.90	3.44	8.78	16.74			
			11.40					
Fermate	July 8 5:30 AM	41.40				88	78	cloudy
	3:30 PM	47.04	5.64					
	July 11 5:30 AM	41.87		5.17	10.81	85	77	cloudy
	3:30 PM	45.60	3.73					
	July 12 5:30 AM	41.19		4.41	8.14	87	77	cloudy
	3:30 PM	45.54	4.35	9.58	18.95			
			13.72					

The data of total gain of dry weight in a four-day record of Block II are given in Tables 4, 5, and 6.

Among the trees of the variety Belle of Georgia in Table 4, the Chlordane treated tree had the highest total gain of dry weight (26.70) compared with those trees treated with D.D.T. (24.35 grams), Fermate (21.41 grams), and untreated one (21.53 grams).

The highest total gain of dry weight in Halehaven variety in this block was the D.D.T. treated tree (23.29 grams) shown in Table 5. The Fermate sprayed tree had the least dry weight gain (19.88 grams) compared with the amount of 22.04 grams found in the untreated tree and 21.15 grams in the Chlordane treated one of the same variety.

The total gain of dry weight produced among trees of Golden Jubilee in Block II is presented in Table 6. The results showed that the Chlordane treated tree produced 24.65 grams of dry weight during the 4-day period to be the highest gain over any one of the other trees in the variety. The D.D.T. treated tree only had 15.62 grams of dry weight and is considered to be the lowest total gain in this variety compared with others.

According to the data given in Tables 4, 5, and 6, the Chlordane treatment had the least influence on the rate of photosynthetic activity of peach leaves.

Table 4. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Belle of Georgia. Block II.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
D.D.T.	Aug. 3 5:30 AM	50.51				77	70	cloudy
	3:30 PM	53.42	2.91					
	Aug. 4 5:30 AM	49.88		3.54	6.45	78	67	partly cloudy
	3:30 PM	53.17	3.29					
	Aug. 5 5:30 AM	49.50		3.67	6.96	77	64	partly cloudy
	3:30 PM	55.80	6.30					
	Aug. 6 5:30 AM	51.15		4.65	10.95	74	65	cloudy
	3:30 PM	52.94	1.79		24.36			
			14.29					
Check (untreated)	Aug. 3 5:30 AM	50.83				77	70	cloudy
	3:30 PM	54.13	3.30					
	Aug. 4 5:30 AM	50.35		3.78	7.08	78	67	partly cloudy
	3:30 PM	53.40	3.05					
	Aug. 5 5:30 AM	50.93		2.47	5.52	77	64	partly cloudy
	3:30 PM	56.03	5.10					
	Aug. 6 5:30 AM	52.20		3.83	8.93	74	65	cloudy
	3:30 PM	54.71	2.51		21.53			
			13.96					
Chlordane	Aug. 3 5:30 AM	48.47				77	70	cloudy
	3:30 PM	50.97	2.50					
	Aug. 4 5:30 AM	48.01		2.96	5.46	78	67	partly cloudy
	3:30 PM	55.12	7.11					
	Aug. 5 5:30 AM	49.14		5.98	13.09	77	64	partly cloudy
	3:30 PM	53.49	4.35					
	Aug. 6 5:30 AM	49.69		3.80	8.15	74	65	cloudy
	3:30 PM	51.47	1.78		26.70			
			15.74					

Table 4 (concl.).

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
Fermate	Aug. 3 5:30 AM	49.55				77	70	cloudy
	3:30 PM	51.16	1.61					
	Aug. 4 5:30 AM	48.67		2.49	4.10	78	67	partly cloudy
	3:30 PM	55.33	6.66					
	Aug. 5 5:30 AM	50.53		4.80	11.46	77	64	partly cloudy
	3:30 PM	53.23	2.70					
	Aug. 6 5:30 AM	50.08		3.15	5.85	74	65	cloudy
	3:30 PM	52.70	2.62		21.41			
			13.59					

Table 5. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Halehaven. Block II.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
D.D.T.	Aug. 3 5:30 AM	43.99				77	70	cloudy
	3:30 PM	48.06	4.07					
	Aug. 4 5:30 AM	44.77		3.29	7.36	78	67	partly cloudy
	3:30 PM	49.69	4.92					
	Aug. 5 5:30 AM	46.50		3.19	8.11	77	64	partly cloudy
	3:30 PM	50.92	4.42					
	Aug. 6 5:30 AM	47.52		3.40	7.82	74	65	cloudy
	3:30 PM	49.72	2.20					
			15.61		23.29			
Check (untreated)	Aug. 3 5:30 AM	43.40				77	70	cloudy
	3:30 PM	47.75	4.35					
	Aug. 4 5:30 AM	43.92		3.83	8.18	78	67	partly cloudy
	3:30 PM	48.76	4.84					
	Aug. 5 5:30 AM	46.31		2.45	7.29	77	64	partly cloudy
	3:30 PM	49.67	3.36					
	Aug. 6 5:30 AM	46.46		3.21	6.57	74	65	cloudy
	3:30 PM	49.53	3.07					
			15.62		22.04			
Chlordane	Aug. 3 5:30 AM	44.54				77	70	cloudy
	3:30 PM	48.39	3.85					
	Aug. 4 5:30 AM	45.40		2.99	6.84	78	67	partly cloudy
	3:30 PM	50.13	4.73					
	Aug. 5 5:30 AM	47.74		2.39	7.12	77	64	partly cloudy
	3:30 PM	51.08	3.34					
	Aug. 6 5:30 AM	47.23		3.85	7.19	74	65	cloudy
	3:30 PM	50.56	3.33					
			15.25		21.15			

Table 5 (concl.).

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams) Day gain	Night loss	Total gain of dry wt. (grams)	Temperature Max. (F.)	Mean (F.)	Character of day
Fermate	Aug. 3 5:30 AM	44.56				77	70	cloudy
	3:30 PM	48.29	3.73					
	Aug. 4 5:30 AM	44.48		3.81	7.54	78	67	partly cloudy
	3:30 PM	50.15	5.67					
	Aug. 5 5:30 AM	48.38		1.77	7.44	77	64	partly cloudy
	3:30 PM	50.29	1.91					
	Aug. 6 5:30 AM	47.30		2.99	4.90	74	65	cloudy
	3:30 PM	50.80	3.50		19.88			
			14.81					

Table 6. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Golden Jubilee. Block II.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
D.D.T.	Aug. 3 5:30 AM	42.75				77	70	cloudy
	3:30 PM	47.10	4.35					
	Aug. 4 5:30 AM	46.80		0.30	4.65	78	67	partly cloudy
	3:30 PM	48.71	1.91					
	Aug. 5 5:30 AM	45.86		2.85	4.76	77	64	partly cloudy
	3:30 PM	49.07	3.21					
	Aug. 6 5:30 AM	46.07		3.00	6.21	74	65	cloudy
	3:30 PM	48.54	2.47		15.62			
			11.94					
Check (untreated)	Aug. 3 5:30 AM	43.98				77	70	cloudy
	3:30 PM	48.46	4.48					
	Aug. 4 5:30 AM	44.80		3.66	8.14	78	67	partly cloudy
	3:30 PM	49.84	5.04					
	Aug. 5 5:30 AM	48.08		1.78	6.80	77	64	partly cloudy
	3:30 PM	50.93	2.85					
	Aug. 6 5:30 AM	47.13		3.80	6.65	74	65	cloudy
	3:30 PM	50.18	3.05		21.59			
			15.42					
Chlordane	Aug. 3 5:30 AM	43.24				77	70	cloudy
	3:30 PM	48.00	4.76					
	Aug. 4 5:30 AM	44.19		3.81	8.57	78	67	partly cloudy
	3:30 PM	49.40	5.21					
	Aug. 5 5:30 AM	46.42		2.98	8.19	77	64	partly cloudy
	3:30 PM	50.45	4.03					
	Aug. 6 5:30 AM	46.59		3.86	7.89	74	65	cloudy
	3:30 PM	49.27	2.68		24.65			
			16.68					

Table 6 (concl.).

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams) Day gain	Night loss	Total gain of dry wt. (grams)	Temperature Max. (F.)	Mean (F.)	Character of day
Formate	Aug. 3 5:30 AM	45.59				77	70	cloudy
	3:30 PM	48.90	3.31					
	Aug. 4 5:30 AM	43.38		5.52	8.83	78	67	partly cloudy
	3:30 PM	51.09	7.71					
	Aug. 5 5:30 AM	49.33		1.76	9.47	77	64	partly cloudy
	3:30 PM	52.25	2.92					
	Aug. 6 5:30 AM	48.92		3.33	6.25	74	65	cloudy
	3:30 PM	50.31	1.39		24.55			
			15.33					

Because the bacterial spot disease was found widely on the leaves of both (Chlordane and Fermate treated) trees in the Golden Jubilee, the leaf surface of the trees in Block III became limited for sampling. The three-day (July 23, 24, and 25) record of the total gain of dry weight in Block III is given in Tables 7, 8, and 9.

In this block, the tree of Belle of Georgia variety had the highest total gain of dry weight (22.19 grams) while the tree was untreated. The lowest gain of dry weight (19.91 grams) occurred on the D.D.T. treated trees shown in Table 7.

The data of total gain of dry weight produced by Halehaven trees are given in Table 8. The D.D.T. treated tree had the highest total gain of dry weight (18.97 grams). The least total gain (14.14 grams) was found on the untreated tree of this variety.

In Table 9, the data showed that the total gain of dry weight among trees of Golden Jubilee variety is relatively constant. Although the untreated tree had a relatively higher total gain (13.06 grams) than those of treated trees, however, the amount of total gain of dry weights found in the Chlordane treated tree (12.56 grams), Fermate (12.62 grams), and D.D.T. (12.23 grams) fairly close to each other.

So far as the total gain of dry weight is concerned from Tables 1 to 9, there was no consistent variation or difference between treatments and varieties in the same block as well as in the three blocks.

Table 7. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Belle of Georgia. Block III.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
D.D.T.	July 23 5:30 AM	47.60				79	65	clear
	3:30 PM	52.86	5.26					
	July 24 5:30 AM	48.39		4.47	9.73	87	73	partly cloudy
	3:30 PM	53.26	4.87					
	July 25 5:30 AM	47.95		5.31	10.18 / 19.91	91	83	partly cloudy
	3:30 PM	51.01	6.94 / 17.07					
Check (untreated)	July 23 5:30 AM	43.75				79	65	clear
	3:30 PM	49.96	6.21					
	July 24 5:30 AM	44.99		4.97	11.18	87	73	partly cloudy
	3:30 PM	49.99	5.00					
	July 25 5:30 AM	43.98		6.01	11.01 / 22.19	91	83	partly cloudy
	3:30 PM	48.13	4.15 / 15.36					
Chlordane	July 23 5:30 AM	42.28				79	65	clear
	3:30 PM	48.06	5.78					
	July 24 5:30 AM	43.40		4.66	10.44	87	73	partly cloudy
	3:30 PM	48.43	5.03					
	July 25 5:30 AM	42.65		5.78	10.81 / 21.25	91	83	partly cloudy
	3:30 PM	46.50	3.85 / 14.66					
Fermate	July 23 5:30 AM	45.06				79	65	clear
	3:30 PM	50.33	5.27					
	July 24 5:30 AM	45.97		4.36	9.63	87	73	partly cloudy
	3:30 PM	50.88	4.91					
	July 25 5:30 AM	45.18		5.70	10.61 / 20.24	91	83	partly cloudy
	3:30 PM	48.57	3.39 / 13.57					

Table 8. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Halehaven. Block III.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams): Day gain	Gain or loss in dry wt. (grams): Night loss	Total gain of dry wt. (grams)	Temperature: Max. (F.)	Temperature: Mean (F.)	Character of day
D.D.T.	July 23 5:30 AM	42.40				79	65	clear
	3:30 PM	47.48	5.08					
	July 24 5:30 AM	43.53		3.95	9.03	87	73	partly cloudy
	3:30 PM	48.34	4.81					
	July 25 5:30 AM	43.21		5.13	9.94	91	83	partly cloudy
	3:30 PM	47.13	3.92		18.97			
			13.81					
Check (untreated)	July 23 5:30 AM	40.34				79	65	clear
	3:30 PM	44.11	3.77					
	July 24 5:30 AM	41.30		2.81	6.58	87	73	partly cloudy
	3:30 PM	44.47	3.17					
	July 25 5:30 AM	40.08		4.39	7.56	91	83	partly cloudy
	3:30 PM	42.56	2.48		14.14			
			9.42					
Chlordane	July 23 5:30 AM	43.46				79	65	clear
	3:30 PM	47.34	3.88					
	July 24 5:30 AM	43.66		3.68	7.56	87	73	partly cloudy
	3:30 PM	48.25	4.59					
	July 25 5:30 AM	42.56		5.69	10.28	91	83	partly cloudy
	3:30 PM	46.64	4.08		17.84			
			12.55					
Fermate	July 23 5:30 AM	43.33				79	65	clear
	3:30 PM	46.81	3.48					
	July 24 5:30 AM	43.40		3.41	6.89	87	73	partly cloudy
	3:30 PM	47.01	3.61					
	July 25 5:30 AM	41.92		5.09	8.70	91	83	partly cloudy
	3:30 PM	45.84	3.92		15.59			
			11.01					

Table 9. Variation in dry weight produced per square meter of leaf area per day, 44 hours after 1st. spray application. Variety - Golden Jubilee. Block III.

Treatment	Date and time 1948	Dry wt. (grams)	Gain or loss in dry wt. (grams) Day gain	Night loss	Total gain of dry wt. (grams)	Temperature Max. (F.)	Mean (F.)	Character of day
D.D.T.	July 23 5:30 AM	43.21				79	65	clear
	3:30 PM	45.69	2.43					
	July 24 5:30 AM	43.33		2.36	4.84	87	73	partly cloudy
	3:30 PM	46.08	2.75					
	July 25 5:30 AM	41.44		4.64	7.39	91	83	partly cloudy
	3:30 PM	44.73	3.29		12.23			
			8.52					
Check (untreated)	July 23 5:30 AM	45.81				79	65	clear
	3:30 PM	48.62	2.81					
	July 24 5:30 AM	46.02		2.60	5.41	87	73	partly cloudy
	3:30 PM	49.55	3.53					
	July 25 5:30 AM	45.43		4.12	7.65	91	83	partly cloudy
	3:30 PM	48.35	2.92		13.06			
			9.26					
Chlordane	July 23 5:30 AM	42.32				79	65	clear
	3:30 PM	44.79	2.47					
	July 24 5:30 AM	42.17		2.62	5.09	87	73	partly cloudy
	3:30 PM	45.42	3.25					
	July 25 5:30 AM	41.20		4.22	7.47	91	83	partly cloudy
	3:30 PM	44.23	3.03		12.56			
			8.75					
Fermate	July 23 5:30 AM	44.33				79	65	clear
	3:30 PM	46.85	2.52					
	July 24 5:30 AM	44.12		2.73	5.25	87	73	partly cloudy
	3:30 PM	47.35	3.23					
	July 25 5:30 AM	43.21		4.14	7.37	91	83	partly cloudy
	3:30 PM	46.38	3.17		12.62			
			8.92					

Table 10. Average of dry weight produced per square meter of leaf area per day by leaves for a period of ten days from all varieties and blocks.

Treatment	Average gain per day (grams)	Mean of day gain and night loss per day (grams)
D.D.T.	4.03	8.33
Check (untreated)	3.79	8.02
Chlordane	4.14	8.61
Fermate	3.83	8.12

From Tables 1 to 9, the average day gain and total gain of dry weight for all varieties and blocks were computed and are shown in Table 10. The rate of photosynthesis of those trees that were treated with Chlordane had the highest average of dry weight produced per square meter of leaf area per day. Those treated with other treatments ranked: D.D.T., Fermate, and Check (untreated).

Table 11. Analysis of variance of dry weight in apparent photosynthesis after first spray.

Source of variation	Degree of freedom	Sum of squares	Variance	F
Varieties	2	9.67762	4.83881	4.468*
Treatments	3	2.25606	0.75202	0.694
Blocks	2	4.2904	2.1452	1.981
Variety x Treatment interaction	6	6.95653	1.15942	1.071
Days in the same block	7	39.90533	5.70076	5.264**
Remainder	99	107.22166		
Total	119			

* Significant
** Highly significant

Table 12. Analysis of variance of dry weight in the rate of corrected photosynthesis after 1st. spray.

Source of variation	Degree of freedom	Sum of squares	Vari-ance	F
Varieties	2	39.57432	19.78716	8.088**
Treatments	3	4.72335	1.57445	0.644
Blocks	2	38.8291	19.4146	7.936**
Variety x treatment interaction	6	26.35501	4.3925	1.795
Days in the same block	4	35.5032	8.8758	3.728**
Remainder	66	161.46312	2.44641	
Total	83			

* Significant
** Highly significant
*** Very highly significant

An analysis of variance of dry weight in determining the rate of photosynthesis was made as in Tables 11 and 12. Due to the variation within varieties and treatments, an attempt is made to determine whether varieties differed in their response to the spray materials and whether the spray materials affected differently on their varieties. On the bases of 5 percent and 1 percent level in F Table, the significant variation between treatments should be 2.76 or 4.13 and between the variety and treatment interaction should be 2.25 or 3.12. The analyses shown in Tables 11 and 12 indicated that there are no significant differences among the rate of photosynthesis, either on varieties or treatments, because the F values are far below the 5 percent and 1 percent level.

In regard to the study of internal structure, leaves were collected at one week after the application of the third spray. The measurements of the total depth (P value) of palisade cells are presented in Tables 13 and 14.

According to the data shown in Table 14, it is apparent that Fermate had the relatively higher reducing effect upon the total depth (P value) of palisade cells compared with other treatments.

Both Halehaven and Golden Jubilee varieties were found normally possessing palisade cells from two to three layers instead of two layers found mostly in the variety of Belle of Georgia. The Fermate treated leaves had the least depth, lesser number, and looser arrangement of palisade cells.

Table 13. The depth of palisade cells from each cross section of leaf samples collected after the application of the third spray.

Treatment	Variety	Average total depth of palisade cells from each section of leaf samples (microns)		
		Block I	Block II	Block III
D.D.T.	Belle of Georgia	66.132, 54.525	69.722, 72.895	68.136, 65.464
		57.281, 65.547	72.478, 94.104	76.486, 67.301
		58.784, 58.784	71.726, 75.484	65.798, 71.142
	Halehaven	52.354, 59.869	85.671, 66.048	67.635, 70.140
		63.627, 52.020	80.494, 63.794	64.295, 65.631
		52.855, 52.271	68.637, 76.736	62.458, 64.629
	Golden Jubilee	61.706, 68.386	73.229, 71.225	61.790, 67.468
		59.953, 71.058	71.977, 80.160	65.631, 64.963
		56.446, 56.446	82.915, 87.007	62.458, 64.629
Check (untreated)	Belle of Georgia	75.233, 67.468	85.921, 99.031	73.313, 82.164
		75.651, 73.146	106.963, 76.486	73.146, 87.675
		68.971, 73.313	71,225, 88.593	74.816, 75.317
	Halehaven	67.885, 68.386	81.436, 86.589	74.315, 78.824
		67.718, 64.211	75.484, 75.317	75.651, 65.365
		61.038, 67.301	87.341, 72.979	75.317, 65.297
	Golden Jubilee	68.470, 71.392	93.520, 82.164	78.490, 79.659
		72.728, 70.975	92.601, 79.408	65.965, 77.655
		57.865, 76.319	101.870, 85.420	68.470, 70.474
Chlordane	Belle of Georgia	85.504, 65.460	89.261, 85.088	84.001, 73.480
		72.144, 80,076	84.168, 86.339	74.983, 82.164
		79.241, 66.800	89.679, 79.325	66.299, 76.085
	Halehaven	62.040, 66.967	82.999, 74.482	79,993, 73.647
		67.050, 56.529	72.812, 79.074	77.154, 65.130
		58.450, 62.124	87.257, 69.762	70.975, 75.484
	Golden Jubilee	75.317, 66.215	73.397, 83.082	80.679, 81.496
		61.289, 67.301	86.172, 95.524	67.969, 73.430
		66.466, 63.126	69.889, 75.818	70.307, 63.627

Table 13 (concl.).

Treatment	Variety	Average total depth of palisade cells from each section of leaf samples (microns)		
		Block I	Block II	Block III
Fermate	Belle of Georgia	60.704, 66.132	76.569, 73.229	58.450, 74.148
		58.032, 57.615	82.247, 73.814	66.633, 59.619
		58.199, 61.790	75.818, 74.816	59.285, 61.790
	Halehaven	56.112, 52.354	86.422, 86.172	53.941, 58.784
		58.366, 61.706	70.808, 88.259	57.114, 66.967
		43.670, 55.026	87.675, 62.625	57.448, 62.291
	Golden Jubilee	57.030, 65.464	86.339, 74.399	58.784, 63.293
		56.112, 57.114	74.482, 80.744	59.953, 62.625
		53.690, 56.195	58.533, 72.728	61.289, 64.128

Table 14. Average total depth of palisade cells from cross sectional leaf samples collected after the application of third spray.

Treatment	Variety	Average total depth of palisade cells from each variety (microns) Block I	Block II	Block III	Mean from all blocks (microns)	Mean from all varieties and blocks (microns)
D.D.T.	Belle of Georgia	60.18	76.07	69.05	68.43	
	Halehaven	55.60	73.56	66.19	65.08	67.24
	Golden Jubilee	62.33	77.75	64.49	68.19	
	Mean	59.37	75.79	66.58	67.24	
Check (untreated)	Belle of Georgia	72.30	88.04	77.74	79.36	
	Halehaven	66.09	79.87	72.56	72.84	76.54
	Golden Jubilee	69.62	89.16	73.45	77.41	
	Mean	69.37	85.69	74.58	76.54	
Chlordane	Belle of Georgia	74.54	85.64	76.17	78.78	
	Halehaven	62.19	81.06	73.73	72.33	75.01
	Golden Jubilee	66.62	80.73	74.42	73.92	
	Mean	67.78	82.48	74.77	75.01	
Fermate	Belle of Georgia	60.41	76.08	63.32	66.60	
	Halehaven	54.54	80.32	59.42	64.76	65.33
	Golden Jubilee	57.60	74.62	61.68	64.63	
	Mean	57.52	77.07	61.47	65.33	

Table 15. Analysis of variance of depth of palisade cells after the application of the third spray.

Sources of variation	Degree of freedom	Sum of squares	Vari-ance	F
Varieties	2	742.21605	371.108025	8.73**
Treatments	3	5023.05484	1674.351613	39.42***
Blocks	2	10404.01024	5202.00512	122.50***
Variety x Block	4	179.09124	44.77281	1.05
Treatment x Block	6	322.32666	53.72111	1.03
Variety x Treatment	6	237.12602	39.52100	0.93
Block x Variety x Treatment	12	455.88974	37.990811	0.89
Remainder	180	7643.58669	42.46437	
Total	215			

*Significant
**Highly significant
***Very highly significant

In Table 15, an analysis was made to determine whether varieties differed in their P values or the spray materials had an effect differently on them. On the bases of 5 percent and 1 percent level in F Table, this analysis indicated that the variability between treatments is very highly significant, because the F value between treatments shown in Table 15 outnumber larger than 1 percent or 3.88 in the F Table. There was no significant difference between varieties and treatments interaction. It is obviously true that those leaves treated with Fermate spray had the least depth of palisade cells compared with others in all varieties.

An attempt was made to determine whether the effect on the internal structure may b directly correlated with the rate of photosynthesis. Leaf samples were collected at one week after the application of the third spray for this purpose. By the data given in Tables 16, 17, 18 and 19, correlation between the total depth (P value) of palisade cells and the rate of photosynthesis is computed. The analysis of correlation (r) between the rate of corrected photosynthesis and the total depth of palisade cells is -0.255 indicating that there was no significant correlation between them. For this reason, there is no analysis table given here for explanation.

Table 16. Variation in dry weight per square meter of leaf area per day after the third application of spray. Variety - Belle of Georgia. Block II.

Treatment	Date and time 1948		Dry wt. per M^2 of leaf area (grams)	Gain or loss in dry matter (grams) Day gain	Night loss	Total gain in dry wt. (grams)	Temperature Max. (F.)	Min. (F.)	Character of day
D.D.T.	Aug. 23	5:30 AM	50.59						
		3:30 PM	52.76	2.17			99	86	cloudy
	Aug. 24	5:30 AM	49.74		3.02	5.19			
		3:30 PM	53.39	3.65			96	84	cloudy
	Aug. 25	5:30 AM	50.58		2.81	6.46			
		3:30 PM	53.25	2.67			92	82	clear
	Aug. 27	5:30 AM	50.06		3.19	5.86			
		3:30 PM	54.68	4.62		17.51	90	79	partly cloudy
				13.11					
Check (untreated)	Aug. 23	5:30 AM	55.43						
		3:30 PM	56.60	1.17			99	86	cloudy
	Aug. 24	5:30 AM	55.29		1.31	2.48			
		3:30 PM	58.04	2.75			96	84	clear
	Aug. 25	5:30 AM	55.58		2.46	5.21			
		3:30 PM	56.85	1.27			92	82	clear
	Aug. 27	5:30 AM	54.16		2.69	3.96			
		3:30 PM	58.64	4.48		11.65	90	79	partly cloudy
				9.67					

Table 16 (concl.).

Treatment	Date and time 1948	Dry wt. per M^2 of leaf area (grams)	Gain or loss in dry matter (grams): Day gain	Gain or loss in dry matter (grams): Night loss	Total gain in dry wt. (grams)	Temperature: Max. (F.)	Temperature: Min. (F.)	Character of day
Chlordane	Aug. 23 5:30 AM	53.10						
	3:30 PM	54.35	1.25			99	86	clear
	Aug. 24 5:30 AM	52.83		1.52	2.77			
	3:30 PM	55.39	2.56			96	84	clear
	Aug. 25 5:30 AM	53.74		1.65	4.21			
	3:30 PM	55.49	1.75			92	82	clear
	Aug. 27 5:30 AM	52.06		3.43	5.18			
	3:30 PM	55.36	3.30		12.16	90	79	partly cloudy
			8.86					
Fermate	Aug. 23 5:30 AM	51.45						
	3:30 PM	54.82	3.37			99	86	clear
	Aug. 24 5:30 AM	52.23		2.59	5.96			
	3:30 PM	54.78	2.55			96	84	clear
	Aug. 25 5:30 AM	52.88		1.90	4.45			
	3:30 PM	55.19	2.31			92	82	clear
	Aug. 27 5:30 AM	52.00		3.10	5.50			
	3:30 PM	55.79	3.79		15.91	90	79	partly cloudy
			12.02					

Table 17. Variation in dry weight per square meter of leaf area per day after the third application of spray. Variety - Halehaven. Block II.

Treatment	Date and time 1948	Dry wt. per M^2 of leaf area (grams)	Gain or loss in dry matter (grams) Day gain	Night loss	Total gain in dry wt. (grams)	Temperature Max. (F.)	Min. (F.)	Character of day
D.D.T.	Aug. 23 5:30 AM	46.01						
	3:30 PM	48.55	2.54			99	86	cloudy
	Aug. 24 5:30 AM	46.39		2.16	4.70			
	3:30 PM	49.83	3.44			96	84	cloudy
	Aug. 25 5:30 AM	48.03		1.80	5.24			
	3:30 PM	50.65	2.62			92	82	clear
	Aug. 27 5:30 AM	48.23		2.42	5.04			
	3:30 PM	49.76	1.53		14.98	90	79	partly cloudy
			10.13					
Check (untreated)	Aug. 23 5:30 AM	42.30						
	3:30 PM	48.72	6.42			99	86	cloudy
	Aug. 24 5:30 AM	47.04		1.68	8.10			
	3:30 PM	50.21	3.17			96	84	clear
	Aug. 25 5:30 AM	48.13		2.08	5.25			
	3:30 PM	51.05	2.92			92	82	clear
	Aug. 27 5:30 AM	47.53		3.52	6.44			
	3:30 PM	51.20	3.67		19.79	90	79	partly cloudy
			16.18					

Table 17 (concl.).

Treatment	Date and time 1948	Dry wt. per M^2 of leaf area (grams)	Gain or loss in dry matter (grams): Day gain	Gain or loss in dry matter (grams): Night loss	Total gain in dry wt. (grams)	Temperature: Max. (F.)	Temperature: Min. (F.)	Character of day
	Aug. 23 5:30 AM	44.82						
	3:30 PM	47.69	3.14			99	86	clear
	Aug. 24 5:30 AM	45.30		2.66	5.80			
Chlordane	3:30 PM	48.74	3.44			96	84	clear
	Aug. 25 5:30 AM	46.38		2.36	5.80			
	3:30 PM	49.19	2.81			92	82	clear
	Aug. 27 5:30 AM	46.51		2.68	5.49			
	3:30 PM	49.56	3.05		17.09	90	79	partly cloudy
			12.44					
	Aug. 23 5:30 AM	46.54						
	3:30 PM	48.61	2.07			99	86	clear
	Aug. 24 5:30 AM	46.96		1.65	3.72			
Fermate	3:30 PM	49.97	3.01			96	84	clear
	Aug. 25 5:30 AM	48.08		1.89	4.90			
	3:30 PM	50.91	2.83			92	82	clear
	Aug. 27 5:30 AM	48.27		2.64	5.47			
	3:30 PM	50.22	1.95		14.09	90	79	partly cloudy
			9.86					

Table 18. Variation in dry weight per square meter of leaf area per day after the third application of spray. Variety - Golden Jubilee. Block II

Treatment	Date and time 1948	Dry wt. per M^2 of leaf area (grams)	Gain or loss in dry matter (grams) Day gain	Night loss	Total gain in dry wt. (grams)	Temperature Max. (F.)	Min. (F.)	Character of day
D.D.T.	Aug. 23 5:30 AM	47.13						
	3:30 PM	50.15	3.02			99	86	cloudy
	Aug. 24 5:30 AM	48.32		1.83	4.85			
	3:30 PM	51.11	2.79			96	84	cloudy
	Aug. 25 5:30 AM	49.86		1.25	4.04			
	3:30 PM	52.07	2.21			92	82	clear
	Aug. 27 5:30 AM	48.17		3.90	6.11			
	3:30 PM	51.87	3.70		15.00	90	79	partly cloudy
			11.72					
Check (untreated)	Aug. 23 5:30 AM	45.57						
	3:30 PM	48.46	2.89			99	86	cloudy
	Aug. 24 5:30 AM	46.47		1.99	4.88			
	3:30 PM	49.98	3.51			96	84	clear
	Aug. 25 5:30 AM	47.82		2.16	5.67			
	3:30 PM	51.16	3.34			92	82	clear
	Aug. 27 5:30 AM	48.26		2.90	6.24			
	3:30 PM	52.82	4.56		16.79	90	79	partly cloudy
			14.30					

Table 18 (concl.).

Treatment	Date and time 1948	Dry wt. per M^2 of leaf area (grams)	Gain or loss in dry matter (grams) Day gain	Night loss	Total gain in dry wt. (grams)	Temperature Max. (F.)	Min. (F.)	Character of day
Chlordane	Aug. 23 5:30 AM	47.97						
	3:30 PM	48.47	0.50			99	86	clear
	Aug. 24 5:30 AM	46.95		1.52	2.02			
	3:30 PM	49.28	2.33			96	84	clear
	Aug. 25 5:30 AM	48.41		0.87	3.20			
	3:30 PM	50.89	2.48			92	82	clear
	Aug. 27 5:30 AM	47.32		3.57	6.05			
	3:30 PM	50.44	3.21		11.27	90	79	partly cloudy
			8.52					
Fermate	Aug. 23 5:30 AM	47.70						
	3:30 PM	50.54	2.84			99	86	clear
	Aug. 24 5:30 AM	48.24		2.30	5.14			
	3:30 PM	51.87	3.63			96	84	clear
	Aug. 25 5:30 AM	49.34		2.53	6.16			
	3:30 PM	53.31	3.97			92	82	clear
	Aug. 27 5:30 AM	48.17		5.14	9.11			
	3:30 PM	51.59	3.42		20.41	90	79	partly cloudy
			13.86					

Table 19. Average of total depth of palisade cells after third application of spray. Block II.

Treatment	Variety	Means of total depth of palisade cells on each variety (microns)	Means of total depth of palisade cells on all varieties (microns)
D.D.T.	Belle of Georgia	76.07	75.79
	Halehaven	73.56	
	Golden Jubilee	77.75	
Check (untreated)	Belle of Georgia	88.04	85.69
	Halehaven	79.87	
	Golden Jubilee	89.16	
Chlordane	Belle of Georgia	85.64	81.48
	Halehaven	81.06	
	Golden Jubilee	80.73	
Fermate	Belle of Georgia	76.08	77.01
	Halehaven	80.32	
	Golden Jubilee	74.62	

DISCUSSION OF RESULTS

In Tables 1 to 9, the data were presented for the study of effects among four treatments including D.D.T., Check (untreated), Chlordane and Fermate on the rate of photosynthesis of Belle of Georgia, Halehaven and Golden Jubilee, three peach varieties. In determining the rate of photosynthesis, the values, obtained by the dry weight method, were expressed into apparent and corrected photosynthesis. The rate of photosynthesis was expressed as grams of dry weight produced per square meter of leaf area per day.

The fluctuations in apparent photosynthesis from day to day of both the untreated and the sprayed trees were shown for all varieties and blocks.

By mathematical calculation, the dry weight produced per square meter of leaf area per day over the whole period of this experiment, shown in Tables 1 to 9, indicated that there was no consistent reducing effect between any one of the treatments upon the rate of photosynthetic activity of the three peach varieties. Analyses of varianee of dry weight in the rate of photosynthetic activity were given in Tables 11 and 12, showing that there are no significant differences between treatments. The variability between treatments and varieties also showed no significant differences.

The values of measurements from the depth of palisade cells were used for the study of internal structure of the leaf. No attempt was made to calculate the ratio of the internally exposed surface to the exterior surface (R value) in this study. The depth of palisade cells of untreated trees is markedly different from the treated trees shown in Tables 13 and 14. It is obvious that Fermate had the highest reducing effect on the depth of palisade cells of peach leaves.

The least depth of palisade cells which was reduced by the application of Fermate spray coupled with less compact, more slender cells in arrangement of internal structure. With the effect of reduction on the depth of palisade cells, the treatments formed an order as: (1) Fermate, (2) D.D.T., (3) Chlordane, and (4) Checks (untreated) consistently.

The variability of the depth of the palisade cells between treatments is very highly significant as shown in Table 15.

There is no significant correlation between the depth of palisade cells and the rate of photosynthesis of the samples collected after the third application of sprays, if it can be assumed to be a negative result in the analysis of variance for correlation which has been mentioned precedingly. There are two possible factors to set in governing the results in determining the rate of photosynthesis: (1) There are different potential powers in manufacturing of photosynthetic products between trees in the same variety as well as in different varieties. From Tables 1 to 9, trees that were sprayed with Chlordane or Fermate fluctuated irregularly over the experimental period indicated that there obviously was a different individual manufacturing power among them. In order to obtain the better result, it might be suggested to have an extra set of leaf sample collection before the application of spray for the standard readings of their individual dry weight producing power as comparison for the further readings.

(2) The size of particles and the amount of residue of spray materials deposited on the leaf surface should be considered in dry weight method for the determination of photosynthesis. Murphy (1939) washed the leaf samples with distilled water immediately preceding sampling on the sour cherry experiment. Unfortunately, this method was impracticable in this experiment because it was impossible to collect 1,200 leaf discs in a given limit of time before sun rises in the morning and after 3:30 in the afternoon before the sun sets.

According to Pickett (1937), no entirely satisfactory method for determining the rate of photosynthesis has been devised. It is really true. Photosynthesis is a so complicated vital process in the green plant. It is undoubtedly still to be a valuable subject for further research.

SUMMARY

The influence of three organic spray materials including 50 percent wettable D.D.T., Chlordane, and Fermate was tested on their effects on the photosynthetic activity of peach foliage. The results may be summarized as follows:

1. There was no significant difference between treatments affecting the rate of photosynthetic activity in the same variety or among varieties.

2. The depth of palisade cells in all varieties was reduced by the application of Fermate, likewise, the 50 percent wettable D.D.T., also had the reducing effect on the palisade cells respectively.

3. There was no significant correlation between the depth of palisade cells and the rate of photosynthesis.

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