PANEL ON PARATHION

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Mr. President, Members of the Florida Horticultural Society and Guests:

The Executive Committee of the Society requested that a panel be developed on Parathion to be presented at this meeting.

In planning the panel the assistance of Dr. J. T. Griffiths, Mr. W. L. Thompson and Mr. Frank L. Holland was sought.

Due to the keen intellect and efforts of these three gentlemen, plus the very fine cooperation of the twenty-two gentlemen seated before you, we have the panel prepared according to the outline that has been distributed to you.

These gentlemen, no doubt, are among the best qualified to speak on Parathion and its uses that could be found in the world today. They each have prepared questions which they are qualified to discuss intelligently. Many have prepared questions, they want others in other fields of work to answer. The opportunity has been given all of you to submit questions and many of you have done so.

All of these questions have been sorted and grouped and will be answered by the person or persons qualified in that particular field.

Whether or not the Moderator will allow questions from the floor will depend entirely on time. The outline covers all phases of the subject and we feel that all phases should be covered rather than too much time be spent on certain phases and others neglected.

While Parathion is undoubtedly an outstanding insecticide, it like all material, has its limitations. It is expected that the discussions here today will deal with the limitations as well as the outstanding qualities of this material.

On behalf of the Society and personally, I wish to thank each of you gentlemen who have helped plan the panel and all of you who are participating in it.

I now turn the panel over to our most efficient Moderator, Mr. Frank Holland.

Moderator: We will go right to work if members of the panel are ready. Before we get into detailed questions there is a preliminary question which the mod-
What is Parathion?

_Dr. Gleissner:_ Well, Mr. Holland, Parathion is an organic phosphate. Actually the name Parathion is the common name for the chemical O, O-diethyl-O-panitro-phenyl-thiophosphate. Obviously, you couldn't use such a long chemical name so they picked Parathion. The compound was discovered in Germany but it has been more widely developed here in the United States for the control of several hundred economic species of insects and mites that attack crops grown in this country.

_Moderator:_ Thank you Dr. Gleissner. Now, to Dr. Herbert Spencer, Entomologist with the United States Department of Agriculture's Subtropical Fruit Insects Laboratory at Fort Pierce.

_In the USDA experiments, what citrus pests have been controlled with Parathion?_

_Dr. Spencer:_ The purple scale, Florida red scale, cloudywinged and citrus white flies and some of the mealybugs. The insects and mites that have not been controlled well are the purple mite and the rust mite.

_Moderator:_ What materials have you found compatible with Parathion?

_Dr. Spencer:_ We have found Parathion compatible with wettable sulfur, with coppers and with oil; in fact, with most of the insecticides and fungicides except those that are very basic. We have not used it with liquid lime sulfur but there is a possibility it can be used in that combination too.

_Moderator:_ What poundage per 100 gallons of spray gives adequate control of scale insects?

_Dr. Spencer:_ In our cleanup work for heavy infestations we are using 2 pounds of 15% wettable with wettable sulfur. There is a possibility with light infestations that two applications spaced over the year with 1 pound of 15% each time may keep the infestations to a very low level.

_Moderator:_ Thank you Dr. Spencer. The next questions will be directed to Mr. W. L. Thompson, Entomologist with the Citrus Experiment Station at Lake Alfred.

_To obtain scale control, is it necessary to spray trees as thoroughly with Parathion as it is with an oil emulsion?_

_Mr. Thompson:_ Yes. Although Parathion has some fumigating effect it has not the same effect that you would expect from sulfur for rust mite control. Purple scale control was not satisfactory where a combination spray containing Parathion, copper and sulfur was applied as an outside brushing spray which was typical of the usual application made for melanose and rust mite control. The scales should be covered with Parathion for satisfactory control.

_Moderator:_ Is Parathion as effective as oil emulsions for purple and red scale control?

_Mr. Thompson:_ On a three year average it has been as effective as oil emulsions. However, this year where we have had an abundance of red scale, there are more red scale in the tops of the trees where we sprayed with Parathion than we have with oil emulsions. On the average, it has been as satisfactory as oil emulsions.

_Moderator:_ Are two applications of Parathion at 1 to 100 as effective as one application at 2 to 100?

_Mr. Thompson:_ If there is a light to medium infestation of scale to start with, two applications of 1 pound of 15% material have been as satisfactory as 2 pounds per 100 put on once. In other words, a Spring application with another application in July or August, both with 1 pound to the 100, have been just as satisfactory and in some cases
more so than when the application was delayed until July or August with 2 pounds to the 100 used.

Moderator: Does purple mite infestation develop faster following a Parathion spray than where no Parathion was applied?

Mr. Thompson: There is very little evidence to show that the effect of Parathion increases purple mite. Parathion does not kill eggs, only the active mites; therefore, when you have a rather heavy infestation of purple mites when you apply the Parathion spray, you can expect a comparable infestation about two to three weeks later. Two Parathion sprays applied at ten day intervals would probably control purple mites but that is really not practical.

Moderator: Thank you Mr. Thompson. The next questions will be directed to Dr. R. K. Voorhees, Associate Horticulturist with the Citrus Experiment Station at Fort Pierce.

What are some of the factors responsible for certain cases of poor or inconsistent citrus scale control with Parathion during 1950?

Dr. Voorhees: Some of the factors responsible for poor scale control with Parathion, as far as the East Coast is concerned, are: poor tree coverage for any reason, but frequently due to windy weather which also shortens the period of effectiveness of Parathion; thorough tree coverage for good scale control is frequently not obtained with the broom-type hand spray guns and the boom-type applicators employed on the coast; low or minimum concentrations on heavy scale infestations during any season.

Moderator: How effective is Parathion in reducing scale infestations when employed at a minimum rate in combination with the spring melanose sprays?

Dr. Voorhees: In general, good results have been obtained with Parathion when combined with the melanose sprays at the minimum rate of 1 to 1 1/2 pounds per 100 gallons. In most cases, this has reduced light to medium infestations to the extent that only a minimum dosage had to be considered during the summer, and in some cases this second application was not needed until fall.

Moderator: What are some of the main factors responsible for accidents that occurred in connection with the use of Parathion by citrus spray operators on the East Coast during 1950?

Dr. Voorhees: In checking on several authentic cases of Parathion poisoning to citrus spray operators there were several different factors responsible, but no single factor particularly predominate. Some of these factors were: negligence in following the recommended precautions; abnormally low cholinesterase level of the operator; overexposure from spraying in windy weather, high summer temperatures and especially in connection with heavy canopied groves with poor air circulation, and from being exposed to Parathion too many days at any one interval.

Moderator: Thank you Dr. Voorhees. The next set of questions will relate to vegetable crops, so as to continue under Item 1 of the agenda, and will be directed to Mr. Norman C. Hayslip, Associate Entomologist with the Everglades Experiment Station at Fort Pierce.

Does Parathion have a place in controlling sweet corn insects?

Mr. Hayslip: The use of Parathion on sweet corn is still in the experimental stage; however, we have conducted a series of studies using Parathion on sweet corn. It has shown up better than any other material for the control of the corn silk fly, killing the adult stage just before the silks appear, thus preventing oviposition. On corn earworm, Parathion at 2% strength in a dust was, in two experiments, slightly superior to 5%
DDT dust; at 1% it was slightly inferior to 5% DDT dust. Cage trials indicated that Parathion has some toxic effect on adult moths of the corn earworm. The effect on the adults has not been verified under field conditions, however. Against fall armyworms, Parathion is effective at higher rates of application. That is to say, 2 pounds of 15% wettable to 100 gallons of water. Parathion also reduces the damage caused by aphids on corn.

Moderator: In most cases, it has not been recommended to use Parathion on vegetables later than 30 days before harvest. How does this restriction affect the use of Parathion on vegetables?

Mr. Hayslip: This question was phrased to show that such a restriction is impractical on some crops. One example would be tomatoes, which are harvested over a period of 40 to 50 days; by adding 30 days to the first harvest, results in a period of 70 to 80 days that the tomato plants are in the field unprotected by this insecticide, leaving them exposed for a long period of time to attack by insects. Other crops of a similar nature would be peppers and, to some extent, cucumbers. The question points out the very serious need for more intelligent recommendations as to the period of time elapsing between the last treatment and harvest; and I am happy to say that I have just recently learned we are getting more and more information on the subject. I was told recently that 21 days is now the period for most vegetable crops and, even more recently, that some have even a smaller lapse of time between harvest and the last application.

Moderator: Thank you Mr. Hayslip. I believe that later on in the panel there will be some further information developed on that one point. The next questions will be directed to Dr. E. G. Kelsheimer, Entomologist with the Vegetable Crops Laboratory at Bradenton.

Is Parathion compatible with fungicides and nutrients used in vegetable sprays?

Dr. Kelsheimer: Parathion is compatible with our dithiocarbamates and copper sprays commonly used on vegetables. There is one exception; you should not use lime in combination with the carbamate fungicides. It is compatible with practically all our insecticides; again, one exception, which is cryolite. A common practice with us is to add nutrients to the combination of insecticidal and fungicidal sprays but we have evidence to show that an excess of zinc and iron, and naturally lime, has an adverse effect on Parathion.

Moderator: What is the best time of day to apply Parathion on vegetables?

Dr. Kelsheimer: We find that the best time to apply Parathion is the latter part of the day and especially after the dew is off the plants. We have found that Parathion will cause burn on tomatoes and cucurbits, such as squash and cucumber, when the foliage is wet.

Moderator: Thank you Dr. Kelsheimer. The next questions will be directed to Dr. J. W. Wilson, Entomologist at the Central Florida Experiment Station, Sanford.

Does Parathion kill insects by fumigation or is it necessary for the Parathion to come in contact with the insects to be effective?

Dr. Wilson: Parathion is capable of killing insects by acting as a fumigant, a contact poison or as a stomach poison. Thus it is not necessary for Parathion to come into contact with the individual insects to kill them. But the greatest benefit from Parathion is obtained when it is applied to thoroughly cover the entire leaf surfaces and particularly the lower surface where most insects are found.

Moderator: Why is Parathion so often recommended for use on vegetable crops in preference to nicotine sulfate?
Dr. Wilson: That question, I think, refers to the weather conditions under which vegetable crops are grown in Florida. Nicotine sulfate requires temperatures of 80° F. and should be applied when there is little or no air movement to be most effective. We seldom have weather conditions favorable for the most effective use of nicotine sulfate. Parathion is more effective than nicotine sulfate under our weather conditions.

Moderator: What information is available on the residues which may be found on vegetables following the use of Parathion?

Dr. Wilson: The residue data available for Parathion on Florida grown vegetables are rather meager but the information we have in conjunction with information from other sections of the country indicates that Parathion deteriorates rather rapidly. After from two to four days very little Parathion remains on the vegetable and after a period of twelve to fifteen days only traces of Parathion can be found.

Moderator: Thank you Dr. Wilson.

The next questions will be directed to Dr. D. O. Wolfenbarger, Entomologist at the Sub-Tropical Experiment Station, Homestead.

Is Parathion satisfactory for control of soil inhabiting insects?

Dr. Wolfenbarger: Mr. Thames of the Everglades Experiment Station is finding it is very satisfactory for use on the muck soils there for the control of wireworms. In Perrine marl soils of Dade county it is a little different story there, and Parathion has not been effective in wireworm control on our potato growing soils.

Moderator: Are any precautions advisable for use of Parathion on leafy crop plants?

Dr. Wolfenbarger: Yes, that is one place where we need a great deal of precaution. One of the places of question-
Continuing with the subtropical fruits, Dr. Wolfenbarger.

On what subtropical fruits may Parathion we used? For what pests?

**Dr. Wolfenbarger:** It seems that Parathion has a very wide use on many of our subtropical plants, beginning with the avocado. It has been used on the avocado for dictospermum scale, in which case it seems it compares very favorably with oil emulsion for control of the scale and then, in addition, there is not the danger of plant injury. It gets the red banded thrips on avocados. It gets the leafrollers and is very effective for many places, it seems, for avocados. It has been used on limes, for example, in which case it is equivalent to oil and, in addition, there is not the chance for plant injury there. It has been used on mangos for lesser snow scale and other scales on mangos. It would seem to me that it would have a very widespread use on the mango for all of its scale pests, and for the red banded thrips. It is very effective in those cases. There is one precaution, when you use Parathion on mangos or avocados in the season when you can expect mite infestations, and that is you had better put in your sulfur with the Parathion to combat and control the mite and spider populations. If you don't, they will build up on the subtropicals, as Mr. Thompson mentioned for citrus.

**Moderator:** What dosages are recommended for use on subtropical fruits?

**Dr. Wolfenbarger:** About one pound, the same as is generally used for other plant pests.

**Moderator:** The next questions will be on ornamentals and directed to Dr. L. C. Kuitert, Entomologist at the Agricultural Experiment Station, Gainesville.

What is the present status regarding the effectiveness of Parathion sprays in controlling insect infestations on ornamentals?

**Dr. Kuitert:** Parathion appears to be somewhat superior to oil emulsions. It has the advantage that it can be applied at seasons of the year when you can't apply oil emulsions. It will control as effectively and, in some cases, more effectively most of the insect pests of our choice ornamentals.

**Moderator:** In your opinion, can the home gardener use Parathion safely?

**Dr. Kuitert:** Yes, I feel they can if they follow a few simple precautions. I don't think that a mask will be necessary if they are very careful in mixing their insecticides. Most of the home gardeners would only apply the material to perhaps six or eight ornamentals at a time. The short length of exposure and the infrequency of the application would, in my opinion, be safe for the home gardener.

**Moderator:** Thank you Dr. Kuitert. The next questions are directed to Mr. R. P. Tomasello of the Wilson Spraying and Supply Co., Inc. at West Palm Beach, Florida.

Has Parathion caused any spray injury to ornamentals?

**Mr. Tomasello:** Parathion has caused some injury to Hibiscus, Oleanders, Aralias and Bougainvilleas. There is a shedding of the older leaves when Parathion has been used at the rate of 1 ½ pounds of 15% wettable Parathion to 100 gallons of water. This is especially noticeable when spraying has followed high winds or if plants suffer from a lack of adequate moisture or food. Certain varieties of the above named ornamentals appear to be more susceptible to injury than others.

**Moderator:** Has any illness been reported by home owners following the use of Parathion on foundation plantings, etc?

**Mr. Tomasello:** Because we are aware of the potential dangers of Parathion, a careful check has been made of the homes where this material has been used. We
have been using Parathion approximately two years and during this time there has not been a single report by home-owners of illness following its use on foundation plantings.

**Moderator:** That completes Part I of our questions. We will now proceed to Part II, dealing with practical considerations for growers in field use. The next questions will be directed to Mr. Wilbur Charles, Production Manager of the Florence Citrus Growers Association of Florence Villa.

What precautions should be used to protect the user of Parathion from danger?

**Mr. Charles:** We have equipped our men with coveralls and masks. We have not adopted the use of rubber gloves.

**Moderator:** How do the growers living in groves feel about using Parathion near their homes?

**Mr. Charles:** We have several growers of the association living in their groves. When we started using Parathion each of these were consulted as to whether we were to use this material around their houses or not. In each case, the grower consented, in fact, he now asks us to use it around the house the same as any other insecticide.

**Moderator:** What changes in the groves have been observed, if any, from the use of Parathion as compared to oil?

**Mr. Charles:** The outstanding effect that I think I see from the use of Parathion is in the older groves, such as we have in this section. The older groves that have been here since the early 1900s, I feel, were beginning to show a great toxicity to the use of oils. Since we have been using the Parathion, I see a great improvement in the condition of the groves. This I know is not due to any change in fertilizer because the fertilizer program has been the same. We, of course, have had dry weather to com-
Drug Administration hearings to the effect that a residual level somewhere between two and five parts per million would not be hazardous to consumers. The American Cyanamid Company placed data in the record which indicated that even a considerably greater residual tolerance could be allowed and still be conservative but under the conditions of the uses of Parathion, two to five parts is the largest that will ever be necessary.

**Moderator:** Thank you. I wonder if I might ask another one of these questions to Dr. Kelsheimer or Dr. Wolfenbarger.

What effect has sunshine and rain on removing any objectionable residue of Parathion?

**Dr. Kelsheimer:** What meager records we have show that Parathion is broken down very quickly under our sunlight conditions. Do you want the rainfall?

**Moderator:** Yes.

**Dr. Kelsheimer:** The rainfall also tends to wash off this residue.

**Moderator:** Thank you. I see there is another question, Dr. Kelsheimer, which has been answered in part. The question is as follows:

How close to picking time can Parathion be used on the following vegetables without danger of having excess residue which may be questioned by the Pure Food and Drug Administration? The commodities are tomatoes, cucumbers, peppers and leaf crops such as cabbage and lettuce. Do you think that has been answered or do you care to comment?

**Dr. Kelsheimer:** I believe that has been answered.

**Moderator:** Thank you. The next questions will be directed to Mr. J. J. Taylor of the State Department of Agriculture from Tallahassee, Florida, on State Label, Package and Control data.

Are there adequate methods for determining Parathion?

**Mr. Taylor:** Yes. There are a number of methods for determining Parathion. The method we use in our laboratory is the colorimetric method, which was developed by Averill and Morris for residues of Parathion modified to use for dust formulations. There are a number of other methods in use but we have found this to be the most satisfactory and that is the one we use for regulatory purposes.

**Moderator:** Have you found accurate methods for both concentrate and dilute mixtures?

**Mr. Taylor:** Yes. The method is accurate both for concentrate and dilute mixtures. It is, of course, more accurate in the smaller amounts; possibly accurate in the 15 and 25 percent concentrates to something like a one-half or one quarter of 1%.

**Moderator:** Do you find that Parathion mixtures usually come up to their guarantee?

**Mr. Taylor:** For the most part Parathion mixtures meet their guarantees. A few have failed to do so. We found most of the companies put up their 15 and 25 percent concentrate in tin containers. For 1 percent dust, some companies use paper bags with inner linings; some, containers with tin top and bottom and cardboard sides. These seem very satisfactory but even some of the paper bags with inner linings don't seem to hold the dust in too well.

**Moderator:** Thank you Mr. Taylor. We will now have Section III, *Citrus Fruit Quality Factors*. The questions are directed to Dr. Paul L. Harding, Fruit and Vegetable Handling, Transportation and Storage Investigations, U. S. Department of Agriculture, Orlando, Florida.

Is Parathion spray superior to oil in increasing the total solids content whether applied in either June or August, or at both times?

**Dr. Harding:** A few years ago the
Bureau of Entomology and Plant Quarantine and the Bureau of Plant Industry, both of the U. S. Department of Agriculture, set up experiments to determine the effect of oil and Parathion sprays on the composition of oranges. During the first two years the work was on Valencia oranges. Emphasis during the last two years has been on early oranges with the tests being made on the varieties Parson Brown and Hamlin. The results of these studies show:

A. That Parathion is definitely superior to oil in increasing the total solids content whether applied in June or August or at both times. B. That oil applied in June does not seem to have a depressing effect on total solids content. C. That oil applied in August has a very depressing effect on total solids.

**Moderator:** Did your studies show that Parathion increased the total solids content over the controls?

**Dr. Harding:** The question is asked, "Did Parathion definitely stimulate or give a definite increase in total solids over the control?" When we compare Parathion applied in June and August with the controls we find that there is a difference of .23 which tells us there is a significant difference between the control and Parathion applied in June and August. We can similarly establish the fact that oil sprays depress the total solids level by comparing the treatment of oil applied in August, or the treatment of oil applied in June and August, with the control. To summarize our findings, our results show that single applications of Parathion applied in June or in August did not significantly affect the total solids content when compared with the controls. On the other hand, two applications of Parathion, one applied in June and the other in August, did significantly increase total solids.

**Moderator:** What is the general effect of oil and Parathion sprays on Vitamin C, total acid, and the degreening of fruit?

**Dr. Harding:** The ascorbic acid (Vitamin C), and the total acid content of the fruit was slightly depressed by the application of oil sprays. The differences were small and the decrease generally resulted from the applications of oil in August. Parathion sprays had very little effect on Vitamin C and the results indicate a very slight increase when our data are compared with the control fruit. The results are of interest from a scientific point of view but it should be pointed out that the increase is too small to be of practical value. The effect that various sprays have on the degreening of fruit or on the color of the rind is of importance to the citrus grower and shipper. It was, therefore, of considerable interest to find that the fruit which we sprayed with Parathion should degreen at an earlier date than the fruit from either the oil or controlled plots. The brighter color of the fruit from the Parathion plots appeared to persist into the stage of over-ripeness, however the differences among treatments are not so marked when the fruit is completely degreened. Our results show that the late oil sprays applied in August are largely responsible for the depressive effect in total solids, total acid and Vitamin C, as well as the failure of the fruit to degreen as early as when sprayed with Parathion. I wish to emphasize that the early (June) applications of oil had very little deleterious effect on fruit composition or on the rind color of the fruit.

**Moderator:** Thank you Dr. Harding.

**Dr. J. W. Sites,** Horticulturist with the Citrus Experiment Station, Lake Alfred, Florida, the next set of questions will be directed to you.
contrasted to trees sprayed with oil at the same time, been found?

Dr. Sites: Yes. Very appreciable differences have been found. Of course, the magnitude of these differences depends on the time of the application of the oil spray. Where we checked groves throughout the state last year, for example, the differences, where we were comparing Parathion sprays to oil sprays applied about the middle of June varied between three-tenths Brix unit and one Brix unit.

Moderator: Does the rate of application of Parathion affect the soluble solids content of the fruit?

Dr. Sites: The work which we have done thus far indicates that the rate of application has practically no effect on the soluble solids content of citrus.

Moderator: Is the use of Parathion in place of oil sprays for scale control equally effective for all varieties in so far as the quality of the fruit produced is concerned?

Dr. Sites: So long as one is comparing Parathion against oil sprays it would have to be stated that you cannot expect the same effect for the use of Parathion for all varieties. The reason for this is not that the Parathion is less effective on certain varieties, but rather that oil sprays do not cause the same effect consistently for all varieties. Because oil sprays usually do not cause as severe lowering of the soluble solids content in grapefruit as in oranges, it follows that one could not expect as much increase in the soluble solids content of grapefruit varieties where Parathion was used in place of oil sprays.

Moderator: Is there any reason to believe that the use of Parathion sprays will result in the production of fruit with a higher soluble solids content than would have been produced had no sprays for scale control been applied?

Dr. Sites: That question goes back to the fact it was more or less intimated early in the use of Parathion that benefits were being gained by its use over and above the limitations set by the generic pattern of the tree itself. I do not believe that is true.

Moderator: Thank you Dr. Sites.

Part IV is Processed Citrus Products Factors. The field of Molasses and Feed will be addressed to Mr. R. N. Hendrickson, Assistant Chemist at the Citrus Experiment Station, Lake Alfred, Florida.

Has Parathion been found in citrus pulp or citrus molasses and, if so, in what quantity?

Mr. Hendrickson: Citrus pulp and molasses made from grapefruit peel sprayed with 25/100 pounds active Parathion per 100 gallons was found to have approximately one part per million in the dried feed and one-half parts per million in the molasses. The Parathion content of the wet peel in this instance was considered to be an average value.

Moderator: Is the quantity of Parathion present in feed and molasses harmful to dairy or beef cattle?

Mr. Hendrickson: Feeding trials at the Kansas Agricultural Experiment Station where dairy cattle were fed five parts per million on a total feed basis for 81 days and thereafter slowly increased to 40 parts per million, showed the Parathion as having no harmful effect on the health of the cow. No Parathion was found in the milk, nor any objectionable off flavors. Cooperative studies between the University of Illinois, a large packing company and the American Cyanamid Company, in which beef animals consumed five parts per million actual Parathion, based on the silage intake of their diet for 100 days finishing period, showed no Parathion in the fat, lean meat, or liver tissue at the time of slaughter.

Moderator: Thank you Mr. Hendrickson. The next questions on peel oil will
Where is Parathion found in the citrus fruit and in what concentrations?

**Mr. Kesterson:** The oil cells are the only part of the fruit in which the Parathion is retained. In 23 samples of cold-pressed oil studied this year, for both orange and grapefruit the concentration of Parathion was found to range from 0 to 236 parts per million. In 75 percent of the samples, the range was 0 to 60 parts per million.

**Moderator:** Does the presence of Parathion in a coldpressed citrus oil harm the oil?

**Mr. Kesterson:** No. The presence of Parathion did not show any noticeable influence on the physical or chemical characteristics of the oil. Warburg respirometer studies to determine the keeping quality or oxidative stability of the oil showed Parathion to have the beneficial effect of slightly increasing the stability of the oil.

**Moderator:** Thank you Mr. Kesterson. The next questions relate to Residues in Citrus Products and will be addressed to Mr. C. R. Stearns, Jr., Associate Chemist at the Citrus Experiment Station, Lake Alfred, Florida.

Does Parathion sprayed on groves have any effect on flavor or keeping quality of canned citrus?

**Mr. Olsen:** We found no difference in flavor between the Parathion sprayed fruit and the control in freshly extracted juice or, upon storage, of the finished product.

**Moderator:** What happens to the Parathion, if any is present, during processing?

**Mr. Olsen:** Orange juice containing Parathion lost up to 48 percent of the Parathion during the processing of single strength orange juice and up to about 25 percent in the manufacture of frozen concentrate.

**Moderator:** Thank you, Mr. Olsen. Part V on the program relates to Human Health Aspects with Reference to Factory and Field Workers: Safety Precautions; Preventive Measures: Practical and Professional Steps that have Been Developed and Are Important to Employer and Employees; Residues; Air Contamination; Public Health and Industrial Commission Considerations. The first questions will be directed to Dr. John W. Williams, Pathologist at Morrell Memorial Hospital, Lakeland, Florida, relating to indications of susceptibility, coupled with symptoms and treatment.

Should individuals about to work with Parathion be given medical examination? If so, why? And are there any specific examinations indicated?

**Dr. Williams:** The answer is yes. Individuals about to work with Parathion should be given medical examinations. It is important to determine whether the individual is a psychoneurotic or not. If the grower employs a psychoneurotic, he...
can expect headaches. Certain laboratory examinations should be done. These laboratory examinations can all be done on one specimen of blood taken from the vein. They are hemoglobin for anemia. An individual about to work with Parathion should have a hemoglobin above 75%. Second, there should be an examination for blood proteins. The total protein should be above 6%. The third examination is for cholinesterase. The cholinesterase should be 75% or more. Now what are the implications of low values in the above examinations? Low hemoglobin indicates fewer blood cells to contain cholinesterase, and low blood proteins indicate possible liver damage which organ is the site of production of cholinesterase. Low cholinesterase indicates less of this protective substance to destroy acetylcholine which, if in excess, produces the signs and symptoms of the poisoning.

**Moderator:** Should an individual working with Parathion be checked occasionally? If so, are there any signs and symptoms which should be looked for?

**Dr. Williams:** This is advisable until there is more detailed knowledge of this problem. If the worker shows a marked reduction of cholinesterase, it is advisable to withdraw him from exposure. A reduction of 20% to 65% or lower even without symptoms, should be considered reason for withdrawal. Muscle twitchings, digestive symptoms such as abdominal cramps, nausea, vomiting, or change in vision, or nervous symptoms such as headaches, feeling of dullness, dizziness should be looked for and investigated.

**Moderator:** Are some persons more sensitive to Parathion than others?

**Dr. Williams:** Yes. Less Parathion would be necessary to cause ill effects in persons with anemia or liver damage. Those who have been exposed with reduction of cholinesterase would be more sensitive. It is probable, also, that some may store Parathion in the lipoid layers of the skin from which it may be absorbed from time to time, producing symptoms or delaying recovery.

It is possible that some have noticed discrepancies in reports of cholinesterase from various laboratories. I believe that mistakes have been made by laboratories where there has been lack of experience on the part of the technician with the potentiometer. It takes considerable experience to handle this instrument properly. When I worked in close cooperation with those developing this instrument, we found some very excellent laboratories storing it in attics or the like because they did not have the patience to study its peculiarities and master its use.

**Moderator:** When would a person who has experienced symptoms from Parathion be allowed to resume work with this substance?

**Dr. Williams:** The usual time given is 60 days. In order for the plasma cholinesterase to reach normal it takes about three weeks, and for the red cell, about three months. The plasma cholinesterase should be normal, and that of the red cells at least 75% of normal, and because of the experience, the worker should be watched closely.

**Moderator:** Thank you Dr. Williams. The next set of questions is in relation to Safety Precautions in Industrial Plants and is directed to Dr. John M. McDonald, Director of the Division of Industrial Hygiene, Florida State Board of Health, Jacksonville, Florida.

What mechanical installations are necessary to provide a safe working atmosphere for employees engaged in blending Parathion?

**Dr. McDonald:** Thank you Mr. Chairman. As most of you know, no doubt, Parathion comes to our mixing and blend-
ing plants in strengths of, well, maybe the technical grade, of liquid Parathion or 15 percent or 25 percent powder. The job in the processing plant is to dilute that raw material down to the strength that is used in the field, perhaps three, two, one or down even to one-half percent. The other job they have to do is to pack that diluted material for distribution. In all this work, the essential thing is to keep Parathion dust and Parathion vapor out of the air of the factory, and that is usually accomplished by what is known as a closed system. The materials are first of all dumped at a dumping station which is protected by exhaust ventilation; i.e., air is drawn in at that station to pick up any dust or vapors that may get loose in the process of opening packages. Then, the material is carried in an airtight duct to the grinders, and then to the mixers or blenders. All of these machines are tightly enclosed. From there it goes to a hopper, usually fairly well up in the factory, and from the hopper it drops into the bagging system. The bagging machine is in a small chamber and it also has exhaust ventilation to pull out any dust or vapors that may escape as the material comes down from the hopper. The exhausted air that comes from these various stations I have mentioned, is then led to a bag filter and, after that, it goes to a scrubber, that is, a system of sprays (water sprays) in an enclosed cylinder, before it is discharged to the open air. One other point is, I think, worth mentioning here; that if any of the material is spilled on the floor in the factory, it should be neutralized with a strong alkali solution.

**Moderator:** What personal protection should be provided for the employees to work at this job?

**Dr. McDonald:** For the employees themselves in addition to the machines I have mentioned, first of all, a hat; overalls or coveralls which fit tightly around the neck; rubber gloves; rubber shoes; if there is any splashing of liquid Parathion then, of course, a rubber apron or perhaps a rubber suit; in addition to that a respirator or, as it is sometimes called, a mask. He should, of course, have plenty of showers, soap and hot water, where he can wash himself at the end of the day. He should also wash himself before he eats or smokes, as someone has mentioned previously here. I think it is a good idea to have a separate lunchroom and clean place where he can go and eat his lunch. One other small point—I would be very wary of overtime in a Parathion packing plant.

**Moderator:** What is the one most important consideration in the prevention of Parathion poisoning?

**Dr. McDonald:** The one most important consideration is good supervision. Machines break down, connections break loose, and we must have somebody who knows how to repair those things and keep the machines in order. Also, the people who work in the plants are human beings just like you and me; they make mistakes, get a little careless and tend sometimes to think these precautions that we are preaching so vehemently are not quite as necessary as we make out. I have had experience in lead factories and I know that supervision is one of the most difficult things to effect. Perhaps the best idea there is to have the supervisor or foreman obey all the rules, even to the tiniest one. Wear his respirator, change his clothing and do as we have been prescribing here for the employees in the factory.

**Moderator:** Thank you Dr. McDonald. The next questions are on Precautions in Handling in the Field, directed to Dr. J. T. Griffiths, Associate Entomologist from the Citrus Experiment Station, Lake Alfred, Florida.

In what type of job is a man most likely to be affected?
Dr. Griffiths: In a survey of the cases of parathion poisoning which occurred during citrus spray operations, it was found that the most cases were encountered among men spraying with hand guns. Very few Speed Sprayer operators were sick, but men filling supply units were sick in a number of cases.

Moderator: What danger is there in entering or working in a grove after it has been sprayed with Parathion?

Dr. Griffiths: There is some danger for anyone entering a grove after it has been sprayed with Parathion because of the intimate contact with foliage and fruit that has Parathion residue on it, and because of the possible contamination from vapors. In one experiment this past summer here in Florida, we had animals exposed in a grove immediately following the application of excessive amounts of Parathion. Some of these animals were exposed for as long as 10 days. During that time, blood was checked for changes in the amount of cholinesterase present and the animals were checked at autopsy. No adverse effects attributable to Parathion were found. Those that were left in the grove were perfectly healthy at the end of the 10 days. Thus, the major precaution for anyone going into a grove after it has been sprayed, is to avoid contamination with the foliage and with the fruit. In other words, any job which is going to take an individual into intimate contact with the tree itself should be avoided for some period after the time of spraying. We are suggesting now that for such things as irrigation, cultivation, a matter of seven days following application will be a safe period for grove labor.

Moderator: Do you know if there have been any illnesses or deaths in Florida during 1950?

Dr. Griffiths: There have been a number of illnesses. There have been no deaths. So far as I know personally, to date there have been no deaths in the United States in the field attributable to Parathion. Certainly, there have been none in Florida. We have had some 50 cases that we have actually checked on at the Experiment Station. These represent, maybe, 50 percent of the total cases in the state. A high percentage were very questionable; about 25 percent were definitely not Parathion poisoning.

Moderator: Continuing with Precautions in Handling in the Field, maybe we had better address this jointly to Drs. Griffiths and Gleissner.

Will you list, in approximate order of importance, the protective devices and protective handling procedures to avoid Parathion poisoning? Bear in mind this has to do with "in the field."

Dr. Griffiths: This will be based on our experience here in Florida, particularly this year. I think the thing we failed to emphasize sufficiently for most people was the danger of skin absorption. By and large, the men have worn respirators. Some outfits have been faithful about changing clothes and taking daily baths. Skin absorption begins to look like the way in which many men are becoming contaminated. They have not been careful enough; they have been wearing short sleeves; they haven't worn rubber gloves; and they haven't been careful about taking a bath at the end of the day. The primary thing is to avoid exposure to the Parathion itself. In other words, don't get it on you; don't breathe it. Anything that you can do to prevent contamination is the thing to be done. This means changing clothes daily, wearing a respirator, wearing a hat, and above all be careful.

Moderator: Thank you Dr. Griffiths. Dr. Gleissner, would you care to comment on that?

Dr. Gleissner: Dr. Griffiths very well pointed out the important considerations for citrus. As you understand, Para-
Parathion was used both as a dust and as a spray. As a dust, it presents a respiratory hazard; and we continue to emphasize the respirator under those circumstances. I also would like to point out that protective devices and protective handling features really complement and supplement each other. That is, one is a check on the other. In other words, you know individuals who have been able to handle Parathion without many of the protective devices and they get away with it. Still, I want to emphasize it is good supplementary procedure to have both followed to the letter.

*Moderator:* Thank you. The next questions will deal with Residues, Post Application Phases, directed to Mr. C. R. Stearns, Jr., who has answered some other questions earlier.

**How rapidly does Parathion disappear from the leaf and fruit surfaces?**

*Mr. Stearns:* Usually at the end of one week's time 90 percent of the Parathion has disappeared from the surface of the foliage and fruit.

*Moderator:* If Parathion volatilizes so rapidly is it dangerous to stay in groves for long periods of time immediately following the application of Parathion?

*Mr. Stearns:* As Dr. Griffiths pointed out, if no contact with foliage, limbs or fruit is made, there is no danger from vapor concentrations that may be present in the air.

*Moderator:* On the basis of our present information, Mr. Stearns, what can be said concerning the time for safe entry into groves and fields following treatment with Parathion?

*Mr. Stearns:* Again, as Dr. Griffiths pointed out, we are considering seven days for cultivation, irrigation or any other operation where no contact is made with the foliage, limbs or fruit. With regard to pruning and fruit picking, we are still adhering to the recommendations that were made last year, that is 30 days following the application of Parathion to the grove.

*Moderator:* Thank you Mr. Stearns. The next question will deal with Public Health, and directed to Mr. John Mulrennan, Director of the Division of Entomology, State Board of Health, Jacksonville, Florida. Question is as follows:

What steps have been taken by the State Board of Health to inform the medical profession and public health workers regarding the toxic properties of Parathion?

*Mr. Mulrennan:* That question can better be answered by a demonstration. We have sent out to the medical profession in Florida a blotter which called the attention of the doctor to the symptoms and treatment of Parathion. A second blotter presented a second warning on Parathion which gave the symptoms and treatment and also suggested never to use morphine. A leaflet on Parathion in some detail was also presented to the medical profession. A reprint was secured from the New York State Journal of Medicine, Volume 50, No. 13, July 1, 1950, entitled “Physicians and Phosphate Insecticides,” which was presented to the medical profession.

All pharmacists in the state of Florida have received two notices pertaining to the symptoms of Parathion.

All hospitals in the state of Florida were sent a placard to hang in their emergency room pertaining to Parathion, its symptoms in man and the treatment for same.

All county health departments received a mimeographed brochure pertaining to Parathion in addition to all the information that had been sent to the doctors, pharmacists and hospitals.

A state-wide news release pertaining to Parathion was released to the press on March 10, 1950.

*Moderator:* Thank you Mr. Mulren-
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nan. Considerations of the Florida Industrial Commission will be given by Mr. Wendell Heaton, General Counsel for the Florida State Industrial Commission, Tallahassee, Florida.

What interest does the Commission have in this subject?

Mr. Heaton: The Commission, other than the general interest of everyone, is interested in the use of Parathion from the standpoint of its administration of the Workmen's Compensation Act. We think the use of this insecticide should be surrounded with caution and that men and supervisors should be carefully trained. We are convinced that it can be used safely and we know that it means much to the industry.

Moderator: Would the Commission encourage pre-employment examinations?

Mr. Heaton: The Commission approaches this subject with some misgivings, but in this instance that, no doubt, is the only way that high susceptibility may be determined. These pre-employment examinations should be made only for the purpose of discovering susceptibility to this chemical and not let such an examination prevent employment because of other physical handicaps. I don't know whether we would permit Dr. Williams to rule out all psychoneurotics; I don't know how limited that would make our labor in this industry.

Moderator: Thank you Mr. Heaton.

Will the Commission cooperate in requiring necessary precautions in the use of Parathion?

Mr. Heaton: The Commission will not only cooperate in that field but are very anxious to do so. In trying to be of some assistance to the industries, the Commission has, during the past year, entered into some very extensive studies with reference to illnesses and accidents traceable either directly or indirectly to Parathion. These studies are most interesting. It might be well to mention just briefly that the reported accidents range in importance from these causes: first and foremost and, I believe Dr. Griffiths will agree with me here, the accidents reported have been caused from improper use of masks or respirators, or a lack of the use of them; second in importance is improper clothing being worn; and third, improper bathing facilities being provided. Of course, an overall cause is, as we all know, lack of proper supervision of the employees in their use of Parathion.

Moderator: Thank you Mr. Heaton.

The next question has to do with the Status of U. S. Food and Drug Hearings with Reference to Use of Parathion.

What is the status of these Food and Drug hearings with reference to the use of Parathion? Dr. Gleissner would you give us that?

Dr. Gleissner: The present status of Parathion, as with all our newer organic insecticides, is that we do not have anything official from the Food and Drug Administration at this time. However, since January 17, this year a very detailed hearing has been conducted. Incident to that, I want to tell you that growers here in Florida should be extremely proud of the fine presentation by your Florida representatives—one of the two best of any state representatives at the hearing. We obviously cannot say anything more than that the record is complete. I have already mentioned to you what their contention is on Parathion—i.e., that two to five parts per million would not be considered a consumer health hazard. Also, in published papers, representatives of the Food and Drug Administration have confirmed that same tolerance level. Now, it is extremely important from the standpoint of the timing of the last application and harvest, that we do know what kind of a level we have to shoot at. It is rumored
that we will not get anything official until sometime in June. Now that is, in my opinion, entirely too late for most of the growers in the United States to plan a program in an orderly manner, and it is hoped that something official can be given this winter. I might say on that score, a very adequate presentation is available on Parathion as well as many other organic insecticides, and I think we can look forward optimistically to a good intelligent conclusion to be drawn from this information.

Moderator: Thank you Dr. Gleissner. In the next set of questions there are one or two which, in an indirect way, concern use of Parathion. It has to do with the birds and bees. I would like to direct some to Mr. Steams, some to Dr. Griffiths and some to Dr. Gleissner.

Have there been any scientific studies made to get facts on potential impact of Parathion use, in groves or farms, on wildlife and bees? Mr. Steams will comment first on bees.

Mr. Steams: First, I would like to find out if Mr. Robinson, entomologist from the main station is present. I would like to have him give that report as he cooperated with us at the experiment station this summer on our spray trials. Mr. Robinson’s conclusions as to the effects of Parathion spray on bees were that there would be higher mortalities if the bees came directly in contact with the spray. The bees were placed in this grove we were carrying on the experiment in, prior to the spraying, and were present during the spraying. Now, we must remember that the trees were not in bloom so we cannot tell what would happen had the trees been in bloom and the bees out working. However, there was some mortality of the bees that were in the grove during the spray operation. Part of that mortality was due to the moving of the bees from one place to another. With regard to the post application sprays, Mr. Robinson did not feel that there were any disastrous results, as, in that case also, some bees were killed or died and he felt that also was due to the moving of the bees. We cannot tell you what the effect would have been had the trees been in bloom and the bees out working.

Moderator: Thank you Mr. Steams. Dr. Griffiths, do you care to comment on this same thing? Has there been any work at the Experiment Station done on pigeons or other birds?

Dr. Griffiths: In this grove that Mr. Steams was talking about, we exposed rabbits, rats, pigeons and chickens. There has been some comment locally that birds were being killed in groves. Pigeons and chickens certainly come in the category of being birds. We had no ill effects whatsoever in this grove sprayed with more Parathion than would normally be sprayed in any grove in Florida. I would like to hazard a guess concerning the effect on bees if Parathion is used at post-bloom time. Post-bloom time means that all the petals are on the ground and, presumably, it’s from one or two days to maybe as much as three weeks following petal fall. There will be no bees in the grove at that time feeding on blossoms. During the time that blossoms and bees are both present, no spraying of Parathion will occur so there should be very little, if any, complication at that season of the year. We have heard some rumors of complaints but we haven’t been actually able to trace down those rumors as being authentic or as having any real basis in fact.

Moderator: Dr. Gleissner, would you have any direct information or know of authentic reports on studies made on quail?

Dr. Gleissner: Mr. Holland, I told you yesterday that I had in my briefcase several reports on quail, but I find that they concern pheasants in both cases.
For those who would like pheasants, I can give this. In Washington state this subject came up from the wildlife interests. They have a lot of pheasants out there that frequent orchards at certain times of the year. Pheasants were confined in cages right under apple trees and the standard spray programs were applied, as well as experimental programs using very high dosages of Parathion. The pheasants were in the orchard at the time of spraying and were kept there for some period of time after spraying. At no time did the pheasants show any effect whatsoever. Now, in another case in California, it so happens that one of the wildlife interests came up with the rumor that pheasants had died by the hundreds in bean fields treated with Parathion in connection with bean pest control. It was rumored that there were hundreds of dead pheasants in the bean fields after harvest. A state wildlife group set up an experiment in which they counted the pheasant population in these bean fields before treatment with Parathion; the regular treatment which was supposed to have caused the mortality was given; and a recount made after treatment. In no case did they find any dead pheasants attributable to Parathion.

Moderator: While we are on the subject, do you have any information on fish? Very briefly, please.

Dr. Gleissner: We have only very sketchy information. The information we have was gathered when someone was interested in using Parathion for a mosquito larvae control. They have found there that the dose to kill fish is considerably higher than that necessary to kill mosquitoes. Now it is true that some small species of fish may be killed by a very careless dumping of Parathion during the filling of the spray tank or some such situation like that. We do not consider that Parathion will cause any unusual problems at all.

Moderator: Thank you. Now we will get down very rapidly to some questions that came in late and should be bracketed in the final setup. This question is addressed to Mr. Thompson.

Are red scale or black scale increasing as a result of using Parathion?

Mr. Thompson: We have found that neither red nor black scale are increasing any more following Parathion than oil sprays. In fact some of the heaviest black scale infestations were in groves that had never been sprayed with Parathion. However, it has been found that parathion has not been quite so effective as an oil emulsion unless there is a high percentage of black scale in the young stages when the Parathion applications are made, in such cases Parathion was comparable with oil.

Moderator: Thank you Mr. Thompson. The next question, in the field of vegetables, I will address to Dr. Kelsheimer.

Can Parathion be used upon such crops as cucumbers and tomatoes during the harvest season?

Dr. Kelsheimer: In a bulletin we published it is recommended that Parathion be used on cucumbers and squash to the time of blooming and fruit set. On tomatoes we have a little different situation. Where Parathion is necessary we try to estimate within a week of the first harvest to make the application; then the fruit is harvested. At the time the fruit is harvested, if necessary to go in again, we do so immediately, but each time we wait a week before the fruit is picked. Our tomatoes are picked mature green and in the process of preparing for market they are either washed, brushed or rubbed. What little residue is left on by that time will be, in our opinion, negligible. The very meager information that we have shows there may be a considerable amount of residue on the foliage but very little on the fruit.
When it goes through this process for marketing, that is very little indeed.

Moderator: Thank you. The next questions are still in the role of vegetables—on sweet corn—and addressed to Dr. Gleissner.

Can sweet corn treated with Parathion be safely fed to livestock?

Dr. Gleissner: Yes. Studies, both with dairy cows and beef animals, show that even when such feeds as alfalfa or corn silage are contaminated with Parathion at levels from ten to fifty times higher than would be present from the field use of Parathion sprays or dusts no Parathion came through in the milk, no Parathion was stored in body tissues, and there was no adverse effect on the health of the animals.

Moderator: What are the hazards to people harvesting sweet corn which has been treated with Parathion up to ten days before harvest?

Dr. Gleissner: The practical experiences in the Wisconsin sweet corn canning area this past season, as well as researches by industrial hygienists of American Cyanamid Company in cooperation with several state agencies, show that there should be no picker hazards if harvesting is delayed four days after the last application. The time might even be shortened after we have been able to conduct more studies but this timing is a reasonable one. It should be pointed out, however, that the present label claims state no applications within twelve days of harvest.

Moderator: The next question is to Dr. Kelsheimer.

At what poundage per day and over how many days in a row are vegetable growers exposed to Parathion?

Dr. Kelsheimer: The application of Parathion by dust or by spray is over such a short period of time as compared with the citrus grower. It would be unusual for the vegetable grower to spray or dust with Parathion more than two days in succession. The vegetable grower is in the open and is not concerned with a heavy canopy of foliage. Applications are made no oftener than once a week or every ten days and at such low rates as one pound of 15 percent wettable to 100 gallons of water. Dusts are either one or one and a half percent applied at the rate of thirty pounds per acre by ground machines or forty pounds by airplane. I don't have any figures on the poundage of material used in any one day by any of the growers.

Moderator: Thank you Dr. Kelsheimer. There are only three more questions. They are in the field of citrus. This question we would like to direct to Mr. Thompson.

How long does Parathion have to be on the trees for good scale control before a rain? Mr. Thompson and Dr. Spencer both can answer.

Mr. Thompson: We do not have very much information about the kill of scale where a rain follows a Parathion application. In one test a 95 percent kill was obtained where Parathion was applied at 9 o'clock and ¾ of one inch of rain fell between 3 and 4 o'clock. We have no information where there was rainfall one to six hours after the application.

Moderator: Thank you. Dr. Spencer do you have anything to add to that?

Dr. Spencer: I believe that if the spray dries on the foliage it will be effective, and you needn't worry about moderate rains.

Moderator: Thank you. Here is another question.

What effect will five pounds of 40 percent Parathion have in slightly windy weather on scale control? Does a member of the panel want to answer that? No answer. This next question will be addressed jointly to Mr. Kesterson and Dr. Sites.

Does a spray containing petroleum oil
at less than the lethal dosage for scale, as perhaps \( \frac{1}{2} \) or \( \frac{3}{4} \) percent, fortified by Parathion, hold promise of being better than oil or Parathion alone in respect to (a) less red spider followup than Parathion alone, (b) less affected by rain following shortly after application than Parathion, (c) less harmful than oil to solids and coloring? May I ask Dr. Sites if he would care to comment on that last phase of the question?

Dr. Sites: Based on the results of previous preliminary experiments, wherever lower concentrations of oil have been used in oil sprays the lowering of the soluble solids content of the juice was less severe. I would expect therefor that reducing the concentration of oil to \( \frac{1}{2} \) or \( \frac{3}{4} \) percent would not cause as much reduction in the soluble solids content of the juice as would have been the case had 1.3 percent oil been used.

Moderator: Dr. Harding, would you care to comment on that question? No answer.

Well, Mr. Kesterson, will you please answer the other parts of that question?

Mr. Kesterson: I am not going to give a direct answer to the question but present some data which may give an indirect answer. In our work on peel oil it was noted that when oil emulsions were combined with Parathion spray mixtures, the amount of Parathion subsequently found in the peel oil was approximately twice the amount which would be expected to result from the use of Parathion alone. Parathion when combined with oil emulsion sprays is apparently an entirely different situation from that when Parathion is used alone, and possibly should be approached with caution until more information is obtained for the combined use of these two spray materials.

Moderator: Thank you. I wonder if there is any entomologist on the panel who would like to comment on phase (a) of the question. Dr. Spencer or Mr. Thompson, either one. I will read the question again.

Does a spray containing petroleum oil at less than the lethal dosage for scale, as perhaps \( \frac{1}{2} \) or \( \frac{3}{4} \) percent, fortified by Parathion, hold promise of being better than oil or Parathion alone in respect to (a) less red spider followup than Parathion? I assume that means less red spider followup then when Parathion is used alone. Do you care to comment Dr. Spencer?

Dr. Spencer: One of our cooperators last year had an infestation of scale and one of purple mites on some grapefruit trees. We considered the possibility of a spray combination, so we picked out one-percent of oil plus two pounds of 15 percent wettable Parathion in 100 gallons. We had no rust mites to contend with at that particular time but we did have the purple mite. We got very good results with both of those pests from that combination spray. We endeavored to kill the scales with Parathion and kill the purple mites with a one percent oil, and we accomplished this.

Moderator: Thank you Dr. Spencer. Mr. Thompson do you have a comment on that question?

Mr. Thompson: I might say that \( \frac{1}{4} \) percent oil will give you very good purple mite control. However, we do not know the effect of \( \frac{3}{4} \) percent oil on solids. That is one thing we haven't taken up yet at the low concentrations.

Moderator: Thank you. There is one more question (there are three phases to it) to be directed jointly to Dr. Gleissner, Dr. Kelsheimer and Mr. Hayslip, in the field of vegetables. Dr. Gleissner:

What are the comparative dangers of using one percent dust versus concentrated, to the operator?

Dr. Gleissner: I might be wrong because of the unique citrus situation here. I believe some of you mix wettable pow-
W. C. Gleissner: In the operation of applying Parathion, the most common method is to use a concentrate or a diluted material. In the case of dilute dust versus concentrate, we have very little evidence as to which one is more hazardous than the other, in relation to the number of pounds of actual Parathion handled and applied. We do know that last year, in the case of the three fatalities in the field, the major causes of death, especially two of them, were associated with the very careless handling of the concentrated wettable powder. Provided that the concentrates are handled safely, once the material is in the spray tank, I can see no difference in using a concentrate or a diluted material. The important thing is to stay out of both of them.

Moderator: Thank you Dr. Gleissner. Now, Dr. Kelsheimer, may I ask you this question:

What causes Parathion dust or spray to injure plants of certain kinds and not others?

Dr. Kelsheimer: I don't know if I can properly answer that question. We do know we can get injury from dust on wet foliage or foliage heavy with dew, particularly with tomatoes or cucurbits.

Moderator: That finishes that phase of the question. Thank you very much. Will any other member of the panel care to comment on that question? Apparently not. The next phase of the question has been answered already, possibly in full, at least to a considerable extent, but we are giving further opportunity for answer in deference to the member of the Society who submitted it. Mr. Hayslip, what is the present status for sweet corn insects (I assume that means the present status of use of Parathion in controlling insects, for the whole forum is on Parathion). Would you care to answer?

Mr. Hayslip: I believe I answered that before. I will simply say that Parathion definitely looks promising for South Florida, especially on certain phases of the insect problem.

Moderator: Thank you very much. This question I would like to direct to Dr. Spencer. This may have been answered to your complete satisfaction earlier, if so, tell me so.

Where does Parathion fit into the citrus spray schedule today?

Dr. Spencer: We have used it almost every month of the year. And it combines very nicely with the regular rust mite application so when the scales appear and we want to put on a rust mite application, we add Parathion to the wettable sulfur. That mixture allows us to drop out the extra oil application recommended in the spray schedule for scales.

Moderator: Thank you. The next question I would like to direct to Mr. Thompson. It previously has been answered by various comments from panel members but perhaps somebody would like to have a positive statement on it.

Does Parathion control purple mites?

Mr. Thompson: Parathion does not control purple mites in the sense that we think of. For instance, it does kill the active mites; it does not kill the eggs, nor does the residual spray material remain toxic long enough to kill the young mites after the eggs hatch. However if only an occasional mite can be found and eggs are not numerous a Parathion spray may keep the purple mite population down to a minimum for four to six weeks. Where Parathion was applied in February when only a few mites were present there was still a low population of mites eight weeks later compared to a medium to heavy infestation on adjacent trees where the Parathion was omitted from the spray. If purple mites and eggs are numerous at the time of application then a rein-
Moderator: Thank you Mr. Thompson. Our time has been consumed and we have been requested to make an announcement. This information about Parathion which we have discussed will be published in the Proceedings. The moderator would like to express appreciation for all members of the panel for your patience in this rather lengthy proposition. I am confident that each and every one of you feel indebted to these 22 gentlemen at the table here who have come from their businesses and homes and work to come, not only to be with you on this panel this morning, but most of them have spent weeks in trying to answer questions that have been accumulated rather early after the panel was announced; and I would like to acknowledge, as moderator, their great assistance and their patience. That concludes the panel.

VEGETABLE SECTION

CONTROL OF LATE BLIGHT AND GRAY LEAF SPOT OF TOMATOES WITH NEW FUNGICIDES

ROBERT A. CONOVER
Florida Agricultural Experiment Stations
Sub-Tropical Experiment Station
Homestead

Since the demonstration by Ruehle (1) that nabam* plus zinc sulfate provided outstanding control of late blight (Phytophthora infestans DBy.), this fungicide has been widely adopted by tomato growers throughout Florida. Even though this material has given excellent results, fungicide testing has continued at the Sub-Tropical Experiment Station with the aim of finding new and more effective fungicides. This paper is a report of the results of experiments with tomato fungicides conducted at Homestead during the seasons of 1948-49 and 1949-50. All data were obtained from field plots, each containing 36 plants. All treatments were randomized and replicated four times. The plots were sprayed with a tractor-drawn power sprayer operated at a pressure of 400 pounds at the pump. Three to 11 nozzles per row were used as needed according to plant size. Cultural care of the plots approximated commercial practice common in the area. Insects were controlled by separate blanket applications of recommended insecticides.

The first experiment was set out on November 17, 1948, with Grothen Globe tomatoes. Fungicides were applied every seven days, a total of 11 applications being made during the experiment. Foliage diseases did not appear until the first picking when gray leaf spot (Stemphylium solani Weber) appeared. This disease spread rapidly and did considerable damage in the check and in plots sprayed with ineffective materials. Late blight and early blight (Alternaria solani (Ell. and Mart.) Jones and Grout) were found in the checks but only in trace amounts and did not influence the yields. The treatments used, disease

*See footnote, Table 1.