of insects is again apparently activated by frequent rains and goes so far as to reduce the yield of the fruit. I mention these illustrations, as perhaps some of the reasons why a material may fail after apparently proving itself a good insecticide.

In conclusion, we have presented some of the facts as we see them. Yes, we are still confused. New products continue to be called to our attention. A new product is a new problem and limited time does not permit us to break down this confusion. We all do the best we can. We supply the manufacturers and growers with the best answers that only limited data provide. The challenge of the "new" is very demanding. We have turned a new page in insecticidal production and with plenty of energy and a dash of luck, we can keep pace and supply the information they are asking us to give.

OBSERVATIONS ON THE INCREASE OF APHIDS ON CELERY FOLLOWING THE APPLICATION OF COPPER A COMPOUND AS A FUNGICIDE

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For a considerable period of time the fact that application of certain materials to various crops tends to be followed by an increase of one or more insects, has been generally recognized by Entomologist and Plant Pathologist. For example, Folsom in 1927 attributed the initial infestations of aphids on cotton following the application of calcium arsenate to the positive phototrophic reaction of the winged females. Bonde and Snyder (1946 and 1947) reported a significant increase of aphid populations in potato plots sprayed with Bordeaux Basic Copper Sulfate, Karbam Z, Karbam Z and soap and Dithane. They also observed that aphid populations are often greater in fields sprayed with Bordeaux than in those receiving applications of neutral copper fungicide. Wylie (1948) reporting on his work on the control of aphids on celery with insecticides combined with fungicides stated that the aphid populations on the plots treated with Bordeaux were significantly greater than on the untreated plots. Thompson (1936, 1937 and 1940) observed the buildup of purple scale on citrus following the applications of Bordeaux. He found that the scale populations increased with the amount of residue deposited on the citrus leaf, and

that the increase in scale population was entirely due to the protection afforded the young scale crawlers by the residue, as was illustrated by the fact that roadside trees where road dust was deposited on the leaves had a heavier infestation of purple scale than trees away from the road that did not receive a deposit of road dust. More recently the buildup of aphids and mites on cotton following the application of DDT has been reported by Loftin (1945) and others. Ruehle (1947), reporting on fungicides for the control of late blight on potatoes, stated that leaf miner infestations were heaviest on plots sprayed with the dithiocarbamates as compared with plots treated with copper and zinc chromate.

Moore (1935) studied the reaction of the potato aphid to potato leaves sprayed with bordeaux and concluded that the winged females were attracted to the bordeaux sprayed leaves because of the greater amount of light reflected by the bordeaux sprayed leaves. Aphids caged on sprayed and unsprayed leaves did not increase faster on the sprayed leaves. There was no difference in the wave length of light reflected from the sprayed and unsprayed leaves, but more intense light was reflected from the bordeaux sprayed leaf surface. When fast green dye was combined with 5-5-50 bordeaux and applied to potato leaves the number of aphids was less than on the bordeaux sprayed leaves but greater than on unsprayed leaves.

During the fall of 1947 an experiment was conducted on pascal celery in which Fermate and Zerlate at one pound each to 100 gallons of water and Copper A Compound at five pounds to 100 gallons were applied at 7-day intervals as fungicides. Triton B 1956 at the rate of 160 cc. per 100 gallons was added to both fungicides as a spreader sticker. Eleven insecticides were combined with each of the fungicides when the aphid population became large enough to require treatment. The celery plants were transplanted to the field on October 28 and the application of fungicides was begun seven days later with a total of twelve fungicide applications for the season. Insecticides were combined with the fungicides December 9, 22 and January 16. The spray materials were applied by means of a pressure sprayer operating at 300 pounds pressure. The spray machine was equipped with a six row boom having three nozzles to each row. This equipment applied the spray material at the rate of 105 gallons per acre. The plots were arranged in a randomized block design with six replications. Aphid counts were made

at approximately 7-day intervals beginning December 2, by recording the aphids on ten trifoliate leaves plucked at random from the two center rows of each plot. No other insect attacked the celery during the growing season. Very light and widely scattered infestations of red spider were found a few days before the celery was harvested. A sample of the aphids was identified by Dr. A. N. Tissot as *Aphis gossypii* Glover.

Table 1 lists the insecticides, the concentration and the source of the insecticides used.

TABLE 1.—LIST OF THE INSECTICIDES, CONCENTRATIONS AND SOURCE OF THESE INSECTICIDES APPLIED TO PASCAL CELERY IN COMBINATION WITH FFRMATE-ZERLATE AND COPPER A COMPOUND DURING THE GROWING SEASON 1947-48.

Treatment No.	Material	Amount per 100 Gallons Water	Source
1	25% DDT Emulsion	1 qt.	Rohm & Haas Company
2	6% gamma isomer Benzene Hexachlor.	4 lbs.	California Spray-Chemical Co.
3	25% gamma isomer BHC	1 lb.	California Spray-Chemical Co.
4	48% Chlordane Emulsion	2 qts.	U. S. Rubber Company
5	40% Chlorinated Camphene	4 lbs.	Pennsylvania Salt Company
6	50% H.E.T.P.	½ pint	California Spray-Chemical Co.
7	50% T.E.P.P.	½ pint	California Spray-Chemical Co.
8	50% Methoxy DDT	4 lbs.	E. I. Du Pont
9	25% Parathion	½ lb.	American Cyanamid Company
10	25% DDD Emulsion	2 qts.	Rohm & Haas Company
11	40% Colloidal DDT	1 qt.	Michigan Chemical Company
12	Check		

Table 2 presents a summary of the aphid counts made during the growing season. From this table it will be noted that with a few exceptions the aphid population on the plots treated with Copper A Compound is considerably greater than on the plots treated with Fermate-Zerlate. This is true in the plots receiving the two fungicides alone, as well as in the plots where the insecticides were combined with the fungicides. It will also be noted that the aphid population was not high at any time during the growing season.

In an effort to account for this larger aphid population on the plots receiving Copper A Compound as compared with the plots treated with Fermate-Zerlate, pH determinations were made of the water used to make up the spray materials, and of the spray mixtures. The pH of Copper A Compound mixtures

TABLE 2.—APHID POPULATIONS AT 7-DAY INTERVALS ON PASCAL CELERY TREATED WITH FERMATE-ZERLATE AND COPPER A COMPOUND IN COMBINATION WITH VARIOUS INSECTICIDES DURING THE CROP SEASON 1947-48.

Date of Counts	Fungicide	Treatment Number											
		1	2	3	4	5	6	7	8	9	10	11	12
12/2	Cu	56	35	71	75	52	78	106	61	65	58	100	55
	F-Z	63	78	43	96	65	113	82	33	72	54	58	53
12/16	Cu	70	84	64	132	85	46	80	79	22	70	48	211
	F-Z	41	49	51	44	25	36	36	77	11	7	27	139
12/22	Cu	45	133	106	176	113	173	110	346	95	97	72	274
	F-Z	93	38	61	45	57	36	55	92	17	47	60	241
12/30	Cu	67	146	82	71	106	118	129	116	54	43	34	348
	F-Z	73	56	63	66	57	70	72	84	93	43	60	196
1/6	Cu	112	161	126	250	70	138	155	104	64	47	79	342
	F-Z	71	65	81	113	58	68	81	55	80	13	40	151
1/12	Cu	150	148	308	97	55	155	265	104	143	31	35	297
	F-Z	92	91	87	136	38	48	91	34	36	16	55	82
1/21	Cu	135	71	80	170	121	225	118	122	18	29	172	217
	F-Z	48	28	21	77	27	49	30	28	41	38	31	45
1/26	Cu	67	62	51	199	48	77	47	37	18	13	39	77
	F-Z	14	21	7	29	16	13	11	23	29	7	16	13
2/2	Cu	69	59	51	259	118	111	71	51	33	30	80	18
	F-Z	17	16	18	114	30	95	11	25	33	44	26	9
2/10	Cu	32	49	51	71	72	46	50	46	55	62	95	72
	F-Z	64	63	24	51	40	51	34	26	74	31	34	20
2/20	Cu	29	38	60	50	45	25	31	37	67	39	57	63
	F-Z	6	42	34	11	14	24	18	38	79	35	27	57

was very slightly lower than the pH of the Fermate-Zerlate mixtures. Furthermore, there was no difference in the pH value of samples of the plant juices from the plots treated with the two fungicides. Thus it would appear that the pH of the spray mixtures or the pH of the plant juices had no influence on the aphid populations in these plots. It has been suggested that the Copper A Compound mixture might destroy the parasitic fungi attacking aphids and thus allow a more rapid increase in the numbers of aphids on the plots sprayed with Copper A Compound. No differences in the number of aphids killed by parasitic fungi was observed in the plots treated with these fungicides during the growing season. However, such an effect upon the parasitic fungi might have been unobserved because the aphid population was comparatively light in all of the plots. The amount of light reflected by leaves sprayed with these fungicides has yet to be measured. It has also been suggested that the applications of copper might have produced a physiological condition favorable to the multiplication of aphids. Plans have been made to test this hypothesis during the present growing season.

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