that (1), 8 trials each with emulsept and chlorine were made rather than 7 as in the controls, and (2), with 100 ppm active chlorine it had been found by preliminary experiments to be necessary to use only 3 groups of the 12 dozen eggs rather than 6 groups. The percentages of microorganisms (in relation to the number in the controls) remaining in the rinse water and in the wash water after using the two different disinfectants are given in Table 1.

SUMMARY

The percentages of microorganisms killed with emulsept in these experiments for the same series of eggs are many times greater than the percentages of those killed when 100 ppm active chlorine was used. Experiments are in progress on other phases of this problem.

VIRGINIA J. PENNISTON
LESLIE R. HEDRICK

DEPARTMENT OF BIOLOGY,
ILLINOIS INSTITUTE OF TECHNOLOGY,
CHICAGO

NEW MATERIALS FOR DELAYING FRUIT ABSCISSION OF APPLES

IN experiments performed in 1939,[1] growth-regulating chemicals as sprays proved highly successful in delaying the harvest drop of apples. Of a number of compounds tested, naphthaleneacetic acid, naphthaleneacetamide and the metallic salts of naphthaleneacetic acid have proved to be the most outstanding in effectiveness. Extensive use of these sprays by orchardists has been exceedingly helpful in reducing losses from harvest drop of apples and pears. However, the limited period of effectiveness of the sprays (usually from 10 days to 3 weeks), with consequent necessity of rather exact timing of the applications, has been the major difficulty in the successful use of these sprays. To increase both the duration and the intensity of the effect of such a spray application, the action of some compounds not heretofore tested was determined in the fall of 1944.

EXPERIMENTAL RESULTS

The data, expressed as accumulated per cent. drop at frequent intervals following the spray applications on Winesap apples are shown in Table 1. Until 15 days after treatment both naphthaleneacetic acid treatments, with and without the addition of Carbowax (a polyethylene glycol), were highly effective in preventing fruit drop. While 4-chlorophenoxyacetic acid and 2,4,5 trichlorophenoxyacetic acid reduced drop significantly during this period, these treatments were not so effective as the 2,4 dichlorophenoxyacetic acid spray. Beginning 15 days following application, the rate of fruit drop with the naphthaleneacetic acid treatment showed a marked increase, and by 17 days the effect of the treatment had been almost or entirely dissipated, since the fruit drop from that date until the completion of the experiment was at approximately the same rate as for the untreated trees. The addition of Carbowax to naphthaleneacetic acid, however, considerably extended both the intensity and duration of effect. The rate of fruit drop for trees receiving this treatment did not approximate the rate of drop for the untreated trees until 23 days after application. The 2,4 dichlorophenoxyacetic acid treatment, while somewhat less effective than the naphthaleneacetic acid treatments for a considerable period following the spray applications, was effective over a period nearly double that of naphthaleneacetic acid alone, and several days longer than for naphthaleneacetic acid plus Carbowax. On October 30, when the fruit was harvested, most of the apples on the trees receiving 2,4 dichlorophenoxyacetic acid treatment were firmly attached to the spurs, and while pulling them off was not difficult, there was no suggestion that the fruit was any "looser" than it had been several weeks earlier. In contrast to this condition, the fruit on the trees of the next most effective treatment (naphthaleneacetic acid plus Carbowax) would drop from the tree at the slightest touch.

TABLE 1

EFFECT OF GROWTH-REGULATING CHEMICALS ON HARVEST DROP OF WINESAP APPLES

Spray treatment	Average accumulated per cent. drop Days following spray application					
	7	11	15	19	23	28
.001 per cent. naphthaleneacetic acid	0.6	1.4	5.3	29.7	36.4	61.8
.001 per cent. naphthaleneacetic acid + 0.5 per cent. Carbowax .	0.8	1.3	2.7	12.9	16.3	41.4
.001 per cent. 2,4 dichlorophenoxyacetic acid	1.9	5.3	10.7	18.1	19.4	24.9
.001 per cent. 4 chlorophenoxyacetic acid .	1.7	8.4	22.7	39.1	44.4	59.8
.001 per cent. 2,4,5 trichlorophenoxyacetic acid	1.7	8.4	21.0	39.9	45.9	64.6
Control	4.0	15.9	35.4	54.4	59.5	72.9
Difference necessary for significance at 5 per cent. point			7.7		11.8	11.0

DISCUSSION

In this experiment the addition of 0.5 per cent. Carbowax to naphthaleneacetic acid significantly increased both the intensity and the duration of effect. Results with the 2,4 dichlorophenoxyacetic acid treatment offer considerable promise as a means of extending the effective period of fruit-drop sprays. In order to obtain effectiveness with this compound comparable to naphthaleneacetic acid immediately following treatment, several possibilities suggest themselves: (1)

[1] F. E. Gardner, P. C. Marth and L. P. Batjer, SCIENCE, 90: 208–209, 1939.

using a spray solution stronger than 10 p.p.m.; (2) applying the spray at an earlier date with reference to fruit maturity; and (3) combining the 2,4 dichlorophenoxyacetic acid with Carbowax and with naphthaleneacetic acid, or with both.

L. P. BATJER
P. C. MARTH

AGRICULTURAL RESEARCH ADMINISTRATION,
U. S. DEPARTMENT OF AGRICULTURE,
BELTSVILLE, MD.

INFECTIOUS MYXOMATOSIS IN MALNOURISHED RABBITS

THOMPSON[1] and Parker[2] have demonstrated that infectious myxomatosis is modified in rabbits exposed to high external temperatures. In preliminary attempts to determine whether or not chemically induced fevers have a similar modifying action, we studied the action of dinitrophenol in 12 rabbits. Six of these rabbits were injected with myxoma virus and sustained at fever temperatures by the subcutaneous injection of alpha dinitrophenol (20 mg/Kg of a 3 per cent. sodium salt) twice daily at 12-hour intervals. Two of these rabbits (as seen in Table 1) showed a delayed and modified infection. Since these two rabbits had a distinct loss of weight we decided to investigate further the effect of malnutrition on infectious myxomatosis.

Twelve rabbits were kept on minimal amounts (5 to 20 grams) of stock rations for a period of 10 days prior to the injections of virus and during the course of the disease, except where premature death was expected. Myxoma virus was titrated intradermally[3] and temperatures, weights, tumor measurements and clinical signs were recorded daily. Thirteen tumor biopsies were made serially on starved and well-fed rabbits and examined microscopically to determine the progressive pathology.

Microscopic study of the tumor biopsies revealed that the process of tumor formation was retarded in the malnourished rabbits. Table 1 presents data on 9 malnourished rabbits; 3 others died before any significant observations could be made. Tumors in the malnourished rabbits were delayed in appearance, and were definitely smaller than those in the controls in this series or in any of the well-fed animals in our previous study.[3] In one malnourished rabbit only a single minimal lesion appeared in one of the 16 injected sites.

TABLE 1

INFECTIOUS MYXOMATOSIS IN MALNOURISHED RABBITS

Number of rabbits	Treatment	Weight loss in per cent.	Days after virus injection: Lacrimal discharge	Secondary lesions	Death	Gross pathology of tumors*
1	Malnourished	16	0	0	7	+
1	"	22	8	0	13	+
3	"	23–26	7–9	0	10–11	+++
1	"	28	8	8	11	++
1	"	29	0	0	8	+
1	"	30	8	0	10	+
1	"	34	0	0	8	+
4	Dinitrophenol	0	6–8	6–9	9–11	++++
1	"	10	9	0	9	+++
1	"	25	0	0	7	+
7	None	0	6–8	5–8	8–13	++++

* ++++ = typical, large, cyanotic, raised; +++ = delayed, typical but smaller; ++ = delayed, only slightly raised; + = small, not raised or edematous.

Strict comparisons of the 50 per cent. end-points could not be made because of the atypical appearance of many of the dermal lesions in the starved rabbits. The delay in the appearance of lacrimal discharges—or the complete absence of such—and the absence of secondary lesions in 8 of 9 rabbits suggests that there was less generalization of the virus than in the controls. The known mortality rate of about 100 per cent. and the duration of the infection were not modified. It should be noted that 4 of the starved rabbits died showing an atypical clinical picture of infectious myxomatosis.

RALPH B. HOULIHAN

UNIVERSITY OF VIRGINIA
SCHOOL OF MEDICINE

W. ANSELL DERRICK

CITY LABORATORY, KINGSTON, N. Y.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

APPARATUS FOR GROWING MICROORGANISMS ON A FLOWING MEDIUM[1]

THE work of Shwartzman[2] describing the effect of Cellophane on penicillin production prompts us to publish the description of an apparatus used for growing microorganisms on cellulose tubing. We similarly used cellulose to increase the surface-volume ratio, but also to make a pathway through the growing fungus for the medium to pass into and out of the culture.

The apparatus (Fig. 1) consists of 50 feet of quarter-inch cellulose tubing[3] wound in a coil on

[1] R. L. Thompson, *Jour. Infect. Dis.*, 62: 307, 1938.
[2] R. F. Parker and R. L. Thompson, *Jour. Exper. Med.*, 75: 567, 1942.
[3] R. B. Houlihan and G. McL. Lawson, *Jour. Infect. Dis.* (in press).
[1] Journal Article No. 746 (n.s.) from the Michigan Agricultural Experiment Station.

[2] Gregory Shwartzman, SCIENCE, 100: 390, 1944.
[3] Blood transfusion tubing manufactured by Visking Corporation, Chicago, Illinois.