potential of Vydate (*S*-methyl 1-(dimethylcarbamoyl) - *N* - [(methylcarbamoyl) oxy]thioformimidate) for control of this pest on established plants, foliar applications of the material were made on the infected melons. Vydate is an experimental insecticide-nematicide which has demonstrated the capacity to be translocated *downward* when applied to plant foliage and in certain instances controls nematodes attacking roots. This is one of only two compounds now recognized which has that type of activity, and both are in the experimental stages of development.

Plot size was a single row 125 ft in length; each treatment was replicated four times. Treatments were: (1) Vydate foliar sprays and (2) untreated check. Vydate was applied by hand sprayer three times. The first spray was applied when plants were in first or second true-leaf on March 12 (4# ai/100 gal H_2O sprayed to run-off). The second application was on March 25, and the third on April 17. The Vydate was reduced to 2# ai/100 gal water in the second and third sprays. The melon variety was Top Mart, and cultural practices within the test area were those of the growers. On June 21, the experiment was terminated and ten plants were selected at random from each plot. The root systems were dug and rated for nematode galling. If no nematodes were present a zero rating was given, and if 100% of the roots on a given plant were galled, a rating of five was given. The results of the gall rating are presented in the table.

The data demonstrate that the foliar Vydate sprays reduced the incidence of root-knot galling on the mature plants. In addition, the protection to the plants was definitely reflected in plant size and stand at the end of the growing season. Plants sprayed with the Vydate covered the beds and those in the check plots were small and irregular in size and produced few marketable melons. This report demonstrates that Vydate will retard and prevent nematode attack on established cantaloupe plants but this conclusion *should not* be construed to mean that the authors suggest such a control measure in lieu of proper preplant treatments. Using systemic nematicides shows considerable promise but many avenues must be investigated before it can be suggested for grower usage.

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SURFACE RUNOFF IN DAIRIES

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Hydrologic analysis indicated that surface runoff from manure accumulated in dairy areas would not occur very frequently in southern California. This was verified by a field test using simulated rainfall. Hydrologic data collected in this experiment were used to establish the runoff-rainfall relationship for the Chino-Corona dairy preserve. Though the amount of runoff may not be large, the high mineral and organic carbon contents of manured runoff is detrimental to the water quality of receiving streams. The high salinity and low nutrient content would make its possible beneficial use on cropland seem doubtful. In wet years, the disposal of salt-laden wastewater could become a problem. Holding ponds and retention structures for surface runoff merely prevent it temporarily from entering the receiving water.

SURFACE RUNOFF from livestock-manured areas usually carries a high water pollution potential. Researchers in Texas, Nebraska, and Kansas have characterized the surface runoff from beef cattle feedlots by its high biochemical oxygen demand, nutrient contents, and mineral constituents. Although dairies differ from feedlots in feed rations, animal stocking rate, etc., runoff from dairies is not expected to differ much from that of feedlots. In an area with a heavy concentration of livestock, such as the Chino-Corona dairy preserve in southern California, manure-laden runoff could be a significant portion of the total surface runoff of the watershed and could degrade the quality of the receiving stream. This study was an attempt to determine the hydrologic and water quality characteristics of surface runoff from this area.

Rainfall simulation

A pre-experiment hydrologic analysis was conducted to determine the precipitation pattern of the study area. Data used for this analysis were obtained from a gauging station of the San Bernardino County Flood Control District, located at lat. 34°58′, long. 117°36′, with continuing record dated back to 1940. The result indicated that the annual rainfall at the dairy area ranged from 3.98 inches to 27.66 inches, with annual average of 11.67 inches. A 24-hour storm recurring at ten-year intervals produces 3.95 inches of rain. Further analysis of the magnitude and distribution pattern of daily rainfall indicated that precipitation was infrequent. In the past 32 years (1940–1972), recorded daily rainfall for 97.8% of the days was less than 0.5 inches, and considerable time would have to elapse to accumulate enough runoff data for analysis.

Instead of waiting for runoff-generating storms, researchers simulated precipitation on the surface of dairy corrals where animals are confined. A simple rainfall simulator was fabricated by using 2-inch OD schedule 40 PVC pipe with spraying nozzles on 8-inch risers spaced 5 ft apart. It produced simulated rainfall with intensity ranging from 0.5 inches per hour, to 2.50 inches per hour, at a uniformity coefficient ranging from 81 to 96 (uniformity coefficient of a perfect distribution pattern is 100). It covered a strip of corral surface 15 ft wide and 200 ft long. In comparison with natural rainfall, the simulated rainfall had two shortcomings. First, the simulated raindrops did not travel sufficient distance to reach the terminal velocity of natural raindrops, so they did not have the impact momentum of natural raindrops when they reached the ground. Second, with the nonrotating spraying nozzles water drops tended to fall on the same spot each time.

In natural rainfall, water falling on the ground surface is only slightly contaminated. However, this is not true of simulated rainfalls using well water. But after a comparison of the quality of water used and runoff collected, it was concluded that runoff water was so contaminated that the amount of minerals in the groundwater would not seriously affect the result.

On each simulation, the device was set up at a dairy with a 3.2% ground slope. The overland flow from the test area was measured by a precalibrated V-notch weir. Water samples were taken at the same time and returned to the laboratory for water quality analysis.

Characteristics of runoff

The hydrologic characteristics of each delivered precipitation and its resultant runoff are summarized in table 1. In this table, the waste accumulation condition was described by the number of days after corral cleaning, on the assumption that the longer after cleaning that the runoff was measured, the more waste would have accumulated on the ground. Under the experimental conditions, it appeared that daily rainfall of less than 1 inch hardly caused any surface runoff. Comparing it to the result of pre-experiment hydrologic analysis, the intensity of delivered rainfall always approached the maximum possible rainfall intensity of the given daily rainfall. For an equal amount of precipitation, higher-intensity storms tend to produce more runoff. Based on these tests, surface runoff varied from 3% to 89% of the precipitation, depending on the amount of rainfall. The data were fitted by linear regression to estimate the percent of runoff resulting from a given rainfall (see graph 1). The estimation of surface runoff by this equation closely matched with the result of an EPA-recommended method that

$$Q = \frac{(P - 0.352)^2}{P + 1.41}$$

where Q = surface runoff (inches) and P = precipitation (inches).

Since most figures for daily rainfall recorded in the past were less than 0.5 inches, surface runoff from dairy corrals obviously did not occur often in this region. A 24-hr storm with a ten-year recurrence interval would have an estimated 72% runoff. The waste accumulation and rainfall intensity did not seem to have significant influence on runoff when moisture content of the accumulated wastes was between 15–30% on a dry weight basis.

Using the runoff-precipitation relationship established in graph 1 and assuming no significant loss through infiltration, annual surface runoff was estimated by the daily precipitation data (graph 2). The annual runoff from a manured surface can be estimated by annual precipitation. For an average year when precipitation amounts to 11.7 inches, expected annual runoff would be 3.6 inches. This information would be helpful in designing surface runoff control structures for dairies.

Water quality

Surface runoff was high in water pollution potential (table 2). The result is in general agreement with findings of other researchers. It can be categorized by high mineral and high organic carbon content, which makes it unsuitable for direct discharging into a surface stream. Judging from the high electric conductance and monovalent cations, it would not even meet the quality requirement for irrigation. Although the loss of dissolved minerals to surface runoff was significant, the transport of suspended solids by overland flow did not appear to be a serious problem on midly-sloped land. Comparing with studies of other researchers, where slopes were steeper, precipitation higher, and the rainy season longer, the suspended solids in the surface runoff were significantly less. Overland flow traveling a long distance tends to form channels; this channelled flow with higher velocity would transport larger amounts of loosely-packed wastes. Under experimental conditions, no channel was formed. This leads to the conclusion that a well-sloped corral surface would minimize the loss of suspended material through runoff.

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TABLE 1. SUMMARY OF RAINFALL AND RUNOFF

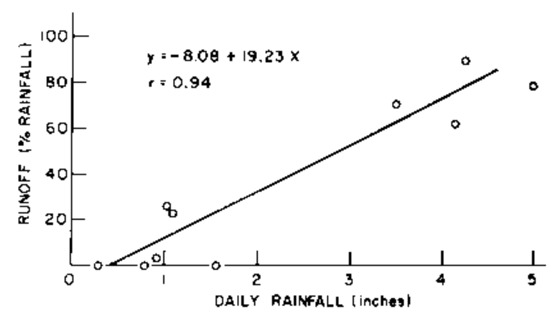
Rain No.	Total precipitation	Average intensity	Precipitation before runoff	Surface runoff		Corral conditions
	Inches	Inches	Inches	inches	% precipitation	days after corral cleaning
1	1.08	0.86	0.61	0.25	23	8
2	1.02	0.42	0.28	0.27	26	13
3	0.92	0.44	0.82	0.03	3	22
4	0.29	0.35	–	0	0	26
5	1.57	0.81	1.57	0	0	91
6	4.13	2.10	0.86	2.57	62	97
7	0.77	1.55	–	0	0	112
8	4.25	1.89	0.20	3.80	89	1
9	4.99	1.81	1.05	3.87	78	8
10	3.45	1.40	0.84	1.97	71	15

TABLE 2. WATER QUALITY ANALYSIS OF SURFACE RUNOFF—RAIN NO. 6

Time*	pH	E.C.	Total solids	Total nitrogen	Chemical oxygen demand	Anions			Cations				
						HCO_3^-	NO_3^-–N	Cl^-	NH_4^+–N	Na^+	K^+	Ca^{++}	Mg^{++}
minutes		mmho/cm	%	mg/l	mg/l	mg/l			mg/l				
35	9.2	14.6	1.49	154	4413	2267	1.1	1074	26.6	875	1540	1000	115
65	9.0	7.0	0.71	88	2625	1303	1.0	953	17.5	413	450	625	53
95	8.9	5.8	0.53	66	2130	1126	1.2	929	16.1	275	500	400	45
115	8.9	6.4	0.84	78	2282	1210	0.4	740	18.9	325	600	400	35

* Minutes after rain started. Runoff started at time 30. Rain stopped at time 108.

GRAPH 1. PREDICTION OF SURFACE RUNOFF BY PRECIPITATION



GRAPH 2. ESTIMATED ANNUAL RUNOFF VS. ANNUAL PRECIPITATION