Filling covered bunkers with ronnel-medicated feed mix for hornfly control tests at the Chrisman Ranch, Tulare County.

CONTROL OF HOR
on range cattle
WITH SYSTEMIC I

R. F. MILLER

Typical placement of covered bunkers used in range trials for hornfly control with systemic insecticides.

HORNFLIES (*Haematobia irritans*) are an economic problem in pasture cattle production in the central San Joaquin Valley during the summer and fall months. Although thousands of flies may be present on individual range cattle, each taking a blood meal several times daily, it is difficult to evaluate the exact economic loss. Infested cattle spend a great deal of time and energy ineffectually warding off hornflies, with resulting stress and weight loss.

The flies make their appearance in Central California in late April or May with the advent of warm weather and persist until late October or November when low temperatures and frost curtail their activity. However, dense populations are observed during the hot summer months from June through September.

Although hornflies are readily killed by a number of insecticides which can be sprayed on the affected cattle or applied through back-rubbing devices used by the cattle, neither of these methods is practical for hornfly control on cattle grazing range land in California's central valley foothills. The cattle are widely scattered over large areas, making it diffi-

Foothill range land covered with scrub oak and cattle seen right (and cover photo) are typical of conditions during range trials with ronnel for hornfly control in Tulare County.

HORNFLY AND CATTLE GRUB CONTROL SUMMARY

1. A spray using 0.15 gallon of 1% ronnel (Korlan) per head controlled hornflies for four weeks at a cost of 3 cents per head, exclusive of labor and weight loss.
2. Ronnel fed at the rate of 1.68 to 2.11 grams per 1,000 lbs of body weight lowered hornfly populations by 60–95% at a cost of approximately 2.8 cents per head per day.
3. Feeding ronnel at a rate of less than 1 gram per 1,000 lbs of body weight did not reduce hornfly populations.
4. Feeding approximately 2 grams of ronnel per head for a period of 84 days decreased the number of cattle grubs by 90%.

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E. C. LOOMIS

cult to round them up for the necessary periodic spraying. Back-rubbing devices usually are not effective because large areas of brush and trees are available for this purpose on these ranges.

This article discusses tests of recent proposals that hornflies might be controlled by daily feeding of small amounts of ronnel, an organophosphorous systemic insecticide which would kill the hornfly larva in the manure. Small amounts of ronnel fed over an extended period of time had also been recommended by the manufacturer for possible control of the cattle grubs, *Hypoderma lineatum* and *H. bovis*.

To determine the degree of hornfly and cattle grub control possible through daily low level feeding of ronnel, a trial was started in the summer of 1965. Other objectives of the trial were to obtain cost data on this method of control as compared with that obtained by spraying with ronnel.

The trial was conducted on the Chrisman Ranch located about 14 miles east of Orosi, Tulare County. The ranch is in a low foothill area covered with grass and oak trees. Annual grasses predominate and are supplemented in summer and fall with a feed mix designed to offset the deficiencies occurring in the available dried forage. This feed mix is self-fed from covered bunkers with salt being used as an inhibitor of consumption. The ronnel was incorporated into the feed mix at a level of 1 gram of active material per pound of feed:

Feed mix Ingredients	Medicated lbs/ton	Control lbs/ton
Cottonseed Meal—41%	800	800
Ground Barley	400	413
Salt	475	500
Molasses	100	100
Dicalcium phosphate	88	100
Limestone	20	50
Urea	30	30
Vitamin A-10	7	7
Premix—5.5% ronnel	80	...

The calves were weaned during the early part of July and three of the four groups of cows as well as the bulls were sprayed with ronnel (using a 1% Korlan-water solution). Cost of the spray material was 3 cents for the 0.15 gallon of Korlan spray used per animal. Following weaning and spraying, the five groups of cattle were moved to their respective fields. Supplemental feed was distributed to the self feeders from July 19 to October 11 (see table).

The cattle were examined for hornflies through binoculars (from a vehicle while driving through each field) at weekly intervals from July 2 through October 18. At least 25% of the cattle in each group were observed each inspection, and the number of flies seen on one side of each animal was recorded (see graph).

As a supplement to the count of adult flies on animals, at least 10 or more four- to five-day-old manure piles from field plots of nearly all herds were inspected periodically for hornfly development. The samples were given a broad classification as follows: 0 = none observed, 1 = larvae but no pupae in less than 50% of the samples, 2 = larvae and pupae in at least 50% of the samples, 3 = larvae and pupae in more than 50% of the samples.

Prior to spraying with ronnel, all cattle had dense hornfly populations. The Arnett cows served as the only "true" untreated group since they did not receive either the ronnel spray or medicated feed. Fly counts on this herd showed a dense population until August 23, after which time they gradually decreased (see graph). All other cattle sprayed with ronnel showed good hornfly control for three to four weeks (July 12 through August 9). This three-to-four-week protection period allowed sufficient time for immature-stage hornfly control in manure from cattle fed ronnel-medicated feed. At the same time, the Goldstein cows placed on non-medicated feed showed effects of the residual period of ronnel spray, as did (by chance) the bull herd which was on far below normal consumption of ronnel-medicated feed (0.80 lb/head/day). Feed consumption for the untreated herds, Arnett and Goldstein, amounted to 2.11 and 2.10 lbs per head per day (see table).

With the exception of one week in September (9/13) for the Indian herd, fly counts on these animals and on those of the North herd remained at a low level. In general, from 60% to 95% hornfly reduction was evident between these animals and those cows in the untreated herds (Arnett and Goldstein). Medicated-feed consumption amounted to 2.12 and 1.68 lbs per head per day with the North and Indian herds, respectively.

Results of the fly counts were confirmed by manure pile inspections for

TREATMENT, FEED AND COST DATA IN HORNFLY CONTROL TESTS

	1	2	3	4	5
Field	West	Goldstein	Arnett	North	Indian
Cattle	17 bulls	47 cows	20 cows	69 cows	39 cows
Sprayed	Yes	Yes	No	Yes	Yes
Feed	Medicated	Non-medicated	Non-medicated	Medicated	Medicated
Feed/hd/da	.80	2.10	2.11	2.12	1.68
Ronnel hd/day	1.20 gms.*	..	..	2.12 gms.	1.68 gms.
Feed cost/cwt	$4.40	$3.00	$3.00	$4.40	$4.40
Cost/hd/da	3.52¢	6.31¢	6.34¢	9.26¢	7.39¢

* Amount in feed for bulls doubled 8/30 due to prior low consumption.

hornfly development. Manure from the Arnett cows had the highest number of immature-stage flies while manure from the North and Indian herds showed much less hornfly development throughout.

On March 1 and 2, 1966, the backs of 55% of the treated cows from the North field, and 48% of the cows from the Goldstein control field, were examined for grubs. In the treated group, four head had one grub each and one head had two grubs for an average of 0.18 grub per head. The 23 head counted in the control group had a total of only 40 grubs or an average of 1.7 grubs per head (range, 0 to 4).

Ronnel is not yet recommended by University of California for systemic control of hornflies or grubs on range cattle.

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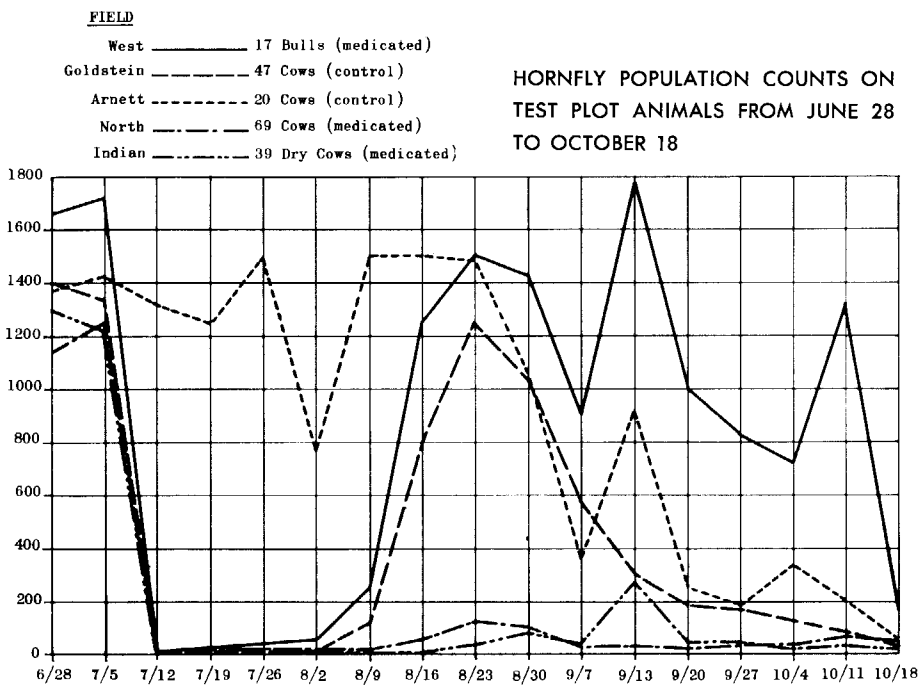

HORNFLY POPULATION COUNTS ON TEST PLOT ANIMALS FROM JUNE 28 TO OCTOBER 18

ORGANIC ACID SYNTHESIS IN LEMON FRUITS

E. BOGIN • A. WALLACE

QUALITY OF LEMONS and of other citrus fruits is affected by the concentrations of acids in the fruit juice. For this reason information concerning the synthesis and accumulation of the acids is important and has been the subject of intensive studies. Until recently organic acids were thought to be synthesized in leaves and then later translocated to the fruit. Sufficient biochemical systems have now been isolated from fruits to warrant the conclusion that lemon and other citrus fruits are quite capable of the acid synthesis.

Major problem

One of the major problems in the studies involved isolation of the enzyme systems from the highly acid citrus fruits. This was accomplished by the proper use of buffers and special grinding techniques. Mitochondria, which have the ability to oxidize all the tricarboxylic acid cycle intermediates, were prepared from lemon fruits. Soluble enzymes which have the capacity to fix carbon dioxide into organic acids were also isolated from the fruit. Fixation of carbon dioxide is one of two mechanisms that can result in a net synthesis of organic acids in cells. These particular results demonstrated that the organic acids could be synthesized in fruits.

Many biochemical mechanisms have been explored by the use of mutants, particularly mutants of microorganisms, and this approach was applied to the study of acid synthesis in lemon fruits. Comparative studies were made with Eureka lemon and Tunisian sweet lemon fruits (see table). The latter is generally considered to be a mutant of a sour lemon. In the mutant, some biochemical