fornia with the first two crops ranking first and second in importance in the state's vegetable crop production. In 1965, 147,600 acres of tomatoes were valued at $164,000,000 and 106,900 acres of potatoes were worth $127,000,000. Although *Tetranychus marianae* has not been found in commercial fields, its presence nearby poses a direct threat to both crops with potential serious economic loss to California growers.

Observations in the field thus far indicate that native predators of mites are practically nonexistent on solanaceous plants heavily infested with *T. marianae* even though they are sometimes abundant on nearby plants infested with native species of spider mites. It is not known whether this scarcity of predators is due to the unacceptability of the prey or the host plant. The problem is under investigation. Preliminary experiments with biological control of *T. marianae* have been initiated, using the predaceous mite *Phytoseiulus persimilis* Athias-Henriot.

The presence of *T. marianae* in Central America and its apparent preference for and destructiveness to solanaceous plants which supposedly originated in Central and South America made these areas initial targets for exploration for natural enemies. However, foreign exploration trips to Central America and Mexico this year were unsuccessful in locating either the spider mite or its predators. It is hoped that further explorations will produce predators that may be introduced before the pest becomes widely established in commercial plantings of tomatoes and potatoes.

Black nightshade, *Solanum nigrum* L., has been found to be a good indicator plant (photo 7) for detecting the presence of *T. marianae*. The reddish-orange spider mite can be readily detected in the field due to its habit of developing dense webbing and clusters of living mites on the tips of heavily infested plants (photos 2 and 3). Positive identification of the species requires careful examination of male specimens by mite taxonomy specialists.

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HORN FLY AND GRUB CONTROL ON BEEF CATTLE

. . . *testing several new insecticides*

W. H. JOHNSON · E. C. LOOMIS

A 75% reduction in horn fly populations lasted from two to four weeks following trial spray applications of insecticides in June, for two to six weeks following August treatments, and for the remainder of the fly season with most of the September grub control treatments. During the entire trial, most treatments kept horn fly populations below 100 flies per animal for five to six weeks after treatment. Grub control was excellent with all treatments, ranging from 96% to 99% control. Both common and northern grub infestations were effectively reduced. The split dose of Ruelene 8R provided excellent grub control as well as satisfactory horn fly control from August to the end of the fly season. There were no adverse effects observed on any animals treated during this study.

THE HORN FLY, *Haematobia irritans*, and cattle grubs, *Hypoderma lineatum* (common type) and *H. bovis* (northern type), continue to create external parasite problems on beef cattle grazed in open rangeland. The effectiveness of various insecticides for control of these pests was tested in Shasta County during 1966–67. Treated animals included weaner bull and heifer calves, and yearling heifers, all of the Hereford breed. The test was conducted on the Crowe Hereford Ranch in the foothill area 17 miles east of Redding.

Each of four groups of bulls (averaging 498 lbs) and four groups of heifers (averaging 475 lbs), received a different treatment. The yearling heifers were given a grub treatment only, and were kept in a field apart from the calves. The bull calves were sorted into two pastures two miles apart, with some of each treatment in each pasture, while the heifer calves ran in the same field with their dams for the first 12 weeks of the trial (June 21 to September 14), and then were moved away from the cows to another field.

The chemical programs for the groups treated are shown in table 1. All treatments except Neguvon and methoxychlor dust followed the recommendations contained in AXT 172, "Control of External Parasites of Livestock" or AXT 253, "Factors Affecting the Cowman's Income"—both University Agricultural Extension Service publications.

Spray applications were made using a power sprayer with mechanical agitator, operated at 200 psi and one half-gallon dosage was applied to each animal. Pour-on applications were made using a standard six-ounce capacity metal dipper.

Weekly horn fly counts were made by recording the number of flies observed resting on one entire side and on the withers area of at least 50% of the bulls and 30% of the weaner heifers in each group. The animals were examined in the morning hours either from a vehicle driven through the pastures, or while walking through the herds. Investigators

TABLE 1. INSECTICIDE PROGRAMS TESTED FOR HORN FLY AND GRUB CONTROL ON BEEF CATTLE

Herd	No. & Type of Animals	Type & Time of Treatment
A AA* F	8 bulls 9 bulls 17 heifers	Neguvon spray 6/21, 8/3 Neguvon pour-on 9/14
B BB H	8 bulls 9 bulls 17 heifers	Co-Ral spray 6/21 Korlan spray 8/3 Methoxychlor dust 9/14
C CC E	8 bulls 9 bulls 18 heifers	Co-Ral spray 6/21 Korlan spray 8/3 Ruelene 8R full dose 9/14
D DD G	9 bulls 9 bulls 18 heifers	Co-Ral spray 6/21 Ruelene 8R, ½ dose, 8/3 and 9/14
..	26 yearling heifers	Co-Ral pour-on 9/14
..	26 yearling heifers	Ruelene 25E pour-on 9 14

* Herd AA also receivel a methoxychlor dust treatment on 9/30.

used a 7 × 50 pair of binoculars to accurately count the horn flies. Grub counts were made by hand examination of the back and loin areas of each animal as it was held in a squeeze or chute.

Fly control

Following the first spray applications for horn flies (June 21 and 22), satisfactory reduction (75% or more) lasted for three weeks when either Neguvon or Co-Ral was used on the heifers. Applications of Neguvon or Co-Ral to the bulls gave four weeks of control in one field but only two to three weeks on the bulls in the other field. In most herds the horn fly populations were kept at less than 100 per head for five weeks. The second treatment was made at the sixth week when fly counts neared 100 on the heifers (herds F,G) and were above 100 on the bulls (herds A,AA,BB,CC,DD).

The second treatment, August 3, 1966, was principally for horn fly control with the exception that the first one-half dose of Ruelene 8R grub control treatment was given to two groups of bulls (herds D, DD) and one herd of heifers (G). All August treatments (Neguvon and Korlan sprays, and one-half dose Ruelene 8R pour-on) gave 75% horn fly reduction on the heifers for six weeks. In one field of bulls, Neguvon and a half dose of Ruelene 8R showed two weeks' effectiveness and Korlan three weeks; in the other bull field, Neguvon and Korlan lasted four weeks and a half dose of Ruelene 8R, three weeks. Again, most treatments kept horn fly populations below 100 flies per head for longer periods of time.

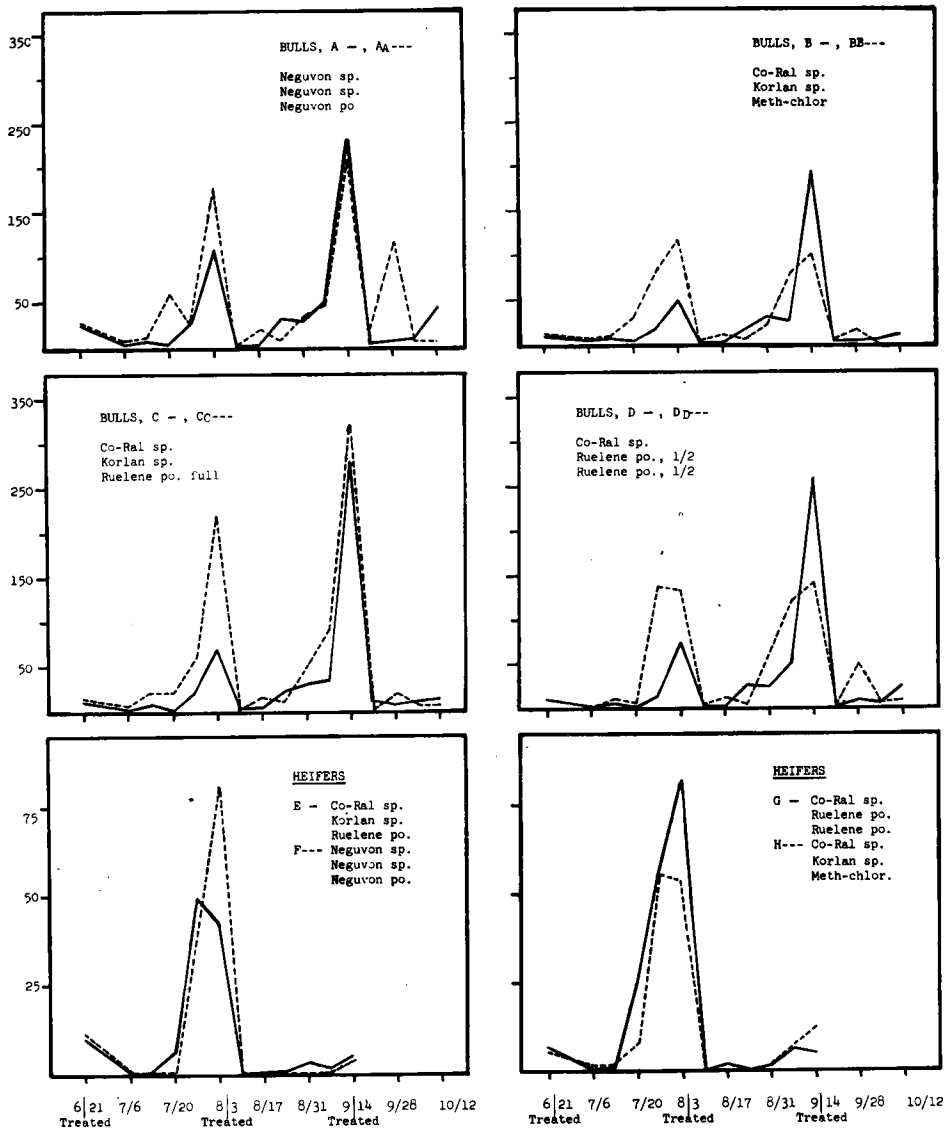
The September 14 treatments, primarily for grub control, gave satisfactory fly control for the remaining five weeks of the study except for two groups of bulls in one field. The two groups were those which received pour-ons of Neguvon (AA) and the second half dose of

TABLE 2. RESULTS OF CATTLE GRUB EXAMINATION ON ANIMALS UNDER TEST, CROWE HEREFORD RANCH, SHASTA COUNTY, CALIFORNIA 1966–67

Herds and Treatment	No. Animals On Test	No. Animals Exam.	No. Animals Neg.	No. Animals Pos.	Grub Count Tot.	Grub Count Range	Grub Count No/Hd	% Grub Red.
			A. BULLS*					
A–AA Neguvon	17	14	13	1	1	0– 1	0.07	99
D–DD Ruelene 8R Split-dose	18	16	15	1	1	0– 1	0.06	99
C–CC Ruelene 8R Full-dose	17	9	6	3	7	0– 5	0.77	96
D–DD Control	17	16	0	16	344	2–55	21.5	..
			B. HEIFERS†					
F Neguvon	17	13	11	2	2	0– 1	0.15	99
G Ruelene 8R Split-dose	18	16	15	1	2	0– 2	0.12	99
E Ruelene 8R Full dose	18	14	12	2	8	0– 7	0.66	96
H Control	17	8	0	8	168	1–41	21	..
			C. YEARLING HEIFERS‡					
Ruelene 25E	26	24	16	8	9	0– 2	0.37	..
Co-Ral 4%	26	26	9	17	40	0– 7	1.53	..

* Examined 1/17, 1/30, 2/13, and 2/15, 1967. Grub identification and ratio of Hypoderma lineatum to H. bovis: 2/13 = 7:1, 3/7 = 1:15.
† Examined 1/17/67.
‡ All yearling heifers were treated (no untreated group for comparison)—examined 12/28/66.

AVERAGE WEEKLY HORN FLY COUNT PER ANIMAL UNDER TEST, CROWE HEREFORD RANCH, SHASTA COUNTY, 1966



Ruelene 8R (DD). The Neguvon group had such high fly counts 16 days later that a methoxychlor dust was applied, resulting in horn fly control to the end of the study.

Grub control

Weaner bulls and heifers were practically grub free after treatment with either Neguvon, Ruelene 8R, or with the split dose of Ruelene 8R. Better than 99% control resulted from both Neguvon and the split Ruelene 8R treatments, while the single Ruelene 8R treatment provided 96% control. The majority of animals were examined on January 17, and the remainder (some that had been sold and moved to other locations) were examined during the following four weeks.

Another examination was made on the Crowe Ranch March 7 to check for the emergence of the northern cattle grub. No grubs were detected on the 21 treated weaner bulls. Of the 43 treated heifers, all were negative except two that had one grub each. At this date, 15 untreated weaners had from 0 to 11 grubs per head.

Both species of cattle grubs were recovered from the animals under study. Grub identification from the February inspection showed a ratio of seven common grubs, *Hypoderma lineatum*, to one northern grub, *H. bovis*. In March, this ratio changed to 1:15 for the two species.

Grub counts (made December 28) on the yearling heifers showed very low grub populations after Ruelene 25E and Co-Ral treatments, although there were no untreated animals with which to compare the percentage of grub reduction. Fewer grubs were found, and fewer animals were found infested with grubs following the Ruelene 25E treatment, as compared with the Co-Ral treatment.

Costs

Chemical costs for the full season of fly and grub control were estimated to range from 35 to 80 cents per head depending on the type of chemical used. The least-cost treatment was with a Co-Ral fly spray in June, followed by two half doses of Ruelene 8R pour-on for fly and grub control six weeks apart, in August and September. Chemical costs for grub treatment alone were less variable, ranging from 28 to 32 cents per head for the weaners, and from 32 to 38 cents for the yearlings.

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EARLY APHID INCREASES BEET

Sugar yield was increased 30% in 1965 and 20% in 1966 by aphicide applications to protect young plants from virus-carrying aphids.

THE LARGE ACREAGE of overwintered sugar beets in California's north central valley is considered the primary source of virus inoculum for the spring-planted crop. Yellows and sugar beet mosaic viruses are carried from the old to the new crop by winged forms of the green peach aphid. Flights of this aphid usually occur in March and April but decrease to low levels by mid-May. Beets planted in early May usually escape infection despite overwintered fields; and in most years, yield as well or better than earlier planted crops which become extensively infected with the viruses. Because of this danger to early plantings, a large proportion of the crop is now planted in May and later. Without virus infection, March and April plantings can produce from 5 to 10 more tons of roots per acre than crops planted in May. If young plants can be protected from early infection, improvement in root yield can be expected from a longer growing season.

In these experiments the use of an aphicide was evaluated on a late-March planting only. Earlier experiments showed control to be less effective on earlier plantings.

Sugar beet seed of the variety US H6 was planted March 23 in 1965 and March 25 in 1966 and irrigated for germination. Seedlings emerged to good stands by April 15. To determine the effects of maximum control, certain plots were sprayed 8 times in 1965 and 6 times in 1966 at weekly intervals from mid-April through late May or early June. Other plots were sprayed 2, 3, or 4 times as indicated in the schedule of the table. The spray material was Meta-systox R (oxydemetonmethyl) used at the rate of 12 ounces of toxicant in 50 gallons of water per acre and was applied by back-pack equipment.

Aphid flights

Aphid flight patterns are indicated in the graph as the number of winged insects caught in yellow-pan water traps. Flights began earlier in 1965 and extended later than in 1966; virus diseases were more severe and the maximum spray treatment (eight times) improved sugar yields to a greater extent as shown in the table.

EFFECT OF META-SYSTOX SPRAYS ON NATURAL INFECTION BY APHID-BORNE VIRUSES, AND ON SUGAR BEET PRODUCTION, DAVIS 1965 AND 1966

Year	Number of applications	Dates of application								Disease, July 1 Yellows	Disease, July 1 Mosaic	Root yield	Sucrose		
										%	%	tons/acre	%	tons	% increase*
1965†	0									83	86	29.9	14.3	4.27	..
	2	4/21		5/5						72	78	33.1	14.3	4.73	11
	4	4/21		5/5		5/19		6/2		81	80	35.4	14.3	5.06	19
	8	4/21	4/28	5/5	5/12	5/19	5/26	6/2	6/9	51	73	38.8	14.4	5.58	31
LSD, 5%												2.4	n.s.	0.36	
1966‡	0									76	52	33.7	14.2	4.75	..
	2	4/18			5/9					74	43	38.7	14.4	5.57	17
	3	4/18	4/25	5/2						64	42	38.1	14.5	5.52	16
	6	4/18	4/25	5/2	5/9	5/16	5/23			56	33	39.3	14.9	5.84	23
LSD, 5%												1.9	n.s.	0.46	

* Percent increase over production of non-sprayed plots of the respective years.
† Planted March 23, harvested October 12.
‡ Planted March 25, harvested October 12.