Response to VITAMIN A, VIT of Cattle and Sheep in

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FOR MORE THAN 30 years, selenium has been known among scientists as a rare and versatile, but also toxic mineral, causing poisoning to livestock in the United States as well as other parts of the world.

Researchers in other areas have reported that very small amounts of selenium can be effective in preventing white muscle disease in lambs and calves. As little as 0.1 ppm of selenium, as the salt of sodium selenite, added to the feed of cows and ewes during gestation protected the young for this deficiency, according to one report. Currently, products containing vitamin E and selenium have been approved to use by the Pure Food and Drug Administration. These are available through veterinary practitioners for use in prevention of white muscle disease and are administered subcutaneously or intramuscularly.

Over much of northern California, reports have been made by livestock owners, farm advisors and veterinarians regarding white muscle disease in calves and lambs as well as unthriftiness and abortions in both cattle and sheep. To secure more information regarding this malady, an extensive field experiment was designed and carried out during 1961 and 1962 in Butte, Glenn, Modoc, Plumas, Siskiyou, Shasta–Lassen and Tehama counties. The trials were all conducted on ranches in specific areas where white muscle disease had been diagnosed in the past.

These tests involved 2,532 cattle and 583 sheep with 20 ranchers cooperating. The plan of the experiment was a factorial design involving no treatment, selenium, vitamin E and a combination of selenium and vitamin E. Livestock used in all trials were allotted at random to the different treatment groups. Vitamin A was also included in the experiment (with beef cattle only) to determine whether it was a factor in this disease. The final over-all testing plan for beef cattle, which included cows, calves and weaner calves, was as follows:

0 ..... no treatment
Selenium ..... 25 mg. selenium (sodium selenite) at trimonthly intervals until calving
Vitamin E..... 15,000 I.U. alpha tocopheryl acetate at trimonthly intervals until calving
Selenium-Vitamin E.. combination of the two above

1. 0
2. Vitamin A
3. Selenium
4. Selenium plus vitamin A
5. Vitamin E
6. Vitamin E plus vitamin A
7. Selenium plus vitamin E
8. Selenium plus vitamin E plus vitamin A

Liver biopsy samples—collected on representative cattle in 10 herds at the beginning and end of the test—were analyzed by Dr. John P. Hughes, School of Veterinary Medicine, Davis. Two million international units (I.U.) of vitamin A were administered once at the beginning of the trial by injection directly into the rumen. In addition to these treatments, feed samples were taken on each ranch and tested for carotene and selenium content. At each ranch, core samples of hay were taken from 17 representative bales being fed to the cattle. Ewes and lambs were given the following treatments:

0 ..... no treatment
Selenium ..... 5 mg. selenium (sodium selenite) at monthly intervals until lambing
Vitamin E..... 3,000 I.U. alpha tocopheryl acetate at monthly intervals until lambing
Selenium-Vitamin E.. combination of the two above

Lambs dropped in these flocks received the same treatment as their mothers. Selenium and vitamin E were administered subcutaneously in both cattle and sheep.

The vitamin A trial (table 1) with wintering weaner calves indicated that in general there was no response to this treatment. The analyses of the liver biopsies were high in vitamin A in all

CALIFORNIA AGRICULTURE

Progress Reports of Agricultural Research, published monthly by the University of California Division of Agricultural Sciences.

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TABLE 1. VITAMIN A INJECTIONS*, WINTERING YEARLINGS

County		No. days	Carotene in hay	Initial liver vitamin A	Controls				Vitamin A			
					No. animals	Initial weight	Daily gain	Final liver vitamin A	No. animals	Initial weight	Daily gain	Final liver vitomin A
			mg/lb	mcg/gm†		lb	lb	mcg/gm†		lb	lb	mcg/gm†
Shasta[1]	A	151	0.1	..	38	380	1.19	..	39	378	1.23	..
Shasta	M	93	28.2	..	32	395	1.35	..	34	372	1.60	..
Shasta	C	141	24.4	..	34	398	0.84	..	32	397	0.82	..
Shasta	H	146	21.2	74	39	419	0.57	50	38	430	0.57	52
Siskiyou[2]	G	108	30.5	115	40	488	1.21	54	39	480	1.10	82
Plumas[3]	T	192	30.0	..	19	564	0.71	..	19	543	0.67	..
Butte[4]	F	94	1.9	55	16	771	1.97	20	15	796	2.09	26
Butte	R	181	3.6	140	49	504	0.69	45	32	506	0.69	..
Butte	R	181	3.6	..	11	388	1.08	..	11	385	1.04	..

* 2,000,000 I.U. vitamin A, intraruminal injection.
† When the level of vitamin A drops below 5 mcg/gm, maximum performance may be impaired.
[1] Cattle in Shasta County received approximately 3 lbs barley per head per day, in addition to the hay.
[2] Cattle in Siskiyou County received lang hay only, 14 lbs per day.
[3] Cattle in Plumas County did not receive any supplement; meadow hay until March 1; alfalfa hay until April 10.
[4] Cattle in Butte County: one group of steers were fed hay and concentrate supplement for finishing and another group of cattle were fed hoy, and about 3 lbs grain supplement.

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cases, indicating that these animals were not deficient.

There was no overall response apparent to selenium (table 2). However, in some of the herds in Shasta County slight responses were evident. The history of occurrence of white muscle disease in these areas indicates the need for further studies on this problem. The selenium content of hay samples from 10 different ranches involved in this experiment is also shown in table 2, as analyzed by W. H. Allaway, Director of the USDA Plant, Soil and Nutrition Laboratory, Ithaca, New York. Allaway observed that when the selenium content of a ration is below 0.1 ppm (by the method used) there may be some white muscle disease, if the vitamin E is also low, and when the selenium content is below .05 ppm, white muscle disease is more frequent. White muscle disease has been reported in New Zealand cattle grazing on green pastures of less than .03 ppm selenium.

No significant increase in gains was obtained from the use of vitamin E. Results demonstrated that this treatment did not hamper gains even though abcesses at the site of injection occurred in several animals in some of the tests.

In the ewe and lamb experiments, a definite response was noted in the incidence of white muscle disease in lambs in Glenn County, but there was no increase in weight gains.

Data for cows and calves on test (table 4) indicate that vitamin A treatment had no influence even though, in general, the final levels of vitamin A in the livers of those treated were much higher than in the controls. No consistent animal response was noted.

The animals treated with vitamin E also showed no consistent results. There was a dramatic response (table 3) to the use of selenium on weaning weights of calves in Siskiyou County, however. This was also true to a smaller extent with calves in Modoc County. Combination treatments with both selenium and vitamin E were no more effective than treatment with selenium alone.

Since positive results were not consistent in these trials, further research is suggested to clarify the problem.

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Cooperation in this research project was obtained from farm advisors Al Mitchell, Butte County; Monte Bell, Glenn County; Norm Nichols, Modoc County; Carl Rimbey, Plumas County; Sedge Nelson, Siskiyou County; Sam Thurber, Shasta–Lassen counties; and Lin Maxwell, Tehama County.

TABLE 2. SELENIUM INJECTIONS, WINTERING YEARLINGS

County		No. days	Selenium in hay	Control			Selenium		
				No. animals	Initial weight	Daily gain	No. animals	Initial weight	Daily gain
			ppm		lb	lb		lb	lb
Shasta	A	151	..	38	380	1.13	39	376	1.30
Shasta	M	93	.06	30	388	1.44	36	379	1.53
Shasta	C	141	.06	33	392	0.83	33	402	0.84
Shasta	O*	150	.02	14	410	0.94	15	443	1.35
Shasta	H	146	.04	38	432	0.59	39	417	0.55
Siskiyou	G	108	.02	39	502	1.11	40	466	1.21
Plumas	T	192	.04	20	551	0.70	18	556	0.68
Butte	F	94	.04	16	798	2.03	15	767	2.02
Butte	R	181	..	52	499	0.70	29	515	0.67
Butte	R	181	..	12	388	1.04	10	384	1.08

* This group was composed of bulls and heifers. A differential response was not noted for the bulls and heifers and, consequently, a simple average is reported. The bulls were fed a mixture of 6 lbs. barley and oats plus hay. The heifers received hay alone.

TABLE 3. SELENIUM, COWS AND CALVES

County		No. days	Cows No. in treatment	% born	Weaning wt.*
			Control		
Modoc	R	226	28	82.1	300 (10)
Modoc	S	204	31	77.4	324 (15)
Modoc	P	247	28	71.4	387 (14)
Plumas	G	...	20	85.0	422 (13)
Siskiyou	G	...	20	80.0	384 (15)
			Treated		
Modoc	R	234	14	92.9	326 (4)
Modoc	S	203	30	73.3	345 (16)
Modoc	P	249	26	76.9	397 (16)
Plumas	G	...	20	95.0	428 (16)
Siskiyou	G	...	20	80.0	443 (15)

* No. in parentheses are animals identified and weighed at weaning.

TABLE 4. VITAMIN A, COWS AND CALVES

County		Feed carotene	No. days	No. in treatment	% born	Weaning wt.*	Liver Vitamin A	
							Initial	Final
				CONTROL			mcg/gm	mcg/gm
Modoc	R	26.5	229	21	85.7	315 (3)	110	93
Modoc	S	23.8	204	29	69.0	338 (15)	110	99
Plumas	G	36.2	...	20	90.0	414 (15)	72	47
Siskiyou	P	...	...	20	...	...	234	150
Siskiyou	B	...	...	28	96.0	...	170	77
Siskiyou	F	7.8	...	50	100.0	...	140	49
Siskiyou	G	27.8	...	21	81.0	393 (17)	110	54
				TREATED				
Modoc	R	26.5	228	21	85.7	305 (11)	110	108
Modoc	S	23.8	203	32	81.3	333 (16)	110	62
Plumas	G	36.2	...	20	90.0	437 (14)	72	72
Siskiyou	P	...	...	20	...	...	234	150
Siskiyou	B	...	...	28	96.0	...	170	119
Siskiyou	F	7.8	...	50	100.0	...	140	68
Siskiyou	G	27.8	...	19	74.0	440 (13)	110	82

* No. in parentheses are animals identified and weighed at weaning.