Trial 2.

Nitrogen only	Cost	3.3¢
	Return	8.8
		5.5¢/head/day
Dollars returned for dollars feed cost invested		2.66
Barley only	Cost	9.8
	Return	26.8
		17.0¢/head/day
Dollars returned for dollars feed cost invested		2.75

It is quite apparent from these data that feeding barley alone was a better investment than feeding nitrogen alone. This does not mean that one should never feed N alone or barley alone. Probably over most conditions the most economical diet would be one of a balanced ration with both N and energy. Some feed and ranch conditions may dictate using a supplemental program which will be a little less efficient but will be made up for in practicality.

COPPER AND MOLYBDENUM NUTRITION IN PASTURE MANAGEMENT

F. B. Gomm and Larry Foster

Cattle grazing irrigated pastures in southeastern and south central Oregon may be receiving deficient amounts of copper or toxic amounts of molybdenum from the pasture forage. Recent work at Squaw Butte Experiment Station shows that animal gains can be increased by copper supplementation when forage from improved pastures is grazed.

The importance of copper as an essential element in the animal's diet has been recognized for many years. Early symptoms of the deficiency are usually observed by bleaching of the hair in colored animals, diarrhea, and lowered animal gains. Prolonged deficiencies of copper cause impaired reproduction, inability to coordinate muscular movements, skeletal abnormalities, and anemia.

Copper deficiencies occur most frequently where forage is grown on soils high in organic matter. Such conditions exist in old lake bed areas as one might find near Klamath Falls and where lands are repeatedly flooded year after year as are the meadows in Harney County near Burns. In these muck and peaty soils the copper ion is attached to the organic humus complex and may not be available to growing plants.

Drainage and repeated farming aids the breakdown of the organic matter and can help to make copper more available. In our irrigated pastures at Section 5 of the Experiment Station we have suspected such an improvement.

When highly organic soils produce forage which is only slightly deficient in copper the problem may be corrected in time as the soils decline in organic composition. Fertilizer copper can also be applied to the soil at about 5 to 10 pounds/acre of copper sulfate, but presently supplying needed copper directly to the animal appears to be more practical.

Copper deficiency may be aggravated by molybdenum. Apparently these two elements compete for the same metabolic site. When molybdenum is present in excess of the animal's requirement, copper is excreted, possibly to the extent of causing a copper deficiency. Therefore, the symptoms of molybdenum toxicity are similar to copper deficiency. Both may be corrected by providing additional copper to the animal's system. This can be done by injecting animals with copper glycinate or by feeding copper with salt or other supplements.

EXPERIMENTAL PROCEDURE

In 1968, sixty acres of native flood meadow were diked, drained by a sump pump in a 6 foot ditch around its perimeter, and irrigated with a sprinkler system with an 80 foot well water source. The primary purpose of this area is to provide a research area for obtaining cost and benefit values of differing uses under this system.

Initially 16, 2-acre pastures were seeded to combinations of fawn fescue with vernal alfalfa or ladino clover. These pastures were to determine the benefits from various combinations of grazing and haying practices from irrigated pastures.

All cattle used in the experiment have been yearling replacement heifers from the Squaw Butte herd. The cattle were weighed every 28 days after an overnight restriction from water. In 1970 and 1971 animals were weighed at scales near headquarters and were driven to the scales prior to weighing. In 1972 facilities were developed to weigh the animals at the corrals in the pasture development.

RESULTS AND DISCUSSION

In 1970 cattle grazing the pastures showed symptoms of copper deficiency and of molybdenosis, including bleached hair and diarrhea. Part of the animals which were grazing alfalfa-fescue pastures were injected with copper. In the last 14 days of the experiment (August 21 to September 4) copper treated animals gained 58 pounds per animal (4.1 lbs/head/day) compared to 47 pounds (3.4 lbs/head/day) for non treated animals. During the same period cattle which were grazing clover-fescue pastures and were not treated with copper gained only 21 pounds (1.5 lbs/head/day). Obviously the cattle did better from the alfalfa-fescue pastures.

In 1971 the clover-fescue pastures were grazed by yearling heifers, several of which were injected with copper. In a 112 day season the average gain per animal was 145 pounds with copper and 125 without copper.

Because the animals apparently didn't respond as much as expected to copper injections, it was thought that other mineral elements may be out of balance. Based on this assumption, two studies were made in 1972. Study number 1 compared the gains of animals between alfalfa-fescue pastures with clover-fescue pastures and among 4 mineral supplements. The check treatment received salt and bonemeal only. In addition to this salt-bonemeal mixture, treatment 2 received copper (1 gram/head/day), treatment 3 received copper and zinc, and treatment 4 received a complete mineral mixture. In study number 2, we collected forage samples at two-week intervals through the growing season. Samples were taken from grazed and non grazed pastures, and from alfalfa, grass, and meadow plants. These samples were analyzed for copper, molybdenum, manganese, zinc, phosphorus, calcium, magnesium, potassium, and cobalt.

The results expressed in animal gains are shown in Table 1. Animals grazing alfalfa-fescue pastures gained as much as 0.2 pounds/head/day more than those grazing clover-fescue. Those supplemented with copper gained from 0.2 to 0.3 pounds/head/day more than those not receiving copper. These gains are also reflected in higher gains per acre and gains per animal.

Table 1. Cattle gains from pastures with mineral supplements, 1972 1/

Mineral supplement	Animals per acre	Beef gain per acre	Gain per animal	Gain per head per day
	(No.)	(Lbs.)	(Lbs.)	(Lbs.)
Alfalfa-grass pasture:				
check	3.5	558	186	1.7
copper	3.5	664	221	2.0
copper-zinc	4.0	732	209	1.9
complete mineral mix	4.0	720	208	1.9
Clover-grass pasture:				
check	3.5	533	184(125)	1.6(1.3)
copper	4.0	603	202(145)	1.8(1.6)
copper-zinc	4.0	728	208	1.9
complete mineral mix	4.0	710	181	1.6

1/ Values in parentheses are 1971 data.

The 1972 gains from the clover-fescue pastures were better than in 1971 which could indicate that the pastures might outgrow part of their copper deficiency as the soils become less organic.

A summary of chemical analyses from the herbage samples can be seen in Table 2.

Table 2. Range in chemical composition of different forages through the growing season 5/1 to 8/25/72

Element		Vernal alfalfa	Ladino clover	Fawn fescue	Sainfoin	Manchar brome	Oahe wheatgrass
Manganese	(ppm)	8-38	21-29	10-37	14-31	20-30	21-41
Zinc	(ppm)	13-38	18-25	12-35	23-37	18-21	23-24
Phosphorus	(%)	.14-.39	.24-.28	.09-.28	.27-.29	.20-.25	.23-.25
Potassium	(%)	1.2-3.5	2.3-2.6	1.6-2.4	2.2-2.6	2.4-2.9	2.9-3.0
Calcium	(%)	1.3-2.8	1.3-1.7	.07-.40	1.1-1.2	.30-.32	.34-.45
Magnesium	(%)	.22-.38	.37-.37	.09-.25	.30-.36	.13-.18	.09-.15
Cobalt	(ppm)	.12-1.62	.42-.46	.10-.26	----	.10-.18	.16-.20
Copper	(ppm)	3.0-11.4	5.0-10.4	.2-6.6	5.4-14.4	3.6-7.0	1.6-8.0
Molybdenum	(ppm)	3.9-13.4	22.1-37.5	.4-9.2	----	.8-1.4	.5-3.0

Analyses of the forage would indicate no major mineral problem other than copper and molybdenum. All forages appear to be borderline or slightly deficient in copper from an animal standpoint, while molybdenum is not too far out of line in the grasses but it is rather high in the legumes. Copper in the forage should be at 10-12 ppm with the molybdenum 10 ppm or lower. The ratio of these elements to each other, however, is probably more important than the amounts in these borderline cases. When the molybdenum concentration becomes greater than the copper, problems may begin to appear, and is probably the case in these studies.

Nutritive requirements appear to be about .05 grams of copper per day for cattle or about 10 parts per million in the dry forage. Usually 1/2 to 1 pound of copper sulfate added to 100 pounds of salt should be effective in preventing trouble where forage is deficient in copper and where molybdenum doesn't exceed 15 to 20 parts per million in the forage. When molybdenum composition in the forage is high, diets should be adjusted by copper supplementation to balance copper to molybdenum in a 1 to 1 ratio.

CONCLUSION

Based on recommended levels of mineral elements in the diet, manganese, potassium, calcium, magnesium, zinc, and cobalt are all within the optimum range for cattle grazing our irrigated pastures.

Phosphorus is generally adequate early in the season but may become deficient later in the season especially in grasses. Copper often appears to be borderline deficient in mature alfalfa and in clover but probably not low enough to cause serious deficiency symptoms in itself. Most of the time however, the grasses are deficient in copper . Fawn fescue especially appears too low to meet the animals requirement.

At times during the growing season, molybdenum may be near the toxic level in alfalfa especially in early May. Since it is high and copper low, molybdenum toxicity may result from an unbalanced ratio. Clovers appear especially high and well into the toxic range for molybdenum. The grasses are not high in molybdenum but because of their low copper composition deficiency symptoms can be expected in animals grazing any of the grasses in pure stand or clover-grass mixtures.

Alfalfa in pure stands should meet the animal requirements for copper but because of approaching a 1:2 ratio of copper to molybdenum a copper deficiency could appear. Alfalfa-grass mixtures are quite likely to be deficient in copper especially late in the season.

Supplementing with copper sulfate in the salt mix should alleviate the symptoms and increase animal production from the pastures.

PROFIT FROM A SHORT BREEDING SEASON

R. J. Raleigh and Larry Foster

The estrus or heat cycle of the cow is about 21 days. Theoretically, if the cow is in an adequate plane of nutrition, free of disease and other stress factors, she should conceive with one exposure to the bull. Why then, should the breeding season be extended for long periods of time? This paper will explore some of the advantages of a short breeding season and nutritional and management manipulations necessary to reach the goal of a shortened breeding season.

Advantages of the shorter breeding season are increased weaning weights, more uniform calves that bring higher prices, ability to identify cows of low production, and the opportunities for achieving greater efficiency from feed resources through more intensive management. Weaning weights of calves born at different dates from this experiment station and other records are presented in Table 1.