

it became mature. Buffalo grass was the last species to be eaten of the warm-season group. Mature crested wheatgrass was low in palatability and did not rate above reed canary grass."

This reviewer emphasizes the following quotation from the second paragraph of Mr. Rogler's article: "Palatabilities or preferences in themselves are sometime misleading. Cattle will show a preference for certain grasses if they have a chance for selection, but if restricted to a more or less unpalatable grass they will ordinarily do as well as

those restricted to a more palatable one, providing, of course, that both are of equal nutritive value and productivity. On the other hand, palatability studies are useful in determining when certain grasses become palatable or unpalatable and give an indication of what might be expected when a certain combination of grasses are used together in mixtures." (Abstract of an article by George A. Rogler, on "Relative Palatabilities of Grasses Under Cultivation on the Northern Great Plains" in the "Journal of the American Society of Agronomy 36; 487-496. 1944.)

The Cattle Grub Problem in North Dakota

J. A. MUNRO, Entomologist

NEARLY 75 percent of the cattle in the United States are infested with from 1 to about 100 cattle grubs' each. This, according to the U.S. Bureau of Entomology, represents an annual loss to the livestock industry of from about \$50,000,000 to upwards of \$120,000,000. The grubs cause this loss in various ways, including lowered milk production, reduced gains in weight, damage to hides from "grub holes," and waste of meat which must be cut away from the infested carcasses.

The most apparent injury is to the hides. Any hide which contains five or more grub holes takes a lower grade and a depreciation of about 75 cents. The grub holes are in the central part of the hide, thus seriously interfering with its future use as leather.

Such holes are made by the grubs during the winter and serve as (1) breathing holes during the approximate 2-month period that the grub spends in the back of the animal and (2) provides an exit or means of escape when the grub reaches maturity in late winter or early spring. While in the back of the animal the grub causes constant irritation. Such irritation stimulates the flow of secretions from the surrounding tissue which nourishes the grub. At maturity, with the aid of its spines, the grub

works its way through the hole it has previously made in the back, falls to the ground, and soon burrows just underneath the surface of the soil. The mature grub is dark gray in color, stout bodied, about 1 inch in length and encircled with rows of sharp spines. Upon entering the soil it becomes black and transforms to the pupa stage; here, after about 5 weeks it emerges as a large dark hairy fly. The flies, commonly known as "heel flies" begin to appear in this northern area in late spring.

The "heel flies," so named because of their habit of laying their eggs mostly on the hair of the heels of the cattle, are seldom seen, although evidence of their presence in the herd is often noticed by the disturbance they cause. The flies do not bite or sting the cattle,

²There are two species of cattle grubs which are common in most cattle raising areas of the United States. They are *Hypoderma bovis* De G., and *Hypoderma lineatum* (DeVill). Both species cause the same type of injury to cattle and may be controlled in the same manner. The Red River Valley is an outstanding example of a large area that is free of this pest.

yet they usually cause the cattle to rush for shade or for the protection to be afforded by wading in water. It is an instinctive fear somewhat similar to that which bot-flies cause among horses.

The fly lays her eggs in a row along a hair on the heel or occasionally higher up on the legs, but never on the back of the animal. Egg laying begins in June and may continue for several weeks. One fly may lay upwards of 800 eggs. The eggs hatch in less than a week and the tiny, young grubs immediately burrow through the skin at or near the base of the hair to which the eggs were attached. This is the start of a journey which lasts 5 or 6 months, through connective tissues of the animal, until they reach the back in January or February. The grub then cuts a hole in the skin which provides the air it needs for the remainder of its development and for its escape upon reaching maturity some 2 months later.

While it is recognized that an average of 75 percent of the cattle in this country are infested with grubs, it is known that the extent of grub infestation in cattle may vary with the locality. The only cattle raising area believed to be free of cattle grubs in this country is the valley of the Red River of the North. This tract is some 40 to 50 miles in width and extends from Lake Traverse in Minnesota northwards to Lake Winnipeg in Manitoba, Canada, a distance of more than 300 miles. It is the bed

of old glacial Lake Agassiz and is characterized by a rich heavy soil of high moisture holding capacity and of fairly flat topography.

Following a study of the factors which might account for the scarcity of cattle grubs in this area Bruce² (1938), as a result of numerous, carefully conducted experiments, concluded that the high moisture holding capacity of the soil was responsible. He pointed out that at the time the grubs drop from the backs of the cattle in the Red River Valley, they fall upon frozen ground or upon a very wet soil. His investigations showed that the grubs failed to develop, and subsequently died before reaching the pupal stage in this saturated soil. That appears to be the only explanation of why cattle grubs fail to establish themselves in the Red River Valley, although undoubtedly on innumerable occasions infested cattle have been brought in from outside areas.

To determine to what extent grubs are a problem in North Dakota, other than in the Red River Valley, a preliminary survey was recently conducted by the North Dakota Agricultural Experiment Station in cooperation with Armour and Co., of West Fargo, North Dakota. The survey called for data on (1) the origin of each lot of cattle (2) the total number of hides examined, (3) the number of hides containing 1 to 4 grub holes, and (4) the number of hides containing 5 or more grub holes. The information is tabulated as follows:

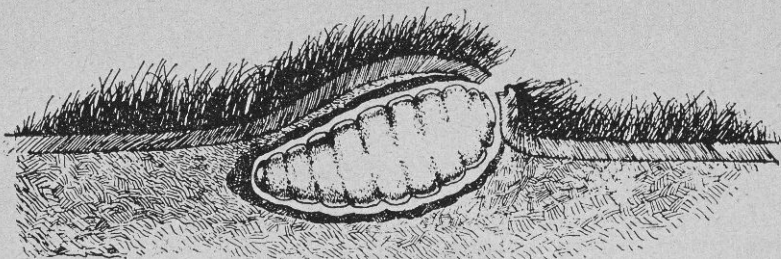
Place	Date	Number of hides examined	Hides containing 1 to 4 grub holes	Hides containing 1 to 5 grub holes or more	Total
Valley City	2-24-44	1	0	1	1
Casselton*	2-26-44	54	0	15	15
Marshall	2-26-44	22	0	20	20
Casselton*	3- 4-44	73	10	9	19
Halliday	3- 8-44	15	0	11	11
Richardton	3-25-44	12	1	5	6
Total		177	11	61	72

Hides containing 1 to 4 grub holes 6%

Hides containing 5 or more grub holes 34%

*Origin of these cattle unknown prior to the fall of 1943 when they were purchased by a Casselton feeder from Armour and Co.

²Bruce, W. G., Soil Moisture and Its Relation to the Mortality of Hypoderma Pupae. Journal of Economic Entomology. (31)6:639, 1938.



Position of Cattle Grub Beneath the Skin. Control materials must gain entrance through this opening.

(From Clemson Agricultural College Extension Circular 250, December, 1943.)

While the results of this survey indicate a much lower percentage of cattle in North Dakota infested by grubs than for the United States as a whole, the percentage is sufficiently high to justify the increasing emphasis placed upon the eradication of this pest in various counties by the N.D.A.C. Extension Service, county extension agents and livestock owners. Statistics furnished by Mr. Ben Kienholz of the U. S. Bureau of Agricultural Economics show a total of 412,092 head of cattle marketed from North Dakota in 1943. Of this, about 82 percent, or 337,915 cattle came from counties outside the Red River Valley. The recent survey indicates that 34 percent or 114,690 of the hides taken from these cattle contained 5 or more grub-holes each. On the basis of the lowered grade and depreciation of 75 cents per hide this represents a loss of at least \$86,017. for grub damage to the hides. This is probably only a small portion of the additional losses due to lowered milk and meat production chargeable to the activity of this all too common insect pest of cattle.

Bearing in mind that cattle grubs have no other way of wintering

over than in the backs of animals, every cattle owner would do well to cooperate fully in community or county campaigns conducted during the winter months to eradicate the grubs.

Cattle grubs are readily located as lumps along the backs of cattle and may be easily felt by passing the hand lightly over the infested animal. Destruction of the grubs is obtained by dusting the backs of the cattle from time to time during the winter with a dusting mixture containing rotenone. Squeezing the grubs from the backs of the animals is also effective but because of the labor involved is practicable only for small herds.

According to Dr. F. Gray Butcher, N.D.A.C. Extension Entomologist, the timing of applications is most important. The treatments must be applied after the grubs appear on the backs of the animals, but before any of the grubs emerge and fall to the ground. All infested cattle in a local community must be treated to eliminate the flies which cause the grub infestations. Treating only a few animals in a community will not result in any noticeable benefits.

In 7 Years Trials at Fargo (1935 to 1942) T. E. Stoa, Station agronomist, found that Early Sumac sorghum produced 4.59 tons per acre of air dried fodder, Dakota Amber sorghum 3.35 tons per acre and Sudan grass (domestic No. 448) 2.73 tons per acre. In the same 7-year period Mercer flint corn produced 2.83 tons per acre of fodder. Since the sorghums differ in degree of maturity reached and in palatability, there is great need for feeding tests on the sweet sorghums as compared with corn.—[H.L.W.]