UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

Department of Entomology

Seasonal Variation as It Affects the Activity and Control of the Alfalfa Weevil in Idaho

By
CLAUDE WAKELAND

BULLETIN NO. 138

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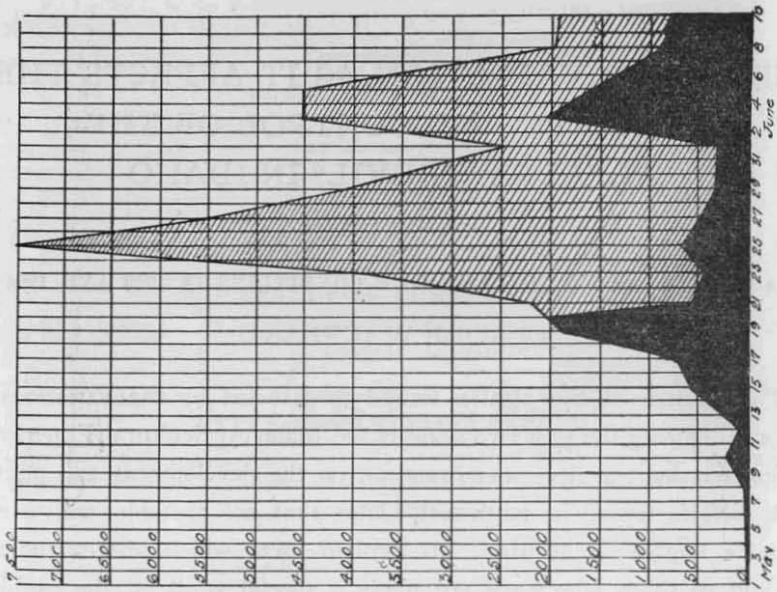

Chart No. 2, 1924

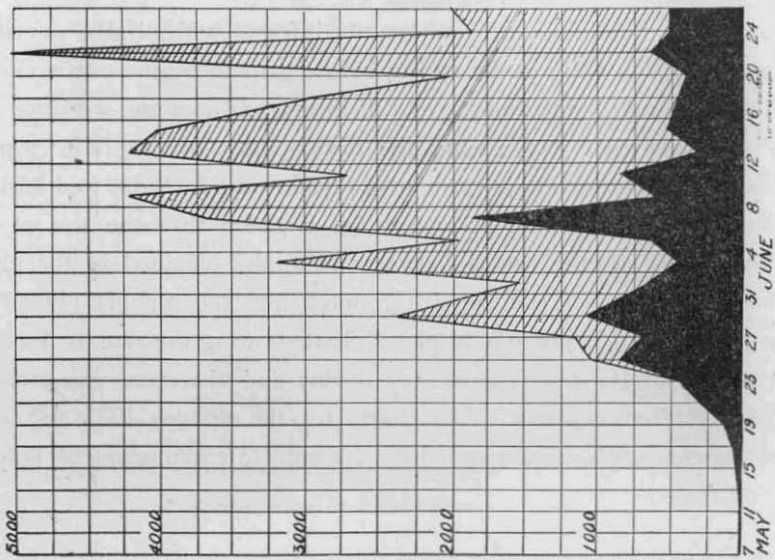

Chart No. 1, 1923

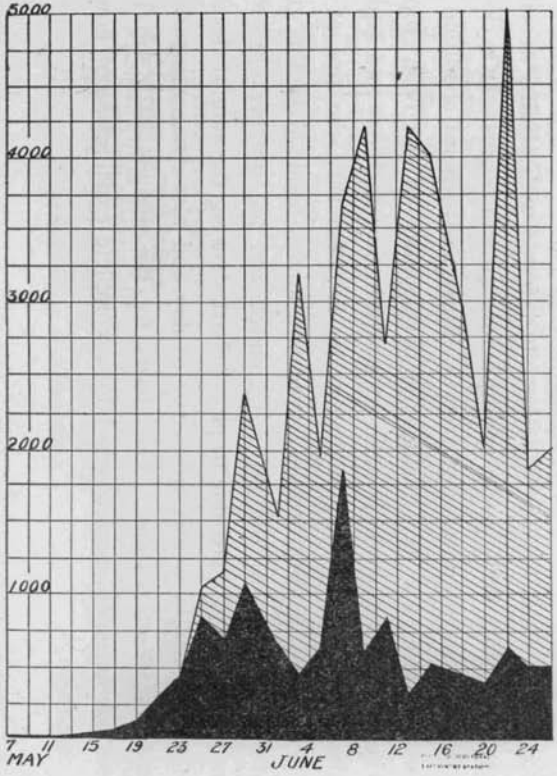

Chart No. 1, 1923

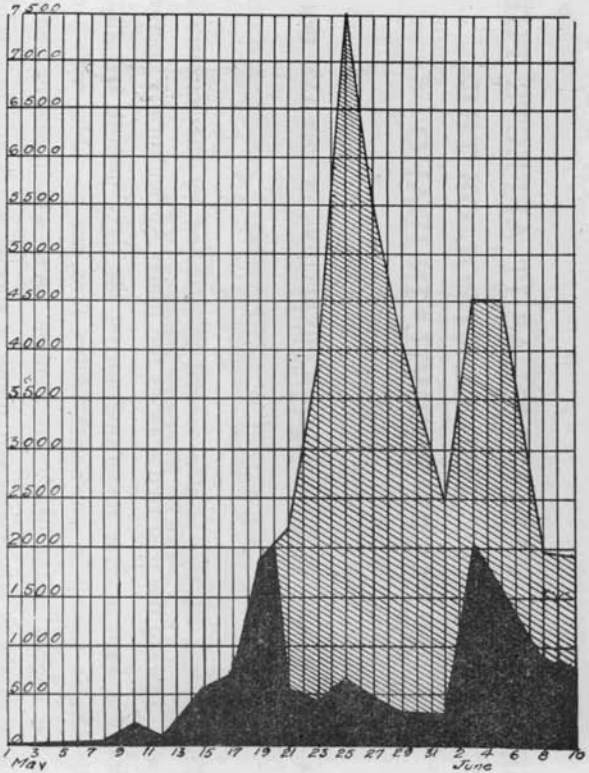

Chart No. 2, 1924

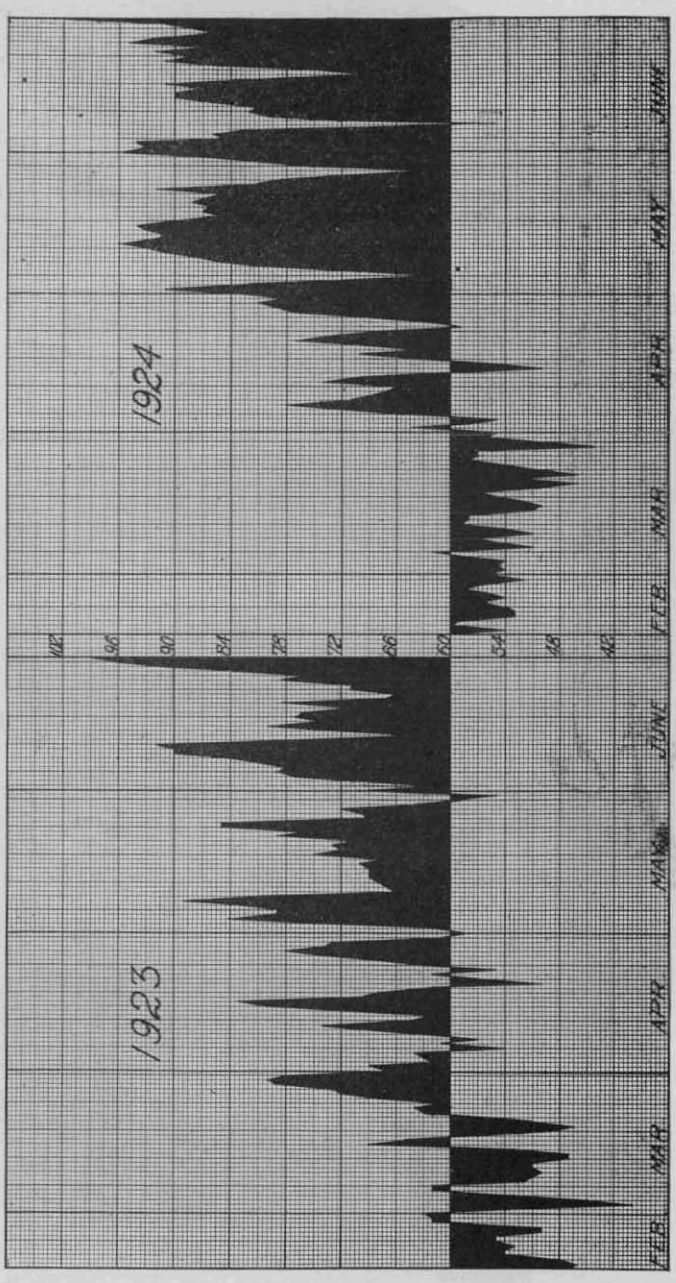

Chart No. 3—Temperature Record, Parma, Idaho, 1924

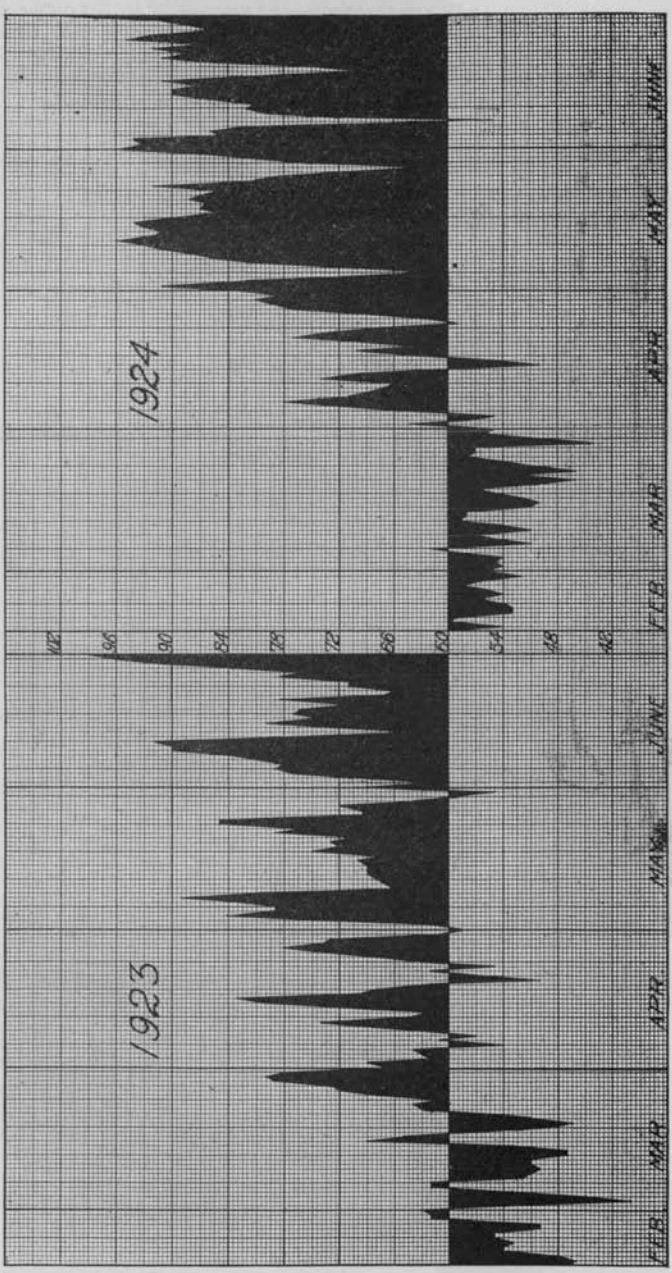

Chart No. 3—Temperature Record, Parma, Idaho, 1924

Explanation of charts No. 1 and No. 2: The figures on the horizontal lines indicate the numbers of larvae collected in 100 strokes of the insect net. The numbers of vertical lines indicate the days of the month. In construct ng the charts, a dot is placed at the intersection of a horizontal with a vertical line and the dot represents the number of larvae collected on a certain day. Beginning with the day the first larvae are found in the spring a dot is placed each alternate day until the end of growth of the first crop. By connecting successive dots with straight lines graphic charts are formed as shown above. The cross-lined area on the charts represents the portion of the field that was not sprayed while the solid black area represents the sprayed portion. In 1923 the first spray application was made May 23d and the second one on June 7th. The dates for the two sprays in 1924 were May 19th and May 29th.

Investigations by the U. S. Bureau of Entomology indicate that the alfalfa weevil is active at temperatures above 60 degrees Fahrenheit. In chart 3, it will be noted that 1923 was characterized by a warm March; that April was but little warmer than March; that May was a comparatively cool month. In 1924 there was but one day before April 2d when the temperature exceeded 60 degrees; April was comparatively much warmer than during the year previous and during May the total daily maximum temperatures that exceeded 60 degrees was nearly double a similar total of maximum temperatures for 1923. In 1923 adult weevils laid eggs very early but the cold weather of April and May delayed their hatching periods and during May and June the cool weather and excessive rain caused a prolonged oviposition and feeding period of larvae. Larval activity was not completed until the hot, dry weather of late June and July. After weevil became active in 1924, egg laying and larval feeding progressed at a maximum speed and practically all larvae had pupated before the date of cutting of the first crop.

From data in the foregoing charts the following table of comparison is derived:

Table I—Comparison of Weevil Activity, 1923 and 1924

	1923	1924	Difference Days
First worms found	May 7th	May 1st	6
Date when injury began to be severe and generally noticeable	May 23d	May 17th	6
Date when the greatest number of worms occurred in the field	June 22d	May 25th	28
Greatest number of worms collected in 100 sweeps of the net	5010	7564	
Period during which number of young worms and amount of injury increased	46 days	24 days	22
Length of time after first spray until greatest number of worms occurred	30 days	5 days	25

The critical period in relation to the growth of the infested plants is from the time that weevil larvae become sufficiently numerous to do severe injury to the first crop of hay until they have reached their greatest numbers and have begun to pupate and stop feeding naturally. Observations made during four seasons have shown that from the time when the number of young larvae in a field exceeds about 1000 in each 100 strokes of the net until the time when they decrease to less than that

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number the amount of feeding is great enough to cause serious and, usually, continuous damage. From the above charts it is evident that the greatest number of larvae occurred 28 days earlier in 1924 than in 1923 and also that, at the time of the greatest larval population, there were approximately 50 per cent more larvae in the field during the latter year. In 1923 an increasingly abundant number of worms caused continuously increasing injury for a period of 22 days longer than in 1924. During the former year 30 days elapsed after the date of application of the first spray until injury began to abate naturally while during the latter year this period of time was but 5 days.

Climatic conditions for the two seasons were extremely different. A late, cold spring with excessive moisture during May and June characterized 1923. The cold wet weather had the effect of retarding the activity of the weevil. Eggs continued to be laid thruout the growing period of the first crop of alfalfa and were present in abundance in the field even after the first crop was cut. Eggs hatched slowly and larvae fed and developed slowly with the result that, after the number of larvae was great enough to do damage, the larval population was sufficient to cause steadily increasing injury during the remainder of the growing period of the first crop. Since there was an abundance of larvae and eggs at the time the first crop was cut the number of larvae remaining in the field immediately attacked second crop shoots and this crop was prevented from growing for a period of from three to five weeks.

A combination of conditions resulted in very early maturity of the alfalfa weevil in 1924 and, consequently, in an extremely short feeding period. Eggs were deposited early and most of the eggs were hatched during the hot, dry weather of early May. Larvae were pupating freely by May 25th and after that date the numbers feeding diminished rapidly. Fields frequently were observed in which injury was quite severe from May 20th to June 1st, but which made a natural recovery so that they had assumed a fresh, green color by the time the first crop was cut. This was possible only because most of the larvae had at that time pupated and ceased feeding naturally, a condition that is without precedent since the alfalfa weevil invaded Idaho.

Moisture conditions during the season of 1924 exerted considerable influence on the relative rates of development of the weevil and its host plant. It was known that there would be a serious water shortage and most alfalfa growers withheld early irrigations. Nearly all fields were hot and dry during early May, a condition that forced development of the insect and retarded growth of the plant. At about the time that the weevil began pupating freely water was applied more generously with the result that alfalfa plants received a new stimulus and made a rapid

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growth. It must be emphasized that this growth was made *after* most of the weevil injury had been done for the year, a condition that has not occurred before, and one that there is no assurance will be duplicated soon. The holding back of growth of the second crop was noticeably light or absent in 1924 since there were very few weevil that were not in the pupal stage at the time the first crop was cut. Consequently sufficient larvae to cause the usual injury were not present.

Public Opinion as Affected by the Unusual Occurrence of 1924

Without a careful analysis the difference in weevil activity and injury in 1924 as compared with former years and the comparatively small amount of damage for that year are likely to cause the alfalfa grower to reason that the alfalfa weevil pest has "run its course." The belief is current that the extreme hot, dry weather quite generally killed the alfalfa weevil or that its parasites have destroyed it.

There is little foundation for either of these beliefs. On December 15, 1924, dirt was removed from around the crowns of alfalfa plants to a depth of about three inches in one of the hottest, driest localities in southwest Idaho. This dirt was passed over a one-fourth-inch mesh screen to remove the trash. After screening the approximately five cubic feet of screened material was found on careful examination to contain 617 live alfalfa weevil. It is evident that these live adults had survived the drouth and heat. They also had escaped parasitism since the only species of parasite* that is known to attack alfalfa weevil in Idaho kills the larvae before they have opportunity to transform to adults. Undoubtedly the dry, hot weather killed large numbers of larvae and pupae, probably more than usual, but there are sufficient weevils left to cause extremely severe injury this season if weather conditions are favorable.

Spray Insurance

Recommendations for control of the alfalfa weevil are essentially the same as given in Circular No. 34, published in January, 1924, by the Idaho Agricultural Experiment Station. The following is quoted from Circular 34: "The spray is applied at the time weevil injury becomes general over the entire field and just before it is severe enough to check the growth of the plants. Following this application the plants send out new growth that develops almost normally in higher elevations, but in regions of lower elevations this new, unpoisoned growth is again attacked by larvae that have emerged after the first spray application, and thus a second spray is required. This is applied when severe injury is again noticeable."

Bathyploctes curculionis.

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This bulletin was written before the unusual occurrence of 1924 and was based on observations made during the years 1921, 1922 and 1923. As explained in a previous paragraph, but 5 days elapsed after the application of the first spray in 1924 until weevil injury began to abate naturally. It has been found that poison sprayed on alfalfa plants is effective against weevil larvae for about 10 days before new, unpoisoned growth is available for larvae to feed on. It will thus be seen that during 1924 larvae began to cease feeding naturally before the first spray had lost its effectiveness. Even in the lower elevations of Idaho, therefore, there are seasons when a single spray application will suffice. The grower may judge by the degree of injury 10 days after the first spray application whether an additional application is needed.

Equipped with spray machinery and material, the grower is in a position of security against weevil attack. Material may be kept in good condition from year to year by storing in a dry place and depreciation on machinery is small. In four years out of five, since weevil injury became severe in south Idaho, no machines or poison could be purchased at the time of weevil injury. With favorable climatic conditions there again will be years of heavy damage and the alfalfa grower who is prepared will be able to protect his crop.

Little Danger of Poisoning Livestock

Chemical and feeding tests indicate that there is no danger of injury to livestock from eating sprayed hay where the recommended quantity per acre is used. Many reports have been circulated to the contrary but dozens of cases investigated have shown these reports to be without foundation. During the past year the Idaho Station has investigated two cases that, it appeared, might have some connection with spraying, tho there is no definite assurance that poisoning had anything to do with them. The history of one case is briefly as follows: A dairy herd was fed freshly cut, sprayed, immature, first crop alfalfa hauled from the field before it was entirely cured. Part of the slipload was rained on and fed wet. The following day a load of wet hay was hauled and the cattle fed on it for two days. The entire herd went off feed, became badly purged and dropped heavily in milk production. The State Veterinarian was called. Since the case was without precedent, it was studied carefully by the Entomologist and by a representative of the State Bureau of Animal Industry, with the cooperation of the owner of the herd, to obtain information of value in relation to future spraying and the feeding of sprayed hay. The wet hay was removed and some of the cattle were fed dry hay from the same sprayed field. After watching the case for several days and watching the progress of the herd for the rest of the season, the

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Deputy State Veterinarian issued the following report:

Symptoms: Animals all off feed; dejected, stary coats; severely purged; subnormal temperatures, averaging 100 degrees; weak, fast pulse (not wiry); shallow respiration; exposed mucous membrane normal.

Diagnosis: Severe gastral enteritis due to sudden change of food from very dry, coarse cutting 1923 hay to immature, uncured, wet hay and aggravated to a very minor degree by calcium arsenate that had been recently applied as a spray.

Treatment: Purely dietary, no arsenical antidotes indicated.

Action and Recommendations: To each of heavy producing cows an entire change of feed; dry, well cured hay; two gallons bran per day. Remainder of herd kept on same feed and watched closely with consent of owner for experimental purposes. Cows that continued on newly sprayed hay that was dry seemed to do as well as those getting old hay and bran."

(Signed) A. J. DICKMAN,
Deputy State Veterinarian.

Analysis of the hay made by the Station Chemist showed it contained 43 parts of As_2O_3 (metallic arsenic) per million. Thus, a cow eating 30 pounds of hay per day would consume 9.03 grains of metallic arsenic daily. Hay containing twice this amount has been fed by the Idaho Experiment Station with results that were entirely satisfactory. Testimony of Dr. H. C. Gardiner*, in the Riverside Dairy Case in the U. S. District Court of Utah, is to the effect that an animal the size of a cow can eat in safety 30 grains of arsenic daily and that the fatal dose is 300 grains. It appears from the facts cited above that the amount of arsenic consumed by the cattle was so small that it was not primarily the cause of their sickness. Many records are available where cattle have been fed dry, sprayed hay with no ill effects and their milk production has substantially increased.

Symptoms of arsenical poisoning and enteritis are identical as to the points enumerated in Dr. Dickman's report but no typical symptoms of arsenical poisoning were present. He expressed the belief, however, that the slow recovery of the cows indicated that the presence of arsenic probably increased the injurious effects of the complete change of feeds. He stated that since the combination of sprayed hay and wet feed did not prove fatal, the safety of sprayed alfalfa hay as a stock feed is still further established. He emphasized the fact that the sick cattle recovered while kept on the sprayed hay, which they would not have done had they been affected with arsenical poisoning.

*Journal of Economic Entomology, Vol. 18, No. 1, Feb. 1925.

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Hay raisers and stockmen and the Agricultural Experiment Station are indebted to R. W. Waldron, owner of the herd mentioned above, for his action in the case. In the interest of science he willingly continued to feed his cows sprayed hay when he believed that the arsenic content was at least partially the cause of their sickness in order that authentic information might be obtained to guide other feeders.

Another case recently came to the attention of the Experiment Station. A dairy herd dropped off in flesh, milk production and appetite. The cows in this case were taken from dry pasture early in the fall and placed in a feed lot. They were given all of the first cutting alfalfa hay that they would eat, and allowed to pick it over and eat nothing but the leaves. No study of symptoms was made in this case and no diagnosis made by a competent veterinarian. The assumption was that the trouble was caused by arsenic since the hay had been sprayed. There is no assurance that arsenic enters into this case at all since the cows were changed suddenly from a feed consisting principally of fiber and carbohydrates to one rich in nitrogen and deficient in "roughage." They ate nothing but the leaves of alfalfa. Many feeders have had similar experiences where the hay contained no poison material but where a sudden change of feed set up digestion and excretory trouble and the overload of nitrogen could not be eliminated.

Precautions to be Observed

The preponderance of evidence is that there is no danger to livestock from eating sprayed hay. The two cases cited above, however, seem to indicate that under some conditions the presence of arsenic aggravates digestive or excretory disorders. In all future recommendations concerning spraying for alfalfa weevil the Experiment Station will take the precaution to advise thoro curing of hay before feeding and to avoid feeding hay while wet or in a soggy or mouldy condition and will advise against abrupt changes from non-nitrogenous foods to alfalfa. Doctor Dickman asserts that, of the cases of sick livestock that come to his attention in southwest Idaho, a large percentage are caused by careless or improper feeding. He especially warns against the feeding of mouldy hay from stack bottoms or from the bottoms of feed racks or mangers. He cites a recent case of botulinus poisoning, resulting in the death of cattle, horses and hogs, where the source of infection was traced definitely to mouldy hay in the bottom of a feed rack.

Information on Spraying

This bulletin does not attempt to give methods of control of the alfalfa weevil. Such information is contained in former publications which will be mailed free upon request. Requests addressed to the Extension Division, Boise, or to the Agricultural Experiment Station, Moscow, will receive prompt attention.

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