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South Dakota Farm and Home Research

Agricultural Experiment Station

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SOUTH DAKOTA *Farm and Home* RESEARCH

Frozen Vegetables

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SOUTH DAKOTA
Farm and Home RESEARCH
a report of progress

Volume IX NOVEMBER 1957 Number 1

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From Director Myers:

The site for South Central Research Farm, authorized by the last Legislature, has been selected. About 20 acres on the Glen Hutchinson farm 10 miles south of Presho on U. S. Highway 183 have been leased for 5 years with an option for an additional 5 years.

Final selection of the site was made by our soil scientists who examined several locations in Lyman County picked by a five-man committee from the ten counties the experiment farm is designed to serve. The site was chosen because the subsoil is uniform, soil changes are not sudden, and there is a gradual slope to the land. The acreage can be increased if necessary and is on a hard-surfaced road.

Some 120 strains of winter wheat have been planted on 2 acres at the new research site. Future work probably will include experiments with sorghum and corn; grass and legumes; fertility; disease and insect control; weed control; new crops; and tillage, cultural, and rotation practices for the area, in addition to the winter wheat work.

The establishment of this research farm brings the total number of research sites in the state to 17, not counting the many research plots on private farms.

On the Cover

Commercially frozen vegetables were rare 25 years ago. Now they account for a big share of the vegetables purchased by housewives. As frozen vegetables became more and more popular, many questions came up as to their value and quality. Dr. Lida Burrill explains results in an experiment here to determine the quality of commercially frozen vegetables, starting on the next page.

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YOU CAN EXPECT GOOD QUALITY WHEN YOU BUY

FROZEN VEGETABLES

By Lida M. Burrill and Beth Alsup

DID YOUR FAMILY use any commercially frozen vegetables last week? Unless you live on a farm, there is a good chance that you did. A recent survey of family food consumption in the United States made by the USDA showed that about one-third of the households used some kind of commercially frozen vegetable during the week of the survey. Twenty-five years ago the answer to the above question would have been a big NO.

Frozen vegetables have gained in popularity because of their bright, natural color and fresh flavor. Research has demonstrated that freezing can be an excellent method for preserving the natural color and flavor of vegetables. However, products of inferior quality may result because of improper methods of storage and transportation in retail channels. As a rule these changes are not evident until the package is opened. This makes the selection of high quality frozen vegetables uncertain and raises a question as to the relative frequency of poor quality frozen vegetables reaching the purchaser.

Accumulation of frost is shown on the vegetables at the left. Vegetables on the right have a natural color.

To help answer this question, a study was made to determine the quality of commercially frozen vegetables purchased from the principal food stores in Brookings, South Dakota. Five vegetables—green beans, broccoli, cauliflower, peas, and spinach—were selected

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This article is by Dr. Lida M. Burrill, nutritionist, and Beth Alsup, former research assistant in nutrition, South Dakota Agricultural Experiment Station.

for study. The plan was to purchase one package of each vegetable from each of six food stores at four times—in August and September 1951 and April and May 1952. However, all vegetables were not available at all stores for each sampling period. After purchase, the packages were placed immediately in a freezer maintained below 0° F. and tests of quality were made within a week after purchase.

A total of 112 packages of commercially frozen vegetables were studied. When the packages were opened, the appearance of the vegetable was noted, particularly the color, relative amount of frost, and signs of dehydration. Samples from each package of vegetable were analyzed for ascorbic acid and for carotene, the precursor of vitamin A. Another portion was cooked under standardized conditions and served to a trained panel of judges for evaluation of flavor, color, and texture.

Dehydration

Signs of dehydration or "freezer burn" were found in 17 packages or 15% of the total number. More packages of peas were in this group than any other vegetable. Dehydration causes discoloration, changes in texture, and off-flavors. In preventing dehydration, the packaging material is most important. Some commercial packers use an extra cellophane interliner or a double waxed paper overwrap. This is done to help keep air out and moisture in.

Frost

As each package of vegetable was opened, an evaluation of the relative amount of frost was made using a four point scale: (1) very little, (2) small amount, (3) moderate amount, and (4) large amount. The results are summarized in figure 1. All of the packages of cauliflower had small to large amounts of frost, with about one-fourth of them being heavily crusted with frost. One-third of the packages of green beans had large amounts of frost; however, slightly more than a fifth had very little frost. A larger proportion (35%) of the peas had very little frost and a smaller number were heavy with frost (11%). About one-fourth of the packages of spinach and broccoli had large amounts of frost. Altogether nearly two-thirds of the packages showed moderate to large amounts of frost.

A similar comparison of all packages purchased at each store shows that more than half (58%) of the packages purchased at market B were heavy with frost. On the other hand none of the products bought at markets A and E had heavy frost. The frost ratings of packages from markets D and F were similar in the proportion having heavy frost. Market C supplied about equal numbers of packages in each of the four frost classifications.

It is natural for there to be small amounts of frost on frozen vegetables but large amounts are an indication of undesirable storage conditions. The formation of ice crystals or frost is faster at temperatures above 0° F. than when storage temperatures are maintained below 0°. Frost formation is further hastened by fluctuating temperatures. Partial thawing and refreezing are espe-

FIGURE 1 *Proportion of packages of commercially frozen vegetables receiving frost ratings at four levels*
A - classified by vegetable B - classified by market

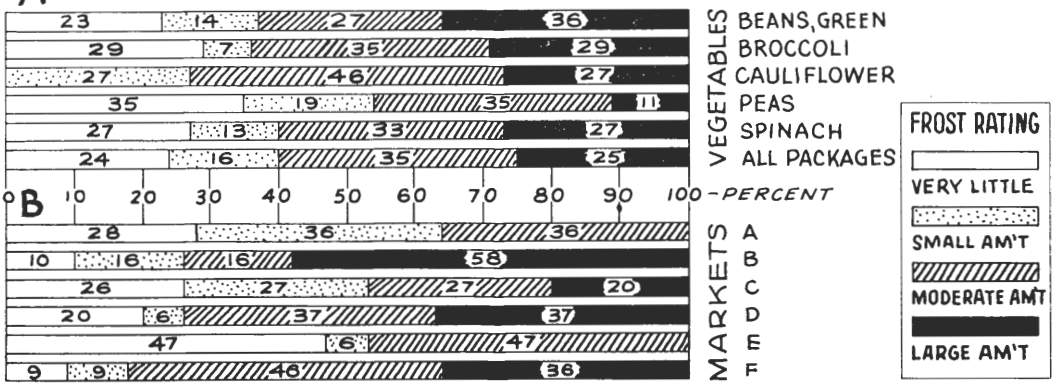


FIGURE 2 *Proportion of packages of commercially frozen vegetables receiving color scores at four levels*
A - classified by vegetable B - classified by market

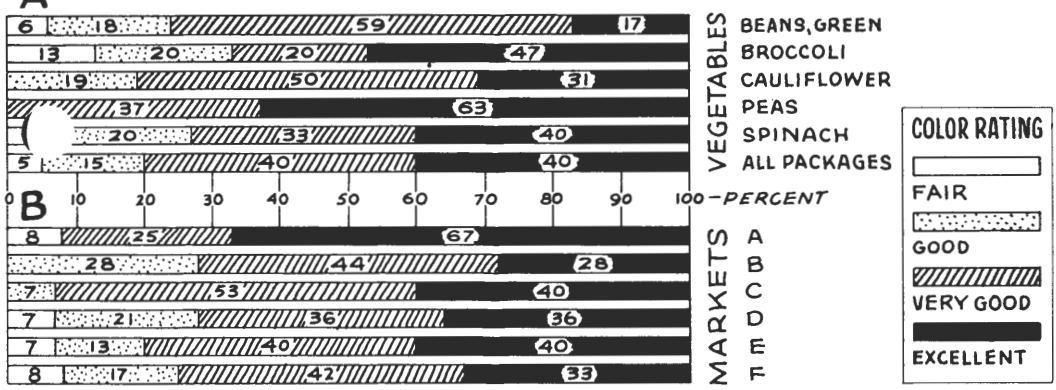
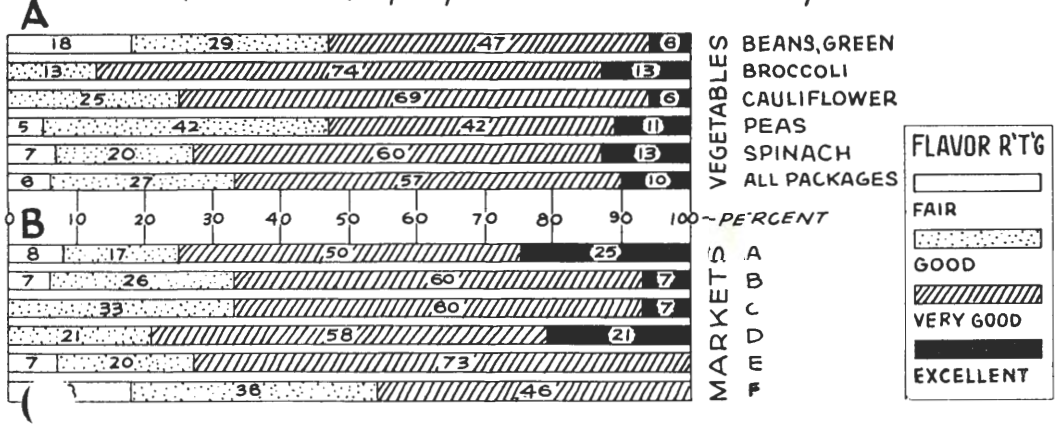


FIGURE 3 *Proportion of packages of commercially frozen vegetables from each market having flavor scores at four levels*
A - classified by vegetable B - classified by market



cially conducive to formation of frost.

Color

Before cooking, the color of the beans, broccoli, and spinach varied from a bright green and a yellowish green to varying shades of brown, gray, or olive green. In some cases the color varied within a single package. One package of peas was described as being "dull." Fewer of the packages of cauliflower were described as having good color. Varying shades of brown and gray were found.

After cooking, the color was scored on a ten-point scale by a panel of three judges. The results are summarized in table 1 and figure 2. Peas had the highest average color score (8.6) and the largest proportion (63%) of packages rating Excellent in color. Green beans, on the other hand, had the lowest average color score (7.2) and the smallest proportion (18%) of packages rating Excellent. Broccoli was next lowest in average color score (7.3) and had the largest proportion (see figure 2) rating Fair in color. Spinach and beans had about the same proportion of samples rating Fair as to color. Altogether 5% of the packages rated Fair, 15% Good, 40% Very Good, and 40% Excellent.

Two-thirds of all the packages of frozen vegetables secured from market A were rated Excellent in color with another one-fourth classed as Very Good. Packages from the other five markets had similar proportions of packages having excellent color. The packages rating Fair in color came from four of the six markets.

Off-color in frozen vegetables may result from several causes or combinations of conditions. The principal reason for scalding vegetables prior to freezing is to destroy or inactivate enzymes which bring about changes in color by means of chemical reactions. If the scalding is inadequate, these enzymes are not destroyed and even at freezing temperatures they will act to produce off-colors. Since all chemical reactions go on faster at higher temperatures, storage temperatures above 0° F. are another factor in causing undesirable color changes. Both inadequate scalding and too high storage temperatures may operate at the same time. Fluctuating temperatures above 0° F. are especially detrimental. Vegetables which have been adequately scalded will withstand adverse storage conditions better than those that have not been sufficiently scalded.

Ascorbic Acid

Carefully controlled research studies have shown that although there is some loss of ascorbic acid during scalding, chilling, and freezing, frozen vegetables properly

Table 1. Evaluation of Color of Commercially Frozen Vegetables After Cooking (Average for Three Judges)

Vegetable	Number of Packages	Color Score		
		Lowest	Highest	Average
Beans, green	17	4.3	9.7	7.2
Broccoli	15	3.0	10.0	7.3
Cauliflower	16	5.0	10.0	7.6
Peas	19	6.7	10.0	8.6
Spinach	15	4.3	10.0	7.6
Total	82			

stored compare very favorably with the fresh product as a source of this nutrient. Since ascorbic acid is rather easily destroyed, the retention of the acid is sometimes used as an indication of quality of frozen vegetables and fruits. However, in this study the amount of ascorbic acid in the fresh vegetable is not known. Therefore this test of quality must be used with caution.

The concentration of ascorbic acid in each of the five vegetables is summarized in table 2. It is evident that the range from lowest to highest values is very great, especially for broccoli. However, the average values for each vegetable, with the exception of green beans and spinach, compare quite favorably with values given in Agriculture Handbook No. 8, USDA, 1950. Values for green beans and spinach show a greater deviation from those given in Handbook No. 8.

Putting it another way, one out of every two packages of frozen spinach and one in three of green beans contained less than one-half the amount of ascorbic acid quoted in Handbook No. 8 for these vegetables. Similarly, one out of every five packages of broccoli and one out of every 10 packages of peas and of cauliflower were low in ascorbic acid. Even so, substantial amounts of ascorbic acid would be furnished by these samples of spinach, broccoli, and cauliflower. The actual amounts remaining in the peas and beans are, however, relatively small.

The ascorbic acid content of a frozen vegetable depends on: (1) the content of the fresh vegetable as harvested, (2) the losses between harvest and preparation for freezing, (3) losses during scalding, chilling, and freezing, and (4) losses during storage. Excessive losses at one or more of these stages would account for the low values observed.

Table 2. Ascorbic Acid Content of Commercially Frozen Vegetables From Retail Stores in Brookings in mg./100 gm.

Vegetable	Number of Packages	Lowest	Highest	Average	Handbook #8
Beans, green	22	4.1	13.0	7.2	11
Broccoli	21	8.0	93.2	60.8	75
Cauliflower	22	28.8	67.9	43.9	51
Peas	26	4.2	23.7	16.8	18
Spinach	21	7.4	58.1	21.0	38
Total	**112**				

Significant negative correlations were found between frost scores and ascorbic acid content for broccoli at the 1% level ($r=-0.687$) and spinach at the 5% level ($r=-0.606$). This means that for these vegetables, the greater the amount of frost the lower the ascorbic acid content is likely to be.

Flavor

Although color is a very important factor in determining quality of frozen vegetables, the final test is the taste. Flavor scores are summarized in table 3. The lowest score was for a package of peas. Three packages of beans and one of spinach also had low scores. None of the samples was given a score of 10 and only eight packages rated a score of 9. Broccoli had the highest average flavor score while beans and peas were lowest.

Table 3. Evaluation of Flavor of Commercially Frozen Vegetables After Cooking (Average for Three Judges)

Vegetable	Number of Packages	Flavor Score Lowest	Flavor Score Highest	Flavor Score Average
Beans, green	17	4.0	8.7	6.7
Broccoli	15	6.0	9.3	7.7
Cauliflower	16	5.0	9.0	7.3
Peas	19	3.7	8.7	6.8
Spinach	15	4.3	9.0	7.3
Total	82			

Figure 3 shows the proportion of the packages in each of the four grades for each vegetable and for each market. Spinach and broccoli had the largest proportion of packages scoring Excellent in flavor, while more of the beans rated only Fair. Two-thirds of all the packages scored Very Good to Excellent, 27% were Good, and 6% rated only Fair.

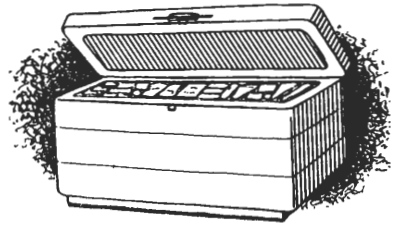
Packages with low flavor scores came from four of the six markets (figure 3). The average score for each of the markets ranged from 6.4 for market F to 7.6 for markets A and D. More of the packages having lower flavor scores came from market F. More of those grading Excellent were from markets A and D. About three-fourths of the packages from market E scored Very Good for flavor.

Conclusions

Thus it is evident that randomly selected packages of commercially frozen vegetables do vary widely in such quality factors as color, flavor, and ascorbic acid content. However, by far the greater proportion of them can be expected to rate good to excellent in quality, with a small proportion, less than 10%, below average. Among the vegetables studied, beans and cauliflower appeared somewhat more likely to be of inferior quality.

Although the differences between markets were not great, market A appeared to rate somewhat higher than the others. This market was doing a large volume of business and the frozen food cabinet was always well-kept, free from excessive frost and rarely were packages stacked above the "full line." The more popular the vegetable the greater the demand for it and consequently the less chance of your getting a package of inferior quality. Where there is little demand, packages may remain in the display cabinets for relatively long periods of time, possibly under adverse storage conditions, such as fluctuating temperatures above 0° F.

Therefore in purchasing commercially frozen foods, it is best to buy from a store doing a good volume of business and one where the frozen food cabinet is well cared for. And after you buy? Either use the vegetable right away or preserve its goodness by storing in a freezer maintained at or below 0° F. (Project 210. Leaders: Lida M. Burrill and Beth Alsup, Home Economics Dept.)



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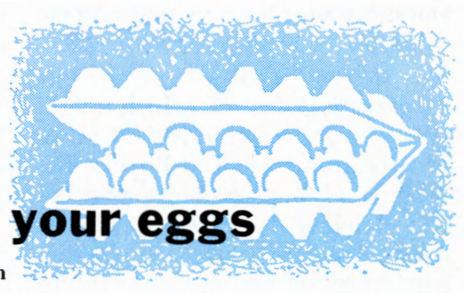

better prices for your eggs

By Gerald Marousek and J. Patrick Brown

SOUTH DAKOTA farmers have long been faced with the fact that they receive lower prices for their eggs than do farmers in any other state except North Dakota. In 1950-52 South Dakota egg prices were more than 10 cents per dozen below the national average.

Why do our farmers consistently get less money for their eggs than farmers in neighboring states? Several reasons have been suggested, including quality of the eggs marketed, assembling and transportation costs from producer to consumer, and the efficiency of marketing facilities.

Questionnaires Sent

The Economics and Poultry Husbandry Departments here conducted a study to determine whether the practices used by farmers in producing, handling, and marketing their eggs had any effect on the prices they received.

Write to the Economics Department, South Dakota State College Agricultural Experiment Station, for information on how to solve your individual egg marketing problems.

Questionnaires were mailed to 1,750 randomly selected farmers at 3-month intervals beginning in May 1955 and continuing through February 1956, to obtain information on practices being followed and prices received each season of the year.

Farmers were asked to report their egg sales for a 1-week period on each of the four questionnaires. Dozens of eggs sold, total dollar receipts, and price per dozen were reported for eggs sold on a current receipt or straight run basis, for Grade A large egg sales, and for all eggs sold on grade.

Along with their report on sales, producers were asked to list production and egg handling practices they carried out during the week. The production and handling practices on which data were collected included breed of layers kept by the farmer, weekly egg production, size of flock, whether or not roosters were kept with the flock, confinement of flock to laying house, fre-

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This article is by Gerald Marousek, assistant economist, and J. Patrick Brown, former graduate assistant, South Dakota Agricultural Experiment Station.

quency of gathering eggs, place of storing eggs, temperature of egg storage room, type of egg storage container, and egg cleaning practice.

Marketing factors which might affect the prices received by farmers were reported also. Buyer's line or type of business, frequency of egg delivery to market, distance from farm to market, and whether eggs were picked up at the farm or delivered to the buyer were the factors included in this group.

Geographic location and seasons of the year, as well as a combination of several of the above mentioned factors, were studied to determine their effect on prices received.

Not Following Recommendations

The study indicated that many producers were not following all of the practices recommended for producing and marketing high quality eggs. Farmers carrying out four or more of the seven recommended practices on which information was obtained received higher average prices when selling on a graded basis than did those following less than four of the recommended practices. This difference was 0.1 cent per dozen in May, 5.2 cents in August, 0.6 cent in November, and 1.0 cent in February.

Higher prices were reported when eggs were sold ungraded to retail grocery stores than to any other type of dealer buying on a non-graded basis. This does not mean that farmers as a group can profit by selling in this manner; often a grocery store buys from only a few selected producers, paying them a premium for eggs which will meet the demands of its retail sales. Grocery stores also sometimes pay a higher price for eggs when the egg check is applied to grocery purchases.

Prices Received by South Dakota Egg Producers by Type of Sale, May 1955-February 1956

Type of Sales	May 1955		August 1955		November 1955		February 1956	
	Cents per Dozen	% of Total Sales	Cents per Dozen	% of Total Sales	Cents per Dozen	% of Total Sales	Cents per Dozen	% of Total Sales
Direct to consumer	32.8	0.9	32.3	1.9	35.8	1.0	35.3	0.9
Current receipt	26.1	56.0	26.7	43.7	32.3	35.0	32.9	51.6
Grade A large	28.7	57.4*	40.7	55.1*	44.5	50.5*	35.0	64.5*
All Graded	27.6	43.1	35.6	54.4	38.9	64.0	33.5	47.5
Hatchery	-----	-----	-----	-----	-----	-----	50.1	-----
Total Number of Respondents	678		338		278		331	
Percent Response	38.7		19.3		15.9		18.9	

*Percent Grade A large of total graded receipts.

More producers reported selling eggs to local produce stations than to any other type of buyer. This was true for both current receipts and graded sales for all seasons of the year.

Although only a few producers sold eggs to egg assembly plants (plants packing eggs primarily for central market or contract delivery), graded sales to this type of outlet brought prices equal to or higher than the average price reported for three of the four reporting periods.

Geographic location plays an important role in prices received by producers of eggs. Local supply and demand relationships affect the egg prices received by South Dakota farmers. Prices received by farmers were generally higher in the western part of the state which is a deficit producing area part or all of the year. Producers in southeastern South Dakota received prices above the state average for eggs sold both on graded and ungraded bases. Lowest non-graded prices were reported in south central South Dakota.

Direct sales to consumers accounted for only 1 to 2% of the total sales during each reporting period. Prices received for direct sales, however, exceeded Grade A large prices for two reporting periods and current receipt prices for all periods (see table). Since many South Dakota egg producers do not live near cities they do not have an opportunity to sell directly to consumers.

Seasonal production patterns affect egg prices. Also the price spread between quality grades is greater when a commodity is in scarce supply. The table shows that highest current receipt prices were reported in November and February and highest graded prices were received in August and November. The greatest spread between current receipt price and graded price occurred in August, with another large spread in November.

The table shows that the percentage of Grade A large sales to total graded sales was from 50 to 65% for the four reporting periods. This is 10 to 20% below the average proportion of grade A large eggs reported sold in other midwestern areas. From 35 to 56% of the eggs were marketed as current receipts or ungraded. These are perhaps two reasons why South Dakota egg producers receive below average prices for their eggs.

Further Study Needed

The study suggests that there is room for improvement in both the quality and marketing of eggs in South Dakota. Information is needed on quality loss between first buyer and consumer as well as farm quality problems. Marketing problems include transportation costs, efficiency of the egg marketing system in South Dakota, and the possibility of developing market outlets for high quality eggs produced in the state.

Egg producers and dealers can be expected to support an egg quality program which will bring returns great enough to offset any additional cost incurred. (Project 175. Leaders: Gerald Marousek, Economics Dept., and William Kohlmeyer, Poultry Dept.)

cattle grub research

WE HAVE GOOD INDICATIONS THAT CATTLE GRUBS CAN BE CONTROLLED ECONOMICALLY BY INTRODUCING CHEMICALS INTO CATTLE

By Wm. Rogoff, Robert Duxbury, and P. H. Kohler

THE CONTROL of cattle grubs is a problem that we have been studying at South Dakota State College Agricultural Experiment Station for many years. The problem is important to both stockmen and meat packers since this insect affects the cattle industry in many different ways.

Cattlemen are very much concerned about the gadding, or excitement and running of cattle in the spring and early summer when the adult flies are busy depositing eggs on the hair of the animals. The following winter and spring the grubs appear in the typical bumpy cysts on the backs of cattle. Grubs remain in these cysts until they emerge later in the spring. Animals slaughtered when grubs are in their backs are reduced in value because of the necessary trimming, possible loss of carcass grade, condemnation of some internal organs, and reduced values of hides.

Search for Systemics

To provide a high enough degree of control to prevent spring gadding requires community effort over large areas, since the adult flies can move from one property to many others. Until very recently the only practical interference in the life cycle of this pest was to kill the grubs in the backs of cattle. The limitations of the available methods led to the initiation, several years ago, of a search for chemicals that could be fed, injected, or sprayed during the summer or fall to kill the larvae before they reach the backs.

Work on this project has been reported in the 1955 summer issue of *South Dakota Farm and Home Research* and in the 69th Annual Station Report (1956) of the South Dakota State College Agricultural Experiment Station.

At present there are several chemicals that have shown a high degree of success in tests in South Dakota and throughout the country. This year interest centered about three organic phosphate materials: "ET-57" of the Dow Chemical Corpora-

This article is by Wm. M. Rogoff, entomologist, Robert Duxbury, assistant animal husbandman, and P. H. Kohler, assistant animal husbandman, South Dakota Agricultural Experiment Station.

tion,[1] "Bayer 21/199" of the Chemagro Corporation,[2] and the recently announced American Cyanamid "CL 12,880.[3]" Of these materials, Dow ET-57 has been the most widely tested this year as it was the first to be announced and made available for testing.

Experimental work here this past year has been of three types. Yard tests at Brookings with 43 calves permitted an intensive study of some problems that required regular treatment and observation. Field tests using two cooperators' herds provided valuable information under ranch conditions. The third type of experimental work was conducted in the laboratory on possible new compounds and on the mode of action of materials being tested in cattle.

The yard tests involved the use of 43 calves trucked into Brookings from the Cottonwood Field Station. After a 3-day resting period the calves were allotted at random (according to weight) into eight lots. All calves received a ration of 4 pounds of grain (corn and oats, equal parts) plus alfalfa hay, free-choice.

Treatment administered to the individual lots of animals is shown in table 1. Three chemicals were included in these tests: Nicarbazin, Dow ET-57, and Bayer 21/199. All feeding indicated in table 1 was on an individual calf basis. Three of the eight lots of animals were fed continuous, low-level dosages of a test chemical in their rations. One lot received a continuous, low-level dosage by permitting free-choice access to treated salt-bone meal mixtures. Two lots were given single, relatively high, oral dosages by means of capsules or boluses. The backs of the animals in one lot were soaked a single time with a wash containing test chemical. One lot of eight calves was not treated and served as controls.

Group of third stage grubs.

Evaluation of effectiveness was made by counting grubs present in the backs of the calves at monthly intervals in January, February, and March. These results are shown in table 2. The heavy infestations shown by the untreated animals is in marked contrast with some of the treated lots, especially those treated with Dow ET-57, where almost complete control was apparently obtained.

There were some differences in weight gains between these yard test lots with the untreated animals (as well as the small lot 7) showing the higher rates of gain. Considering the differences obtained and the small numbers of animals involved, it is not practical to attribute the differences to the effects of the various treatments. The average weight gain for the 43 calves was 1.32 pounds per day for a 141-day feeding period (November 16 through April 5).

Field Tests

One of the systemic agents used in yard and laboratory tests was studied in the herds of two private cooperators. In these tests older animals as well as calves were used. Herd I consisted entirely of cows and two-year-olds. At the time of

[1]Marketed as "Trolene."
[2]Marketed as "Co-Ral."
[3]Marketed as "Dimethoate."

treatment all animals were run through the chutes and ear-tagged, with every other animal of each age-group released without treatment. The others were drenched with Dow ET-57 at the rate of 5 grams of chemical per 100 pounds of body weight. Herd I was treated November 8 while herd II was treated November 12. Each animal was examined twice, and the number of grubs counted, during the winter and early spring. The results of these tests are shown in table 3. While grub infestation was low, as judged by the untreated animals, a relatively high degree of control was obtained, whether judged by the number of grubs present or by the number of cattle that had any grubs at all.

A relationship appeared between the age of the cattle treated and the degree of control. In herd II the greatest infestation was in the untreated calves, which averaged 9.8 grubs per head as compared to 1.6 grubs per head in older animals. None of the treated calves had any grubs at the time of counting. Thus the calves showed 100% control whereas the older animals indicated only a 70.7% reduction in total number of grubs per head.

Laboratory Studies

Laboratory studies during 1956-57 were aimed at increasing the understanding of how the currently successful systemic agents act, and toward the development of new candidate materials for later test in cattle. Young larvae were obtained during the fall and winter from the gullets of slaughtered cattle. In several series of experiments these young larvae were exposed to blood of cattle treated with Dow ET-57. None of these tests indicated any toxicity of such blood at various intervals after a single therapeutic dose, nor of blood removed from animals that had been continuously fed low-level

Table 1. Treatments Administered to Calves in Yard Tests

Lot No.	Treatment	Procedure	Dates of Treatment
1	Nicarbazin, in feed	5 grams per head, each day (91 days)	Dec. 6 through Mar. 6
2a	Nicarbazin, in capsule	25 grams per head	Dec. 3
2b	Nicarbazin, in capsule	50 grams per head	Dec. 20
3a	ET-57, in capsule	20 grams per head	Nov. 19
3b	ET-57, in capsule	20-25 grams per head	Dec. 4
3c	ET-57, as bolus	20-30 grams per head	Dec. 20
4	Control	Untreated	
5	ET-57, in salt bone meal mix	Av. 1.87 grams per head, each day (66 days)	Dec. 17 through Feb. 20
6	ET-57, in feed	3 grams per head, each day (77 days) (15 mg./kg.)	Dec. 6 through Feb. 20
7	21/199, as wash	1.5 qts., 0.75% susp.	Dec. 3
8	ET-57, in feed	30 mg./kg. (7 days)	Feb. 1 through Feb. 7

dosages in their diets. Tests with the chemical introduced directly into dishes containing the young larvae also failed to demonstrate any significant toxicity. An understanding of the mode of action of a chemical introduced into the body of an animal is obviously desirable before a full evaluation can be made of its physiological importance. Several new chemicals were found that are worthy of further investigation.

Conclusions

The outlook for the control of cattle grubs by systemic agents is very good. Several compounds are now available that, when introduced into the bovine body, can kill grubs before they reach the backs of cattle. There are several methods of application that have shown promise: single oral dose, low-level continuous dosage in feed or salt, spray, and injection. Work this coming year will be directed toward the more promising chemicals, improved methods of application, and fate of the chemicals within the bodies of cattle. Many agencies are now involved in these studies, and great attention is being paid to the question of residues in meat and milk. Several practical chemicals should be available for use within the near future. (Project 244. Leader: Wm. M. Rogoff, Entomology-Zoology Dept.)

Table 2. Grubs in Backs of Calves in Yard Tests

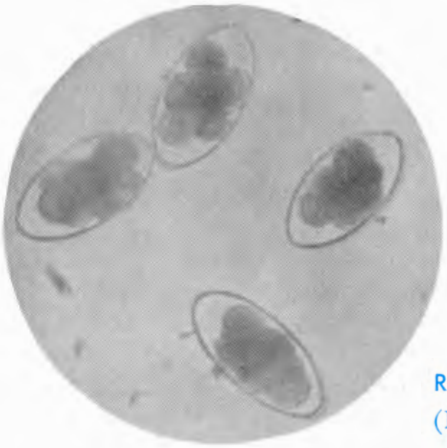
Lot No.	No. of Calves	Treatment	Av. No. of Grubs per Calf		
			Jan. 25*	Feb. 23-25†	Mar. 25†
1	3	Nicarbazin, in feed	24.0	16.3	0
2	4	Nicarbazin, in capsule	10.3‡	7.3	1.8
3	8	ET-57, bolus or capsule	0	0.1	0
4	8	Control (untreated)	25.4	48.6	4.3
5	7	ET-57, in salt mixture	0	0	0
6	6	ET-57, in feed	0	0	0
7	4	21/199, as wash	5.3‡	5.3‡	0.8
8	3	ET-57, in feed	§	0.3	0

*Not extracted.
†Extracted.
‡Some grubs small or dead.
§January 25 count showed average of 4.7 grubs per head, prior to treatment.

Table 3. Results of Field Trials With Dow ET-57 Administered as a Drench at 5 Grams per 100 Pounds Body Weight*

	Herd I		Herd II	
	Treated	Untreated	Treated	Untreated
No. of cattle	30	33	40	47
Total grubs	9	34	10	273
Av. per head	0.3	1.0	0.25	5.8
No. infested cattle	4	9	3	24
Percent infested	13.3	27.3	7.5	51.0

*This dosage rate is about 110 mg./kg.



ROUNDWORM EGGS
(Nematodirus helvetianus)

Intestinal parasites of ca

By Ernest J. Hugghins

WORM PARASITES in your cattle are costing you money, even if the infections are light. In the past, parasitism has been considered a minor problem except in heavy infections. However, in recent years many experiments have shown that low-grade or sub-clinical infection with parasitic worms can have significant effect on rate of gain in your herd.

Often these mild infections are not noticed because they do not seem to affect the health of the animals. The damage has become apparent only in herd studies where one group received treatment while a control group did not, and where all animals have been weighed at frequent intervals.

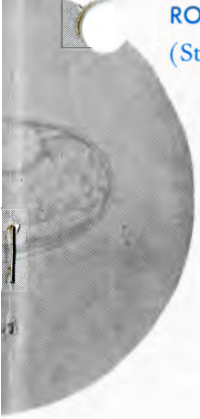
Methods of Treatment and Study

In the fall of 1955, calves at the Highmore, Eureka, and Cottonwood Substations were divided into two groups—a control group and a group to be treated. There were 20 calves in each group or a total of 120 animals in the test.

A different treatment was used at each substation. Treatments were (1) phenothiazine drench monthly, (2) Hypolin drench monthly, and (3) phenothiazine in salt available at all times. Fecal samples from both treated and control animals were collected, and quantitative and qualitative examinations were made for worm eggs.

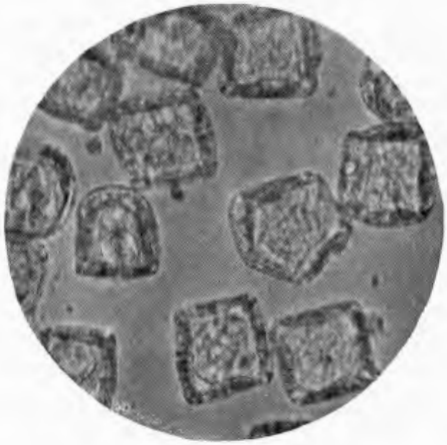
Studies were begun on new lots of calves at Eureka and Cottonwood in the fall of 1956. The calves were divided into treated and control groups of about 20 animals each but treatments were different than in the first study. Only micronized phenothiazine was used (NF Green 5 microns and Purified 3 microns), as some recent work has indicated

This article is by Ernest J. Hugghins, associate entomologist, South Dakota Agricultural Experiment Station.



ROUNDWORM EGGS
(Strongyloides papaillosis)

EVEN A LIGHT INFESTATION IN YOUR HERD WILL COST YOU A LOT OF MONEY IN LOST PROFITS



TAPEWORM EGGS
(Moniezia benedeni)

ttle

that it may be more effective than the larger grain size of chemical. Instead of monthly drenches, phenothiazine was given in capsule form once in mid-December in the dosage of 40 grams per head. The calves weighed about 425 pounds.

A modification of the Stoll technique was used in examining the feces for worm eggs. This is a feces dilution and egg flotation process for determining the number of eggs per gram of feces. Also, the identity of the eggs was determined as closely as possible. Although it is difficult to estimate the number of worms in an animal from the number of worm eggs in its feces, the comparison of relative numbers of eggs in the feces is a useful tool for studying the anthelmintic action of drugs when the animal cannot be sacrificed for autopsy.

The cattle studied in 1956-57 showed a widespread incidence of worms, but egg counts indicated that the level of parasitism was quite low in most of the animals, as shown in the table. The highest count of roundworm eggs in an animal was 228 eggs per gram of feces, while the highest count of tapeworm eggs was 1,120 per gram. A few other animals had relatively high counts, but these are masked in the averages by the large number of animals having low counts.

Perhaps the most important point shown in the table is that roundworms occurred in more than 90% of the cattle, while tapeworms occurred in one-fourth of them. Thus, heavy infections could have built up under conditions favorable to the parasites.

The cattle studied in 1955-56 showed a lower incidence of parasitism and will not be discussed in detail here. The pattern was similar but in lesser degree.

Of the roundworm eggs, most belonged to worms of two genera:

Nematodirus (the thread-necked strongyle) and *Strongyloides* (the intestinal threadworm). The species were *N. helvetianus* and *S. papillosus*.

Heavy infection with *Nematodirus* in calves causes scouring with loss of appetite, weakness, and failure to gain weight. In a report from Wyoming, the deaths of 32 calves on a pasture were blamed on heavy infections with this worm. Other calves in the herd were sick. The eggs of the worm are very hardy, often remaining alive for as long as a year on the ground.

Heavy infection with *Strongyloides* in calves causes inflammation of the intestinal lining which leads to diarrhea. The animals may go off feed and lose weight. These worms have a very rapid life cycle; 10 days after infection of a calf, eggs appear in the feces. This is the only intestinal roundworm of cattle in which the egg is embryonated (has an active larva inside) while still in the intestine.

The tapeworm eggs were all *Moniezia benedeni*. Reports on damage by this worm are controversial. In some reports, diarrhea,

Incidence of Parasitic Worms in Cattle at Cottonwood and Eureka, 1956-57

COTTONWOOD

Fecal samples collected	24 Cattle Treated* Dec. 14, 1956			23 Controls		
	Dec. 1	Jan. 25	April 29	Dec. 1	Jan. 25	April 29
Percentage infected with roundworms	96	83	100	100	83	96
Ave. no. of roundworm eggs per gram of feces in infected animals	35	10	21	36	23	19
Percentage infected with tapeworms	25	17	17	13	13	13
Ave. no. of tapeworm eggs per gram of feces in infected animals	40	41	28	250	93	48

EUREKA

Fecal samples collected	19 Cattle Treated† Dec. 14, 1956			20 Controls		
	Dec. 1	Jan. 26	April 30	Dec. 1	Jan. 26	April 30
Percentage infected with roundworms	88	89	100	95	95	100
Ave. no. of roundworm eggs per gram of feces in infected animals	14	12	21	15	13	26
Percentage infected with tapeworms	29	37	27	25	55	33
Ave. no. of tapeworm eggs per gram of feces in infected animals	308	327	193	295	209	104

*40 grams per head of micronized phenothiazine, NF Green 5 microns, in capsules.
†40 grams per head of micronized phenothiazine, Purified 3 microns, in capsules.

emaciation, and death are attributed to tapeworms, while others contend that damage by tapeworms is negligible.

As to mode of build-up of infections, these roundworms have direct life cycles (no intermediate hosts involved), and therefore the infection could be built up either in the feed lot or on pasture, although transfer is most rapid on pasture. In *Nematodirus* the infective egg is ingested. In *Strongyloides* the egg hatches, and infective larvae normally penetrate the skin of the host although they too may possibly be ingested. The tapeworm *M. benedeni,* requires an intermediate host, a tiny grass mite, and takes about 3 months for completion of the entire life cycle; therefore the infection could build up only on pasture.

Results of Treatment

In none of the groups of cattle studied here did we find any significant difference in the worm egg counts, as summarized for one year in the table. Two explanations can be given for this: (1) the level of parasitism was quite low in most of the animals, and (2) the three species of worms which were most prevalent are among the few species unaffected by phenothiazine. Although phenothiazine is effective against a greater range of species than any other known drug, it is not effective against any tapeworms nor a few species of roundworms, including *Nematodirus* and *Strongyloides.*

Only one calf had a poor weight record which might be connected with parasitism. This calf, a control, had the highest roundworm egg count, 228 per gram of feces at the beginning of the study, and had the poorest rate of gain of any of the 86 calves studied in 1956-57. On the other hand, the calf with the highest tapeworm egg count, 1,120 per gram, was among the better gainers.

In six of the eight lots of calves studied in 1956-57, the controls had a slightly better gain record than the treated animals. Indications were that the phenothiazine caused an initial set-back for which there was no compensation, since the drug was ineffective against the species of worms present. In 1955-56, the set-back was more pronounced when monthly drenches were given.

Evaluation

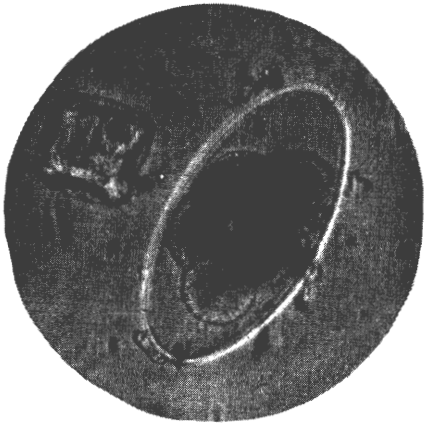
Results so far are inconclusive. The work has been done only on the dry lot wintering phase. The pasture phase should be studied before passing judgment on the value of the treatment, since the transmission rate of parasites is usually much higher on pasture. The study has shown that worm parasites may be widespread in cattle in South Dakota, even though the level of parasitism may be low in most animals. This poses a threat for rapid build-up of infection under conditions favorable to the parasites.

The studies on 206 head of cattle during the past two years indicated that they were not heavily parasitized by worms which can be controlled with phenothiazine, although this drug has received considerable publicity for generalized use in recent years. In fact, the treated cattle suffered a slight initial set-back without compensatory benefits from anthelmintic action of

the drug. Therefore, phenothiazine not only was not worth the cost of treatment but appeared to be detrimental to the cattle treated. This emphasizes the fact that indiscriminate treatment of herds with phenothiazine is not recommended. The feces of representative animals should be sent to a veterinarian or a laboratory for diagnosis to determine whether treatment is indicated.

Since most of the worms in these studies were of species not affected by phenothiazine, a promising new drug is under consideration for study in the future to determine its efficacy against these species. Indications are that no spectacular advantage can be expected in treated cattle. However, efficiency in handling cattle has reached the point where future improvement probably will be in the nature of small individual gains. These gains would be of greatest value where large numbers of animals are handled.

A simple example would be that if an operator could net only $1 per head more by treating his cattle, he could clear an additional $1,000 on 1,000 head of cattle. Since South Dakota is a great producer of cattle, further studies are needed on their worm parasites and the possible effects upon thriftiness. (Project 278. Leader: E. J. Hugghins, Entomology-Zoology Dept., cooperating with Project 120. Leader: L. B. Embry, Animal Husbandry Dept.)



Relative sizes of eggs of tapeworm (Moniezia benedeni), left, and roundworm (Strongyloides papillosus), right.

1958 RECOMMENDED VARIETIES

Final analyses of 1957 crop variety trials have not been completed here but because many of you buy your seed in the fall and winter, we are presenting this tentative list of recommended crop varieties for 1958. The list is subject to minor revisions when final analyses of this year's results are completed but it should be a valuable guide as it now stands. If you have any questions about varieties, write to Agronomy Department, Agricultural Experiment Station, South Dakota State College, College Station, Brookings.

Spring Wheat
- Conley
- Lee
- Rushmore
- Selkirk

Durum Wheat
- Langdon
- Ramsey
- Yuma

Winter Wheat
- Cheyenne
- Minter
- Nebred

Oats
- Andrew
- Brunker
- Cherokee
- Dupree
- Garry
- Marion
- Mo.-0-205
- Nemaha
- Newton
- Osage
- Ransom
- Waubay

Rye
- Antelope
- Caribou
- Pierre

Flax
- Marine
- Redwood
- Sheyenne
- B-5128

Grain Sorghum
- Norghum
- Reliance
- R.S.501

Forage Sorghum
- Piper Sudan
- Rancher
- 39-30-S

Soybeans
- Blackhawk
- Capital
- Chippewa
- Grant
- Harosoy
- Ottawa Mandarin

Barley
- Custer
- Feebar
- Kindred
- Plains
- Spartan
- Traill
- Velvon-11
- Liberty

Red Clover
- Dollard

Alfalfa
- Cossack
- Grimm
- Ladak
- Narragansett
- Ranger
- Rhizoma
- Vernal

Sweet Clover
- Gold Top
- Madrid

Birdsfoot Trefoil
- Empire

Grasses
- Fairway Crested Wheatgrass
- Homesteader Bromegrass
- Lincoln Bromegrass
- Nordan Crested Wheatgrass
- Ree Wheatgrass
- Tall Wheatgrass

Trees
- Chinkota Elm
- Harbin Pear
- Siouxland Cottonwood

Tomatoes
- Siouxann
- State Fair

For Recommended corn hybrids for your area, see Circular 134, 1956 Corn Performance Tests, or write to the Agronomy Department.

2 new corn hybrids

By D. B. Shank and D. E. Kratochvil

SOUTH DAKOTA 420 and South Dakota 622 are two new corn hybrids developed through the corn improvement program of the South Dakota Agricultural Experiment Station. In comparison with existing hybrids, South Dakota 420 is slightly later than South Dakota 400 and fills the need for a hybrid between it and South Dakota 604 in maturity. South Dakota 622 is later than South Dakota 604 and may be of value farther south in the state where no currently produced experiment station hybrid is adapted.

Agronomic Characteristics

South Dakota 420. Under favorable conditions South Dakota 420 produces plants about 8 feet tall with ears about 3 feet from the ground. In general, the stalks are more slender and the leaves are narrower than those of South Dakota 400. Plant uniformity and root and stalk lodging resistance are better than in South Dakota 400. However, some stalk lodging will occur by midwinter. Husk protection is fair. Resistance to corn borers is average. In disease reaction South Dakota 420 has shown a trace of rust, a slight amount of leaf spot, and some smut on both the ears and stalks.

South Dakota 622. This hybrid has a fairly slender stalk 8 to 9 feet in height. The leaves are broad and dark green, giving the plant an attractive appearance. This dark color remains until the grain is fairly well matured. An occasional plant has two ears but in general only one ear is produced, about 3½ feet above the ground. Ear shanks are short; husk protection is good. Standability is excellent. Resistance

This article is by D. B. Shank, agronomist, and D. E. Kratochvil, assistant agronomist, South Dakota Agricultural Experiment Station.

S.D. 420

Figure 1. This hybrid is slightly later than S.D. 400. It is adapted to counties on the northern edge of the southeastern part of the state. Over a 4-year period it has outyielded S.D. 400 by an average of 8 bushels per acre.

S.D. 622

Figure 2. A later hybrid than S.D. 604, this hybrid is adapted to extreme southeastern counties of the state. S.D. 622 has outyielded S.D. 604 by an average of 8 bushels per acre for the past 4 years.

to diseases is also good with only a trace of rust, smut, and leaf spot having been observed.

Maturity

Relative maturity of South Dakota 420 and of South Dakota 622 is shown in the table by the percent moisture at harvest. South Dakota 420 has averaged between 3 and 4% more moisture over a 4-year period than South Dakota 400. This means it should be adaped to southern Minnehaha, McCook, and Hanson Counties and to the northern part of Lincoln, Turner, and Hutchinson Counties, as well as to other areas needing a hybrid of similar maturity.

South Dakota 622, over the 4-year period, averaged 1.4% more moisture than South Dakota 604 when grown in Clay County. This indicates that it is somewhat later in maturity and would be adapted for southern Lincoln and Turner Counties and the northern parts of Clay, Union, and Yankton Counties and in other areas requiring a hybrid of this maturity.

Yields

Yields of the two new hybrids in comparison to South Dakota 400 and South Dakota 604 are also presented in the table. In Minnehaha County, South Dakota 420 averaged almost 8 bushels per acre more corn over the 4-year period than did South Dakota 400. In addition it yielded more corn in each of the 4 years tested. In the Clay County plots, South Dakota 622 outyielded South Dakota 604 by 8 bushels per acre for the 4 years. However, it did not always outyield South Dakota

Performance Records of South Dakota Hybrids 420 and 622 as Compared to South Dakota Hybrids 400 and 604

Hybrid	1956		1955		1954		1953		Average	
	Yield Bu./A.	Moisture %	Yield Bu./A.	Moisture %	Yield Bu./A.	Moisture %	Yield Bu./A.	Moisture %	Yield Bu./A.	Moisture %
Minnehaha County										
S. D. 420	82.0	22.5	55.7	16.5	76.1	30.4	78.6	25.1	73.1	23.6
S. D. 400	73.0	19.0	50.6	14.7	65.0	25.7	71.3	22.4	65.0	20.5
Clay County										
S. D. 622	49.1	14.8	51.9	17.7	76.8	21.9	97.9	21.2	68.9	18.9
S. D. 604	38.3	12.1	54.8	19.3	52.9	19.7	97.0	18.7	60.8	17.5

604 in each of the years tested, the latter hybrid being variable in its yields from year to year. The relative yielding ability of each of the new hybrids in comparison with that of the older hybrids is demonstrated in figures 1 and 2.

Pedigrees

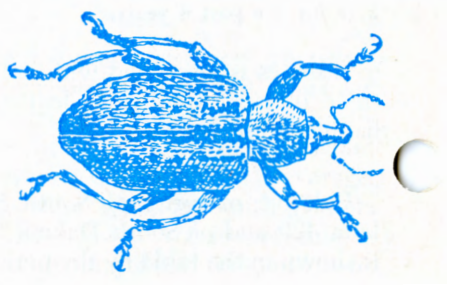
South Dakota 420 has the following pedigree (WF9 x OH56A) (OH45 x B8) and has been tested as Experimental 13. The seed parent, as given, should be planted about one week earlier than the pollen parent in order to have silks present when pollen is being shed.

South Dakota 622 was tested as Experimental 19 and its pedigree is (WF9 x M14) (OH41 x OH43). It also is a mismatched hybrid with the single cross (WF9 x M14) being planted from 4 to 7 days before the single cross (OH41 x OH43). (Project 66. Leaders: D. B. Shank and D. E. Kratochvil, Agronomy Dept.)

GRANULATED INSECTICIDES OVERCOME

MANY DISADVANTAGES OF SPRAYING AND ARE EFFECTIVE

alfalfa weevil



By R. J. Walstrom and J. A. Lofgren

YOU CAN CONTROL alfalfa weevils as effectively with granulated insecticides as with sprays and at the same time overcome many of the disadvantages of using a field-type sprayer in the early spring.

Damage by the alfalfa weevil, *Hypera postica* (Gyll.), in western South Dakota has made the application of chemical controls a regular spring practice in heavily infested areas. While some insecticides in the spray form have provided good control, you have to wait until temperatures are above freezing to use a sprayer. This may crowd your other spring work. Also, if you use a weed sprayer to apply insecticides to alfalfa you must be extremely cautious and thorough when cleaning weed killer from the sprayer to avoid injuring your alfalfa stand.

Since granulated insecticides

This article is by R. J. Walstrom, associate entomologist, South Dakota Agricultural Experiment Station, and J. A. Lofgren, extension entomologist, South Dakota Agricultural Extension Service.

have been successful in controlling other insects, including corn rootworm, European corn borer, meadow spittlebug, and seed weevils on crimson clover, we started a trial to test this type of application for alfalfa weevil control as a way to overcome some of the drawbacks of spraying.

Compare Two Methods

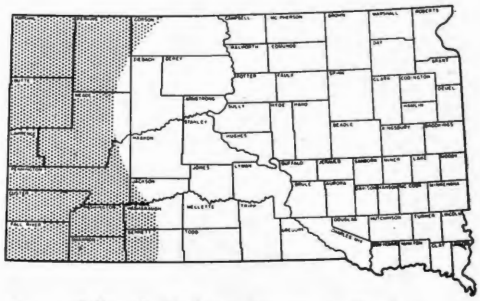
In our experiments we compared the effectiveness of granulated heptachlor and dieldrin formulated on attaclay applied in late winter and early spring to recommended spray applications in early spring for the control of the alfalfa weevil. Two alfalfa fields were used in the trial—one in Butte and one in Lawrence County.

Each field was laid out in randomized complete blocks with three replications. Individual plots were 1 acre in size.

Granulated insecticides were applied at rates of one-fourth and one-half pound of actual insecticide per acre. The spray was applied in the emulsion form at the rate of one-fourth pound of actual insecticide per acre, using the same chemicals as in the granulated form.

Butte County. On the William Schuft farm in Butte County, 21 acres of an alfalfa field which had not been treated in 1955 were used in one part of the trial. Granulated insecticides were applied March 16. The temperature was 27° F. and there was a snow cover of 1 to 2 inches on the field. The spray was applied April 17 when plant growth averaged about 1 inch.

Because of the late spring, larval damage was just beginning to appear June 11 at the one-fourth bloom stage. Since most of the larvae were in the second or third stage of development, we estimated that a severe reduction in hay quality and yield would have occurred if mowing had been delayed 10 days. Ten sweeps in each plot with a 15-inch net were made to determine larval populations. Hay samples from five yard-square areas were cut in each plot. We weighed the samples during cutting and again when they were air-dried. Field hay yields were determined from these samples.



Area of South Dakota known to be infested by the alfalfa weevil in 1956.

Lawrence County. In Lawrence County, 21 acres of an alfalfa field which had been treated with one-fourth pound of dieldrin per acre in 1955 were used. This field was located on the John Ward farm.

Granulated forms were applied April 13 when the temperature was 47° F. and sprays were applied the following day in 10 gallons of water per acre. Plant growth averaged 1 inch.

Hay and larval samples were taken on the same days and in the same way as those in Butte County. Field conditions were also similar

Effect of Granulated Insecticides Compared with Emulsions Applied for the Control of the Alfalfa Weevil in Two Counties in South Dakota, 1956

Insecticide	Pounds of Active Ingredient per Acre	Formulation	Butte County* Larvae per Sweep at First Cutting	Butte County* % Control	Lawrence County† Larvae per Sweep at First Cutting	Lawrence County† % Control
Heptachlor	.25	(2E) emulsion	1.8	95.2	0.3	96.1
	.25	(2.5%) granulated‡	8.4	78.1	0.1	98.5
	.50	(2.5%) granulated‡	0.6	98.4	0.3	96.1
Dieldrin	.25	(1.5E) emulsion	3.5	90.8	0.1	98.8
	.25	(5%) granulated§	5.0	87.0	2.2	73.8
	.50	(5%) granulated§	5.8	84.8	0.3	96.8
Check	-----	-----	38.4	-----	8.4	-----

*Emulsions applied April 17; granules applied March 16.
†Emulsions applied April 14; granules applied April 13.
‡Particle size 30-60 mesh.
§Particle size 30-40 mesh.

as far as larval damage and stage of growth were concerned.

Granular Application Effective

Results of the trial, shown in the table, indicate that the granular application is as effective as the spray application in controlling the alfalfa weevil. Dieldrin and heptachlor are equal in effectiveness and the application of granular forms on snow in mid-March does as good a job as sprays applied at early growth stages of the alfalfa in mid-April. One-fourth pound and one-half pound applications of the insecticides are also about equal in effectiveness.

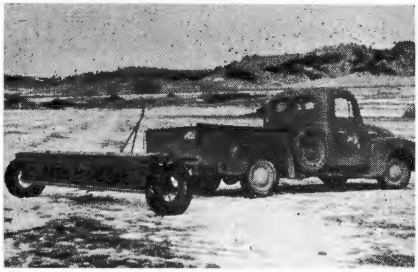
The measure of effectiveness of the treatments in the experiments was considered to be the population level of the alfalfa weevil, as measured by the net sweep samples taken in the individual plots.

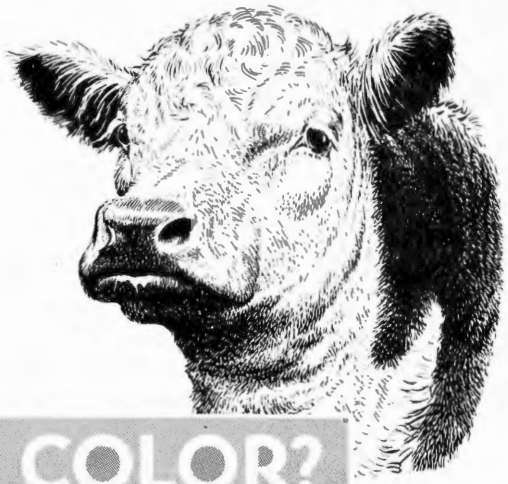
New Trials Confirm Results

Further applications of granular insecicides were made in Butte County and Lawrence County in December 1956 and in Lawrence County in March 1957. Before mowing the following June, we checked weevil larvae populations. Granulated forms of the insecticides proved as effective in controlling the weevil whether they were applied during the winter or early spring.

Because granulated insecticides tested are practical at temperatures too low for using field-type sprayers, you can control the weevil by applying insecticides before the rush of spring work arrives. (Project 288. Leader: R. J. Walstrom, Entomology-Zoology Dept.)

Insecticides in the granulated form can be applied any time during the winter months.





what's the best HEREFORD COLOR?

Our research shows that contrary to a popular belief, color does not affect feed-lot performance

By C. A. Dinkle, P. H. Kohler, and W. C. McCone

MOST HEREFORD BREEDERS, at least in this part of the country, have heard that the yellower or lighter colored the Hereford, the better the feed lot performance. To test this theory, bull calves which are carried each year on a record of performance test at the station were scored for color and their performance in the feed lot was compared with the color scores. Our results show that color has no influence on performance.

Calves used in these trials were registered Herefords produced at Substations of South Dakota Agricultural Experiment Station. They represented the unselected bull calf crop from more than ten lines of breeding. These calves were brought to Brookings at weaning time, about November 1.

Start Test

After a 2- or 3-week adjustment period, the calves were started on the 196-day performance test. Calves were randomly assigned an individual feeder from which they were fed for the entire period. The ration fed consisted of 35% oats, 30% shelled corn, 30% brome alfalfa hay, and 5% linseed oil meal, ground and mixed and self-fed in the individual feeders. The calves were tied into the feeders and allowed to eat for 2 hours in the morning and 2 hours in the evening.

By weighing the feed into the feeders and by keeping weight records on the calves we obtained a measure of their gain and efficiency of gain. In addition, the calves were scored at the beginning and end of the trial for type, condition, and color. We did not make the decision

This article is by C. A. Dinkel, associate animal husbandman, Paul H. Kohler, assistant animal husbandman, and W. C. McCone, associate animal husbandman, South Dakota Agricultural Experiment Station.

to include color scores as a part of the data collected on record of performance test calves until the middle of the 1954 test, so the data available are final color scores for 1954, 1955, 1956, and initial color scores for 1955 and 1956.

Color scores used were the average of the three visual appraisals we placed on the calves. The scoring system consisted of four scores representing yellow—1, light red—2, medium red—3, and dark red—4. To include all shades of red, these grades were further divided into high, medium, and low, giving 12 possible scores.

Score Animals

We scored each animal independently and our three scores were averaged. Ten of the 12 color grades were represented in the 117 calves receiving a final color score. Nine were represented in the 88 calves which received an initial color score.

We feel that the colors approached the extremes present in the Hereford breed. The reason the two extreme classes were not represented may be entirely psychological. A person scoring animals for any characteristic is reluctant to place the highest or lowest score since he may think that it is always possible to get an animal grading higher or lower for the characteristic being scored. This tendency actually reduces the number of possible scores that a calf might receive.

Analysis of Final Color Score

There were 117 calves which received a color score at the end of the performance test. These calves were sired by 16 bulls in three different years. The average gain for the 196-day period was 2.52 pounds per day and the average feed requirement was 645 pounds of feed per 100 pounds of gain.

Since lighter weight calves have a lower feed requirement than heavier calves, the feed requirement of all the calves was adjusted to that of the 400-450 pound calf. This was done to prevent confusing the effects of color and the effects of weight. If one of the color groups had a large number of heavy calves, the actual efficiency of the group might represent more the effect of weight than the effect of color.

As was mentioned previously, the calves were also scored for condition by our three visual appraisals, scoring the calves on the basis of five grades—A, B, C, D, and E—representing, high, good, average, fair, and poor condition. These grades were also divided into high and low to include all the variation encountered. The 117 calves averaged C+ or high average final condition.

Table 1 presents the average for rate of gain, feed requirement, and final condition for each of the years, sires, and color grades represented. Statistical analysis of these data indicated no significant differences between final color scores for rate of gain, feed requirement, or final condition. In fact, for rate of gain and feed requirement the analysis indicated that there was more variation within a color group than between color groups. Significant differences were found between sires for all three characteristics. Significance, as used here, is a statistical term indicating that the

Averages of Feedlot Characteristics by Years, Sires, and Color Groups

		Rate of Gain	Feed Requirement	Final Condition*	No. of Calves
Year	1954	2.58	640	C+	29
	1955	2.49	648	C+	42
	1956	2.50	646	B—	46
Sire	101	2.61	635	C+	13
	012	2.73	603	C+	11
	032	2.28	628	C+	9
	011	2.61	646	C+	4
	920	2.49	655	C+	13
	228	2.57	653	C+	11
	014	2.53	646	B—	10
	028	2.45	686	C+	4
	132	2.20	656	C+	2
	339	2.43	675	C+	3
	436	2.46	636	C+	6
	233	2.68	647	B—	11
	321	2.45	644	B—	5
	433	2.56	640	C+	6
	319	2.24	690	C+	6
	422	2.23	666	C	3
Final Color†	1—	2.47	594	B—	1
	2+	2.60	641	B—	7
	2	2.50	637	C+	11
	2—	2.49	643	C+	22
	3+	2.47	648	C+	23
	3	2.51	655	C+	22
	3—	2.60	649	C+	10
	4+	2.61	626	B—	11
	4	2.45	664	C+	8
	4—	2.50	625	B—	2
Initial Color†	1—	2.54	644	C+	4
	2+	2.52	642	C	3
	2	2.46	643	C+	15
	2—	2.51	646	B—	19
	3+	2.47	652	C+	23
	3	2.52	642	C+	9
	3—	2.53	659	B—	6
	4+	2.51	659	C+	7
	4	2.58	573	C+	2

*A—high, B—good, C—average, D—fair, and E—poor condition with + representing high in the group and — representing low.

†1—yellow, 2—light red, 3—medium red, and 4—dark red with + representing high in the group and — representing low.

differences found have a high probability of being real and are not chance differences brought about by sampling variation.

Analysis of Initial Color Score

The 88 calves fed in 1955 and 1956 received an initial color score at the start of the feeding period as well as a final score at the end. The average rate of gain, feed requirement, and final condition score for each of the initial color groups are given in the table. Analysis of these data yielded much the same results except that a significant difference was found for final condition score between initial color groups. Although the differences were significant, the table indicates there was no trend or relationship between color of the animal and final condition. The next to the lightest color group was the lowest in condition while one of the other lighter groups was highest and one of the darker groups was almost as high. Differences between sires for rate of gain, feed requirement, and final condition were all significant.

Discussion

The results failed to substantiate the theory that lighter colored cattle perform better in the feed lot, when using rate of gain, feed requirement, and final condition as the measurements of feed lot performance. The data indicate that hair color is independent of rate and efficiency of gain and that good performing cattle can be found among any of the color groups.

When there is a real price difference between light and dark colored feeder cattle, it may mean an opportunity for the feeder buyer to obtain darker colored cattle at less cost without sacrificing feed lot performance. When this buying pressure equalizes the differential between light and dark colored cattle, the breeder will be able to shift the selection pressure applied to color to the more important characteristics of feed lot performance and conformation. (Project 167. Leaders: C. A. Dinkel, J. A. Minyard, A. L. Musson, and W. C. McCone, Animal Husbandry Dept.)

AGRICULTURAL ENGINEERING FIELD DAY

Land leveling work is explained to one of the groups at Agricultural Engineering Field Day near Brookings. About 300 people attended the event.

NEW INSECTICIDE MAKES

house plants "bite back"

By Jesse Rawson

FOR SEVERAL YEARS entomologists have been looking for an insecticide that can be used on plants which will "make the plant bite back" when attacked by insects.

This idea has been used for a number of years with ornamental plants by using sodium selenate as a "systemic" insecticide. Systemic insecticides of this type are placed in the soil, the plant roots absorb a part of the material, and the plant becomes poisonous to insects which attack it. Unfortunately, plants treated in this manner are poisonous to people and animals as well as insects so they cannot be used for food. Also, the soil in which such crops are grown must be disposed of carefully as selenium lasts for a long time in the soil.

More recently attempts have been made to develop new materials which have the advantage of sodium selenate as a systemic insecticide without having its disadvantages. One new material of this type is Thimet (O, O-diethyl S-ethylthiomethyl phosphorodithioate). In the winter of 1956-57 we received two formulations of this material for trial in the greenhouse, on various house plants.

One was an emulsion containing 90% Thimet, and the other was in granular form containing 2% Thimet. The first testing was done on African Violet (*Saintpaulia*, variety Azure Beauty) to control mealy bug (*Pseudococcus* spp.). This is perhaps the most difficult of all insects to control on African Violets because most spray materials effective on the mealy bug injure the plant. The mealy buy is a sucking insect which secretes a waxy coating over itself when it settles down and begins to feed, so contact sprays are effective only against the very young insects which have not yet settled down. For this reason, a systemic seemed to be the answer to the problem.

The liquid Thimet was made up in four concentrations—1.5 parts per million, 3 p.p.m., 6 p.p.m., and 12 p.p.m.—and 50 ml. of each solution were used to water each plant in the treatment. Five plants were used for each treatment. The granular Thimet was mixed with the soil prior to potting at rates equal to the three lower levels.

This article is by Jesse Rawson, associate horticulturist, South Dakota Agricultural Experiment Station.

Comparative effects of liquid and granular Thimet at 1.5, 3, 6, and 12 parts per million on African Violet to control the mealy bug (left). Effect of liquid Thimet on Cineraria plants for the control of aphids (right).

As of this writing, the treated plants have remained free from mealy bugs but by June other effects were becoming quite evident. In all cases, the liquid Thimet depressed growth, as shown in figure 1. The highest concentration killed two of the five plants and severely stunted the others.

The granular Thimet seemed just as effective in controlling the mealy bugs but caused little or no injury to the plants at any of the levels.

Later in the spring, before the injury reported above on the African Violet plants became noticeable, liquid Thimet was applied (50 cc. of 1.5 p.p.m.) to a group of Cineraria plants to control aphids. The aphids were eliminated, but injury to the plants was noted in a relatively short time. This injury was confined to the leaves which were smaller with curled margins and had many small dead areas spotted throughout (figure 2). The flowers were not noticeably affected although the foliage injury would make such a plant unsaleable.

The liquid formulation of this material is hazardous to use, has a strong, unpleasant odor not unlike skunk, and may cause injury to plants so we cannot recommend it at this time. Further studies are being conducted on various house plants using the granular Thimet because it seems to give good insect control with less danger of injury and may prove to be a useful new insecticide for future greenhouse and house plant use. At present, however, Thimet is available only on an experimental basis and cannot be obtained for general use.

J. W. McCarty
Animal Husbandry

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