

EXPERIMENT STATION
OF THE
KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN.

BULLETIN No. 116 — JANUARY 1903.

GENERAL DEPARTMENT.

D. E. LANTZ, M. S..... Field Agent.

DESTROYING PRAIRE-DOGS AND POCKET-GOPHERS.

At the last session of the Kansas legislature, the following bill, introduced in the house of representatives by Hon. S. E. Cave, of Haskell county, was passed by both houses and became a law:

AN ACT to provide for the destruction of prairie-dogs and gophers, for making experiments with that in view, and making an appropriation therefor.

Be it ended by the Legislature of the State of Kansas:

SECTION 1. The township auditing board of any township in this state, at any regular or special meeting, is hereby authorized to purchase material and to employ one or more suitable persons to destroy prairie-dogs and gophers within the limits of such township; any material so purchased and compensation for such services to be paid out of the general fund of such township; but no township shall expend for such purpose more than \$100 in any one year, nor shall such compensation to any one person exceed \$1.50 for each day of actual work performed; provided, that no such employment shall be made until a petition signed by a majority of the legal electors of such township shall be presented to such board asking that such action be taken; provided further, that in any township a larger sum than \$100 may be expended in one year if a petition signed by at least two-thirds of the electors of such township be presented to the township auditing board of such township, making such request.

SEC. 2. The board of regents of the Kansas State Agricultural College is hereby authorized and directed to select some competent per-

son to direct and conduct experiments for the purpose of determining the most effective and economical method of destroying prairie-dogs and gophers.

SEC. 3. The person so selected by said board of regents shall have authority to visit the various counties of the state that are infested with prairie-dogs and gophers, and, either by himself or through such persons as may be selected under the provisions of section 1 of this act, make such experiments as he may deem advisable for the purpose of destroying prairie-dogs and gophers. He shall receive such reasonable compensation for his services as may be determined by said board of regents and actual traveling expenses.

SEC. 4. For the purpose of making such experiments, the person so selected by said board of regents shall have authority to purchase any necessary material, prepare the same in a suitable manner, and furnish it to any persons employed by the township auditing board, as herein before provided. And such person so selected by said board of regents is further authorized and directed to procure and furnish to each person so employed by township auditing boards such prepared material as he may by experiment determine to be most effective and economical, in such quantities as he may consider reasonably adapted to the purpose of ridding such township of prairie-dogs and gophers.

SEC. 5. The sum of \$5000, or so much thereof as may be necessary, is hereby appropriated, out of any money in the state treasury not otherwise appropriated, for the purpose of carrying out the provisions of this act.

SEC. 6. The auditor of state is hereby authorized to draw his warrants upon the treasurer of state for the purposes herein set forth upon verified vouchers approved by the board of regents of the Kansas State Agricultural College.

SEC. 7. This act shall take effect and be in force from and after its publication in the official state paper.

Approved February 12, 1901.

Published in official state paper February 22, 1901.

Under the provisions of section 2 of the foregoing law, the writer of this was employed by the board of regents of the College to conduct the required experiments. I entered upon the duties July 11, 1901, the board having placed the work under the general charge of the Experiment Station Council.

The Council authorized the publication of a preliminary press bulletin, containing inquiries relative to the distribution of and the amount of damage done by the two pests under consideration. It was issued as Press Bulletin No. 97, from the General Department of the Station, and contained blank space for replies to the questions propounded. In addition to the usual edition distributed to the newspapers and others, a special edition was sent to all the township trustees in the state, accompanied by stamped and addressed envelopes for replies. Of the 1400 mailed to trustees, four were returned to

this office as unclaimed, and 687 replies were received. Several hundred replies were also received on blanks sent out in the regular edition.

These replies were of great value, as they enabled me to form a general idea of the extent of the evils which had led to legislative action, and of the magnitude of the task that was before the land-owners of Kansas. They also gave information about the efforts that had been made by private enterprise to clear lands of both prairie-dogs and gophers. Many of these efforts had been failures, some had given doubtful results, and others had been eminently successful. Details of methods and particulars as to cost were also given in some cases, and many suggestions that were of value to me in making my investigations were received.

The answers relating to the distribution of prairie-dogs were tabulated, and showed that these animals were present in sixty-eight counties if the state. The table shows the number of townships in the affected counties, the number of townships from which reports were received, and the number of acres of land occupied by "dog towns." The prairie-dogs in Douglas county are not indigenous, but were introduced.

COUNTY.	Number of townships.	Number of townships reporting...	Number of acres.	COUNTY.	Number of townships.	Number of townships reporting...	Number of acres.
Barber.....	18	7	7,605	Meade.....	9	2	10,000
Barton.....	21	1	5	Mitchell.....	20	3	1,700
Butler.....	29	13	½	Morton.....	3	3	10,800
Cheyenne.....	17	16	14,780	Ness.....	10	5	15,425
Clark.....	10	6	50,010	Norton.....	22	12	3,120
Cloud.....	18	9	960	Osborne.....	23	6	2,840
Comanche.....	10	5	22,470	Ottawa.....	20	8	139
Cowley.....	25	15	½	Pawnee.....	13	9	651
Decatur.....	23	7	1,360	Phillips.....	25	7	730
Dickinson.....	24	11	1	Pratt.....	17	8	595
Douglas.....	9	6	½	Rawlins.....	20	12	7,315
Edwards.....	9	4	2,020	Reno.....	30	15	1,694
Ellis.....	14	6	10,820	Republic.....	20	10	292
Ellsworth.....	16	8	2,770	Rice.....	17	8	157
Finney.....	7	4	212,160	Rooks.....	22	11	6,010
Ford.....	14	10	15,920	Rush.....	15	7	3,065
Gove.....	8	7	211,960	Russell.....	9	4	855
Graham.....	13	8	11,260	Saline.....	19	10	375
Grant.....	3	3	10,500	Scott.....	7	5	70,800
Gray.....	6	3	12,000	Sedgwick.....	27	17	307
Grealey.....	3	3	12,000	Seward.....	3	2	22,300
Hamilton.....	8	6	17,220	Sheridan.....	13	8	8,370
Harper.....	19	7	626	Sherman.....	13	7	13,840
Harvey.....	15	7	10	Smith.....	25	15	1,261
Haskell.....	3	2	8,200	Stafford.....	19	9	3,150
Hodgeman.....	9	6	8,290	Stanton.....	3	2	2,200
Jewell.....	25	13	563	Stevens.....	3	1	22,200
Kearny.....	5	3	4,450	Sumner.....	30	12	155
Kingman.....	23	10	340	Thomas.....	10	6	16,360
Kiowa.....	13	7	3,060	Trego.....	7	5	25,340
Lane.....	9	7	19,000	Wallace.....	7	3	66,500
Lincoln.....	20	7	400	Washington.....	25	12	80
Logan.....	11	11	236,460	Wichita.....	3	2	9,000
McPherson.....	25	14	692				
Marion.....	24	11	315				
				Totals.....	1,015	518	1,224,854½

I made personal investigations in several of the counties from which the heaviest acreage is reported, and think that, while many of the trustees made mere guesses in their replies, their statements are not exaggerated. It will be noticed that about half of the districts affected reported a million and a quarter acres of land occupied by the animals. A conservative estimate for the entire area of the prairie-dog villages in the state is 2,000,000 acres. The greater portion of this is pasture land, and the injury to it for grazing purposes is about fifty per cent. On wheat and alfalfa lands the animals totally destroy the crops on the area within their villages.

It is difficult to make a correct estimate of the annual loss to the state due to the prairie-dog, for the reason that conditions differ in the various counties, and that land has thus a variable rental value. The annual rental value of school-lands in the western counties has been fixed at twenty-five dollars per section. At this low rate, a loss of \$40,000 would result from a fifty-per-cent. damage to the grass on 2,000,000 acres. But the loss per acre in the central counties is much heavier, and it is not an exaggeration to place the annual loss for the entire state from the presence of the prairie-dogs at \$80,000.

From the replies to Press Bulletin No. 97 received, I find that the pocket-gopher is reported present in all the counties of the state except Elk and Neosho, and I have no doubt that these two counties have also a few of the animals. They are not numerous in the southeastern part of the state, but are abundant in the northeastern counties and in the valleys of the Kansas and Arkansas and their tributaries. They delight in loose, sandy or alluvial soils, and if their favorite plant-food is abundant, the gophers are also abundant. Alfalfa seems to be their favorite food, and as it is also our most valuable forage-plant, the damage due to these animals is direct and appreciable. Clover fields and other tame-grass meadows are also greatly injured by their depredations. Native-grass meadows suffer less because the soil, never having been stirred by cultivation, offers greater resistance to the animals.

The injury done by the pocket-gopher is of a double kind, but it consists chiefly of throwing up the hills of soil, which interfere with cutting the crops. In the alfalfa fields there is also a noticeable thinning out of the plants, by reason of the cutting off of the roots. These root cuttings are stored in the burrows in considerable piles, and are used in cold weather by the gophers for food. It is claimed by some alfalfa-growers that this process of thinning out the plants is a benefit rather than an injury to the field, but I have known fields where the process of thinning has continued until the crop did not half cover the ground at cutting time, and the fields were plowed up

for the planting of other crops. The loss from gopher depredations to the alfalfa-growers of Kansas during 1901 was probably fully one-tenth of the entire product, and had a money value of at least \$500,000. Unless active work against this pest is carried on by farmers during the next few seasons, the losses will greatly interfere with the profits of alfalfa-growing.

The pocket-gophers have also done much damage in Kansas to the horticultural interests. They eat apple and other tree roots, both in the nursery and after transplanting to the orchard; they eat beets, carrots, parsnips, beans, peanuts, peas, and other garden crops; they burrow under corn shocks and carry away the grain; and they sometimes carry off considerable stores of both Irish and sweet potatoes, laying them up for winter food.

Field experiments in destroying prairie-dogs were delayed until about September 1, 1901, for the reason that these animals are engaged during July and August in excavating and occupying new burrows for the accommodation of the young animals, and in repairing the old burrows and mounds. These operations greatly interfere with poisoning and other experiments. During September, October, November, and December, experiments were conducted near Oakley, Wallace, Wakeeney, Hays City, Solomon, Jamestown, Dodge City, and in Haskell county. Those at Oakley were made jointly with a representative of the biological survey of the United States Department of Agriculture. Most of the experiments were made at Hays City, on lands belonging to the Branch Experiment Station. On account of limits on the length of the present bulletin, I give details of only a few of the experiments made

Trapping. — Experiments were made with the ordinary No. 0 steel traps. A half-dozen were set and visited twice a day during an entire week. When set without covering, the animals carefully avoided them. As long as even a portion of the chain or the stake securing it was visible they would not go near the trap. When every part of the trap, chain and stake was entirely covered with loose soil, the animals can occasionally be secured, but the greater number of them contrive to release themselves from the trap. Wire traps with funnel-like tubes extending into and fitting the burrow, and with a hinged door, opening upward but not downward, were kept set for days in the mouths of burrows into which animals were known to have gone, but none were caught. Whether they escaped by other entrances to the den or remained in the burrows could not be determined. I conclude that trapping prairie-dogs cannot be made a success.

Fumigation — Some machines for forcing the fumes of sulphur into the burrows for the purpose of suffocating the animals were tried with a reasonable degree of success. A test made with one of these at Hays showed that two men can treat about 120 burrows in two hours, an average of one hole per minute. As the material used is quite cheap, the chief expense lies in the labor and in the first cost of the machine, which is thirty dollars. As it is difficult to construct a small machine employing a bellows which will last long under the ordinary usage, it is doubtful whether this method can be made cheaper than the well-known carbon bisulphide.

Carbon Bisulphide. — Many experiments were made with this popular means of destroying prairie-dogs and prairie squirrels. My chief object was to determine the exact cost per acre or per burrow for complete extermination. The material was bought from the local druggist at a cost of twenty cents per pound. After trials to determine the least amount that would be effective and the number of burrows that could be treated in a given time by a man with an assistant, I found that with commercial refined carbon bisulphide the cost would be about four-fifths of a cent per burrow — an average of about twenty-five cents per acre. Slight variations in the cost were obtained by applying the liquid in different ways. The use of a spray pump was found to economize in the amount of material used, but it required much more effort to apply it, and in the course of a half-day the operator became very tired. The most practical method was found to be the use of dry horse dung as an absorbent material. The balls, saturated with the carbon bisulphide, were merely rolled down the holes and the latter covered with a sod firmly stamped down with the feet. A tablespoonful of the liquid is enough for a burrow.

Several adulterations of carbon bisulphide were tried. Lee's Peerless Gopher-killer gave excellent results, but the cost was about equal to that of commercial carbon bisulphide. A mixture of one part of carbon bisulphide and three or four parts of gasoline was also quite effective. I used nearly two tablespoonfuls of the mixture for a dose, on horse dung or with a spray pump. Cost of extermination with this was less than one-half cent per burrow, or about twelve cents per acre.* With these adulterations, as well as with carbon bisulphide alone, the best results are obtained when the soil is wet, since a very dry soil

*A letter just received from Mr. L. N. McLane, of Cheyenne Wells, Colo., whose pasture is in western Kansas, gives a much lower estimate of the cost:

PORTLAND, ORE., January 5, 1903.
Mr. D. E. Lantz: DEAR SIR— I have yours of the 15th ult., addressed to Cheyenne Wells, Colo. Replying to your inquiry, I will submit the following facts: My pasture contains 2720 acres of land. The latest advice from the man I engaged to destroy the dogs was that there only remained unfinished about

absorbs the gases too rapidly to always bring about fatal results to the animals.

Contagious Diseases. — A favorite theory with many people of the state has been that the introduction of some contagious disease would be the easiest and most rational solution of the prairie-dog problem. It is well known that in the past such diseases have been epidemic in western Kansas at intervals among these animals, and that they have nearly all died over large areas. However, there have been no such epidemics in recent years, and our experiments had to be confined to such diseases as could be handled in the ordinary bacteriological laboratory. In the experiments with the rabbit plague in Australia, much attention was given to this subject. Immense rewards were offered for a contagious disease that would kill the rabbits and yet not harm the domestic animals on the ranges, and without success. In a few experiments with chicken cholera, a mortality of twenty per cent. was obtained with rabbits in confinement, and this is the best that was done under the munificent offers of the various Australian colonies.

An item went the rounds of the newspapers last winter to the effect that the municipality of Lisbon, in Portugal, had succeeded in getting rid of its great plague of rats by introducing a contagious disease among them. The item was sent to me by numerous correspondents, with the question, "Why cannot the College do the same with the prairie-dog?" I wrote to the American consul at Lisbon, enclosing the item and asking for particulars, and in due time received the following reply:

"UNITED STATES CONSULATE, LISBON, PORTUGAL,
 FEBRUARY 12, 1902.

"*D. E. Lantz, Esq.*: SIR — In reply to your letter of the 27th ult., enclosing a newspaper cutting, headed 'Plague of Rats,' I have to state that I have made inquiries on the subject from the director of the health department, within whose province the matter would come, and he not only assures me that there is no truth whatever in the statement, but says that he is himself anxious to discover a remedy for the plague of rats in this city. J. H. THIERIOT, *Consul.*"

Hoping that chicken cholera might perhaps prove more effective with prairie-dogs than with rabbits, because of their living in closer communities, I asked the veterinary department of the College to take up the work, I agreeing to furnish the living subjects for the ex-

twenty acres; consequently there have been 2700 acres destroyed. The expense was as follows: Bisulphide carbon, gasoline, cotton, etc., \$72; labor, \$112.50; total, \$184.50 — an average of seven cents per acre. The work was thoroughly done. It goes without saying that the destruction of the prairie-dogs depends on the cooperation of all settlers. I used one-fifth carbon bisulphide and four-fifths gasoline. — L. N. McLANE.

periments. I turned over to the department a number of the live prairie-dogs last July, but up to this time no success has been obtained with the disease in question. The cultures have all apparently been too attenuated for the purpose.

Poisoning. — Among the poisons tried in September and October were arsenic, corrosive sublimate, barium carbonate, potassium cyanide, and strychnine. These were used in combination with various baits — wheat, cracked corn, corn-meal, Kafir-corn, prunes, bread, etc. None of them were entirely successful, and many of them were complete failures. Later, some better results were obtained with strychnine and potassium cyanide, each alone, and in various combinations. In December, 1901, at his invitation, I visited the ranch of Hon. S. E. Cave, near Lockport, in Haskell county. Previous to this, Mr. Cave had corresponded with Mr. David W. Staples, of Craft, Okla., formerly of Quanah, Tex., and had received from him a sample of a poison that had been patented, and which he claimed would be a successful poison at all seasons of the year.

The sample, a quart, was mixed, according to directions, with a half bushel of wheat, allowed to stand over night, and all distributed by eleven o'clock the next morning. The morning was bright, though rather cold, and the prairie-dogs came out well. Before we had half distributed the poisoned food we began to see its effect on the animals. By noon of the following day we were satisfied that there were no more live prairie-dogs on the eighty acres over which we had distributed the poison.

We had also excellent success at this place with a simple preparation of strychnine and sorghum mixed with wheat. This is given elsewhere as formula No. 1, while the patented formula is distinguished as formula No. 2. Another experiment with potassium cyanide added to formula No. 1, and mixed in the same manner, failed to poison any of the animals. The cause of this failure I afterward learned lay in the fact that I had tried to dissolve the strychnine and potassium cyanide at one time in the same vessel, a process which prevents the strychnine from properly dissolving.

Mr. Cave, who has taken a great interest in this work, was so much pleased with the success, especially of the patented poison, that he urged upon me the adoption of it as that which the College should recommend, prepare, and furnish to township boards under the provisions of section 4 of the act quoted at the beginning of this bulletin. At a later meeting of the Station Council, I was authorized to correspond with Mr. Staples and to purchase from him the right to use his formula in the state of Kansas. By January 1, 1902, I had secured from Mr. Staples a bill of sale which conveyed to the Kansas

State Agricultural College the right for itself and for all the citizens and corporations of the state to use the patented formula, and the right to communicate it to any citizen of the state. The consideration paid was \$200. I immediately began preparations to manufacture the poison and to furnish it to townships at the cost of the materials. I prepared and sent out Press Bulletin No. 108, under date of January 7, 1902, entitled, "Destroying Prairie-dogs — a Preliminary Report," from which the following methods are quoted:

CARBON BISULPHIDE. — A tablespoonful of carbon bisulphide placed upon some absorbent material, as cotton, dry horse manure, or a piece of corn-cob, and rolled down the prairie-dog burrows, is effective in killing the animals. It is best immediately to cover the hole with a sod and stamp down firmly. I found by experiment that four parts of gasoline mixed with one part of carbon bisulphide is about & effective as the carbon bisulphide alone, and not nearly as expensive. The mixture is used in the same manner as carbon bisulphide alone, but a somewhat larger dose is needed.

STRYCHNINE POISON. *Formula No. 1.* — Dissolve one and one-half ounces of strychnia sulphate in a quart of hot water. Add a quart of syrup—molasses, sorghum, or thick sugar and water—and a teaspoonful of oil of anise. Thoroughly heat and mix the liquid. While hot pour it over a bushel of clean wheat and mix completely. Then stir in two or more pounds of fine corn-meal. The quantity of corn-meal will depend upon the amount of extra moisture present. There should be enough to wet every grain of the wheat and no more. Care should be taken that there is no leakage from the vessel in which the wheat is mixed. Let the poisoned grain stand over night, and distribute it in the early morning of a bright day. Use a tablespoonful of the wheat to each hole occupied by prairie-dogs, putting it near the mouth of the burrow in two or three little bunches. Do not put out the poison in very cold or stormy weather. It will keep for a considerable time, and is much more effective after a cold period, as the animals are then hungry and eat the grain readily. A bushel of wheat should poison 1000 to 1200 holes. An excellent substitute for the oil of anise in the above formula can be made by soaking two ounces of green coffee berries in the whites of three eggs. Let this stand for about twelve hours and use the liquid instead of anise oil.

Formula No. 2. — Through the efforts of Hon. S. E. Cave, of Lockport, Kan., the College has purchased the state right to use a preparation patented by Mr. D. W. Staples, of Quanah, Tex. I have tested it in the field and have found it entirely satisfactory. The inventor claims for it that it has the advantage of being effective *at any season*. The simple preparation of strychnine given in formula No. 1 is not successful while green food is plentiful. Formula No. 2 is protected by letters patent and cannot be used *outside of Kansas* without securing the right from the inventor. We have purchased the right to its use for all the citizens of the state. As this bulletin circulates outside of Kansas, the formula is not here given, but it will be sent to any resident of Kansas upon application.

Section 1 of the law authorizes townships, under some restrictions, to levy money and to purchase poison to destroy prairie-dogs. Section 4 makes it the duty of the Agricultural College to furnish the remedy recommended by it to townships that comply with the provision of section 1. Accordingly, this Station will be prepared, on January 10, 1902, and during three months thereafter, to furnish, at actual cost of materials, poison prepared according to formula No. 2. By buying materials at wholesale, a considerable saving in cost will be made. The poison will be put up in half-gallon cans. Each can will hold enough to thoroughly poison a bushel of wheat. This will be enough for from 1000 to 1200 burrows, from 100 to 160 acres, since only occupied holes need be poisoned. Directions for use will accompany each can. The price will, for the present, be \$1.50 per half-gallon can, f. o. b., Manhattan. Shipment will be by express or freight and in such quantities as trustees may desire. Money orders in payment should be made payable to Miss Lorena E. Clemens, secretary.

I began sending out prepared poison about January 15. The early orders were mostly for small quantities, to test its efficiency. By the beginning of February the orders became larger, and soon taxed our facilities for manufacture. Some delays in securing supplies of strychnine and cans hindered us for a time, but by employing a skilled assistant, by March 15 I was enabled to ship the poison as fast as it was ordered. Contrary to my expectations, the demand for it continued into the summer, after the grass on the prairies was green. Up to June 30, the end of the fiscal year, I had sent out 3250 cans, containing 6500 ounces of strychnine, besides the other ingredients. The sale of these 3250 cans represents the filing of 398 orders, of which eighty-seven were from township boards.

Reports from the field indicate a large percentage of cases in which actual extermination over the area poisoned resulted from the first application of it. A number of users reported a destruction of over ninety per cent. at the first trial, with absolute extermination at the second poisoning. A few reported less successful results, and in seven or eight cases an entire failure was reported. Three of the failures were caused by heavy rains which came just after the poison was put out.

A personal investigation in the field in a portion of the territory over which the poisoning operations had extended showed that in many places from ten to twenty per cent. of the animals are still present, and that in a few years the work will have to be repeated. Ranchmen have been satisfied with this partial success, and failed to follow up the first application of the poison by a second one, or the animals have come in from adjoining lands. Nothing short of the entire extermination of the animals should satisfy a community or township.

The larger the area over which they are completely destroyed, the more lasting will be the result. The law contemplates that the entire township shall cooperate in the work, and authorizes the employment of suitable persons to put out the poison. So far as I have learned, this provision of the law was ignored in the various townships that ordered the poison, and the work was left to the landowners to whom the poison was distributed. As a result, a considerable number of persons in some of the townships did not use the poison at all, and the unoccupied lands were entirely neglected. This greatly diminished the benefits from the work of last winter. The poison sent out, if properly used, should have exterminated the animals on 450,000 acres of the land occupied by them. It probably actually exterminated them on 250,000 acres, and partly destroyed them on 150,000 more.

I append a few extracts from letters received from users of the poison. They are sufficient to show that it is effective, if properly used. The letters dated in October and November, 1902, were from persons who used the poison in midsummer, and in replies to inquiries from me as to their success.

SOME REPORTS FROM THE FIELD.

FEBRUARY 18, 1902. — You will find enclosed \$1.50 for a package of prairie-dog poison. It works like a charm. Please send by freight. — E. J. DUMOND, Spearville.

APRIL 5, 1902. — We have used your prairie-dog poison with great success. Allow me to congratulate you. You have done a great thing for western Kansas in finding something that the little pests will eat and kill them. — MRS. ALBERT ROBIDOUX, Goodland.

FEBRUARY 24, 1902. — Some time ago we got a can of your poison for prairie-dogs, and the results were not satisfactory on account of the inclement weather. Please send me another can of it for the enclosed money-order. — HENRY RUNG, Ruleton.

APRIL 19, 1902. — Enclosed find check for six dollars, for which please send me two gallons prairie-dog poison. We used the two gallons this P. M. The men say they can pick them up by the header-box full. — W. L. NESMITH, Wilson.

APRIL 17, 1902, — Please send me a can of your prairie-dog exterminator, as Mr. Skelton, my neighbor, has used it and it is a great success. — W. T. LITTLECHILD, Wakeeney.

MARCH 25, 1902. — As far as I can learn, those of our people who have followed the directions with the poison have had good luck. One man said that he found only four live dogs on 160 acres after he went over it the first time. A number of others did as well as this. There are a few, who mixed only a part of the can at a time, who did not do so well, A few also scattered the wheat instead of putting it in piles, or put it in the burrows. These had poor success. — C. COOKE, Knauston.

NOVEMBER 10, 1902 — One man in this vicinity tried the poison in July. His success was very good. Another put out a bushel of poisoned wheat early in November. He went back next day and found forty-five dead prairie-dogs, seven rabbits, and thirteen crows. We have just about cleared out all the prairie-dogs in this township. — JAMES MAKINSON, Cedarville.

NOVEMBER 29, 1902. — I had the very best of success with the poison. Will send for more some time in February.— U. S. HOFFER, Ellis.

NOVEMBER 10, 1902. — I killed a great many prairie-dogs the first time I went over the ground. Later, they came in from adjoining lands and I put out more poison, but failed to kill them. The first time I used it in very dry weather, but it was wet when I tried it the second time. — ED. SLOAN, McCracken.

NOVEMBER 22, 1902. — I was not very successful with the prairie-dog poison. I used only half a can, and the persons that have used the poison tell me that you do not get enough poison out of the can when you use a part of it. I will try the other half of the can this winter. — C. H. COLE, Gove.

DECEMBER 5, 1902. — The prairie-dog poison furnished by the State Agricultural Experiment Station beats all other preparations I have tried. It is a sure killer, if properly used. The law on the subject should be so amended as to make it obligatory on all landowners to kill off the dogs, and the poison should be furnished free of charge by the county or state. — J. C. STARR, Scott City.

OCTOBER 2, 1902. — The poison was a decided success for us. I purchased it for several neighbors. A. C. Tucker killed every dog. Geo. M. Curtis, Henry Schultz and Harvey Knoeber cleaned out the entire town. H. H. Woodbury and H. W. Dorsett had each four or five burrows left, but they did not repeat the work. One can did not seem to do good work, but all the rest were O. K. Our people did not try any other kind after giving this a trial. — E. J. DUMOND, Spearville.

NOVEMBER 17, 1902. — We used the poison and were well pleased with the result. If I remember correctly, your bulletin stated that we ought to kill ninety per cent. of the animals at the first going over the town. Since using the poison, I am satisfied that it kills more than ninety per cent. We used the one-half gallon of poison on one bushel of wheat, following directions in its preparation. There was stock running at large in the first town in which we placed the poison, and we put only a small quantity of the wheat to each burrow. I found by experience that we should have followed directions and used a full tablespoonful to each occupied burrow. We went over the first town twice, but there were still more dogs left in that town than in all the others combined. All together we poisoned four towns, comprising about 175 acres, with one bushel of wheat. We found it best to get out early in the morning and work until noon, then resting until the next morning before putting out more. Of course, we picked fine weather for the work. — C. S. MARTY, Sun.

OCTOBER 6, 1902. — I took a contract to clear the dogs off a ranch four miles long and two miles wide—solid dogs. I used two one-half-gallon cans to go over it the first time and one can the next time, and got every dog. I find it best to use wheat first and then change to chop or ground feed, as the dogs will not eat the wheat the second time. I then took another contract of 160 acres. I used one can to go over it the first time, and got every dog. I also tried it in the summer, but only killed about twenty per cent. — E. C. TATTEN, Natoma.

NOVEMBER 19, 1902. — We mixed the poison as directed and put it out one fine morning about two weeks after we got it. (Shipped August 11.) I think they did not eat any of it, for the dogs are all here yet. Have some poison left and will try it again. One quart of the poison was used. — W. L. GORUN, Heber.

NOVEMBER 6, 1902. — The poison has been the means of reclaiming thousands of acres of good grazing land which will, in my judgment, revert back to the use of the prairie-dog if not kept up until they are all stamped out. I killed the dogs on about 2000 acres last spring before the grass started, and I find this same land grew as good grass this season as any of the land joining it. A portion of it was state school-land. — STEVE E. CAVE, Lockport.

JANUARY 10, 1903. — Your prairie-dog poison is a grand success. We have tried it and know. — MINER & EIBERT, Ness City.

Experiments with this poison and with others were continued during the spring and summer. I supplied J. G. Haney, superintendent of the Branch Experiment Station, at Hays City, with the poison, and he employed a man to exterminate the prairie-dogs on the land belonging to the Station. He began operations about the middle of April, after grass had started, and went over the ground twice with poisoned wheat, and then killed some that were left with carbon bisulphide. Mr. Haney calculated that the cost for materials and labor of exterminating the 500 acres of the animals on the reservation would have been about eight cents per acre. The work could probably have been done at half the expense in the winter.

This poison has also proved to be effective when used in the destruction of rabbits, prairie squirrels, rats, crows, English sparrows, and pocket-gophers. While poisoning prairie-dogs on the plains in midwinter, a considerable number of shore-larks and longspurs were killed. This result is to be regretted, and could probably be largely avoided by feeding these birds liberally with unpoisoned wheat, scattered near the watering-places, where they congregate in large numbers. This feeding should be continued for a week or ten days. Hawks and eagles congregate in numbers and soon destroy the carcasses of the poisoned prairie-dogs that die outside the burrows, but they are not injured as a result of the feast.

Financially the work of preparing and distributing the poison has been self-sustaining. About \$425 of the state appropriation was used to buy the state right and the first supplies necessary to the work. Cash and supplies now on hand will more than offset this amount.

THE POCKET-GOPHER.

My experiments in destroying pocket-gophers were with carbon bisulphide and its adulterations, with traps, and with poison. It did not, however, take much experience to convince me that the most effective and economical method of dealing with this pest is by means of poison introduced into food and placed in their burrows or runways. An improved method of introducing the poisoned food into the burrows is recommended in this paper, obviating much of the labor which has formerly attended the poisoning of these animals.

Bounties. — Many of my correspondents have expressed the opinion that a system of bounties paid by the state would be effective in dealing with gophers, prairie-dogs, and similar pests. Such bounties have been often tried in other sections, always with a great expense to either county or state, and no appreciable results in diminishing the evils aimed at. In 1866 Benton county, Iowa, offered a bounty of ten cents per scalp for pocket-gophers. No diminution of the pest was noticed, and the following year the bounty was increased to twenty cents per scalp. The bounties for that year amounted to \$10,000. The county borrowed \$3000 and had left \$3000 in unpaid gopher warrants. The bounty was then reduced to twelve and one-half cents for six months, then to ten cents, and was abolished on January 1, 1869. The entire amount paid out in three years was \$18,000; and the gophers were far from being exterminated. Other counties in Iowa, and in Minnesota, North Dakota, and South Dakota, have had somewhat similar experiences in using bounties in dealing with the pocket-gopher. One county in Kansas is now trying the bounty system. The commissioners of Cloud county, in January, 1901, offered a bounty of ten cents each for gopher scalps. In the first year they redeemed 6500 scalps and the bounty continues.

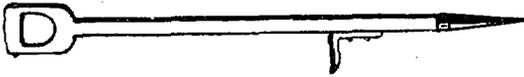
Poisonous Gases. — The use of carbon bisulphide and other poisonous gases has frequently been recommended for the destruction of the pocket-gopher. While these methods have been in part successful, the great length of the burrows and their irregularities in depth prevent the gases from flowing into every part, and thus the animals often escape.

Trapping. — Trapping, if properly done, is a sure method of killing the gopher; but it is attended with considerable labor and is very slow. A correspondent in Doniphan county reports that 350 of the

animals were caught in four months on a forty-acre field of clover. He used the "Out-o'-Sight" gopher trap. An excellent trap for general use is the No. 0 ordinary steel trap. In using it, enlarge the hole sufficiently to admit the trap, and remove all the loose soil which may have fallen in to obstruct the runway. Sink the trap in loose soil to the level of the runway, and nearly conceal it by sprinkling fine earth over it. Leave the hole open.

Poisoning. — Pocket-gophers are easily poisoned. They are very fond of common potatoes, sweet potatoes, apples, raisins, and prunes. The presence of strychnine, arsenic, or other poisons does not seem to deter them from eating the food; but if the poison is sweetened they seem to eat it more readily. In summer it may be desirable to take the trouble to sweeten the poison, but in the fall and early spring it does not seem worth while to do this. The poisoned food being introduced to the burrows below the surface, there is no danger of poisoning stock. It might be well, however, not to let swine run in the alfalfa fields for a time after the poison has been put out.

The following method of introducing the poison is recommended: Cut the potatoes, or other food, into pieces not more than three-fourths of an inch in diameter. Cut a slit in each piece and with the point of the knife blade insert a little sulphate of strychnine; as much as half the bulk of a grain of wheat will answer the purpose. The moisture from the potato will cause the poison to adhere to the blade. Having prepared the bait in sufficient quantity, go to the field armed with a round, sharp-pointed implement an inch or an inch and a half in diameter and of sufficient length. The tool here illustrated was made for the writer by a blacksmith.



It is a spade handle shod with an iron point. A bar is attached about fifteen inches from the point, to enable the operator to use his foot in pressing it into the soil. This tool has proved to be quite serviceable. With it, it is only necessary to find the runway of the gopher. The handle is sufficiently thick to make a hole large enough to permit one to drop the poisoned potato directly into the burrow. The operator then passes to another place, leaving the hole open. No digging with a spade or other hard labor is necessary. An experienced person can distribute poison to many acres of alfalfa in a day; and if proper care is taken to rightly distribute the bait, it will not be necessary to go over the ground a second time.

Some experience is required to enable one to find the burrows

quickly. It is best to insert the food as near as possible to the freshest mounds of earth thrown up by the animals. Two or three pieces of potato at that place are worth many scattered in other parts of the runway. The operator should avoid the larger mounds and those that are not freshly made.

The foregoing information about destroying the pocket-gopher is mostly quoted from Press Bulletin No. 109, prepared by me and issued from the Experiment Station under date of January 14, 1902.

In the various experiments I have make with strychnine poison for pocket-gophers, I have found no difference in the results when different foods were used. Irish potatoes, sweet potatoes, raisins and prunes have all been successful baits. In no case have I found it necessary to go over the ground a second time.

The patented poison for prairie-dogs has also been tried upon gophers with great success. There is the further advantage in using it that it saves the labor of cutting the bait and inserting the poison. The following are directions for its use:

Take one and a half pecks to a half bushel of shelled corn in a metal tub. Pour boiling water over it and let it soak over night. Drain off the water and pour a quart of the prepared poison, a half pint of syrup, and several pounds of corn-meal or chop over the corn and mix all thoroughly. Let it stand over night again, and use a half tablespoonful of this instead of the baits recommended above, to insert in the openings made into the runways.

The Experiment Station is prepared to assist in waging a vigorous campaign against the prairie-dog and the pocket-gopher during the next six months, until the appropriation expires, June 30. We have recently filled about sixty orders for the poison. A single purchase of 2000 ounces of strychnine has been made, and other supplies are on hand in sufficient quantity for us to promise to fill all orders promptly. Such advance preparation is necessary, because it will be impossible for me to secure a capable assistant and I shall have to mix all the poison myself. This operation is exceedingly dangerous and cannot be left in the hands of an untrained or careless person.

I have taken great interest in the work covered by these experiments, and have met with a most cordial reception in every part of the state that I have visited. While the work has been laborious, it has given me excellent opportunities to study the habits of the two animals under discussion, to study other animals of which complaints have been received, and to assist several departments of the College in securing illustrative material. I believe that the importance of these experiments and the necessity for their continuance are not generally understood outside of the sections affected by the pests.

I had planned to include in this report an account of the habits of the animals, but space forbids. The United States Department of Agriculture has published papers concerning both. The Year-book of the department for 1901 contains an excellent article on "The Prairie-dog of the Great Plains," by Dr. C. Hart Merriam, chief of the division of biological survey. Six of the seven accompanying illustrations are from this article, by permission of Doctor Merriam. The other picture, "After Taking," was made from a photograph taken in the field. January 16, 1902.

Up to January 10, 1903, the following expenses from the \$5000 appropriation made by the last legislature have been approved:

Salary to December 31, 1902	\$1,766.67
Hotel and railroad expenses	362.64
Materials and supplies used	634.29
Printing, postage, express, drayage.	95.29
Right to use poison (patent)	200.00
Other items, mostly labor	16.60
Total	\$3,075.49

All labor connected with handling the poison has been paid for out of the receipts from that source.

THE PLAINS PRAIRIE-DOG.

Illustrations from the "U. S. Year-book," 1901.



A SENTINEL ON DUTY.



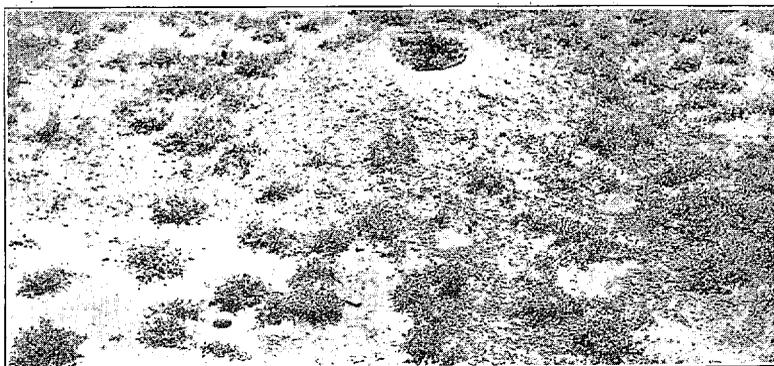
TAKING A CAUTIOUS SURVEY.



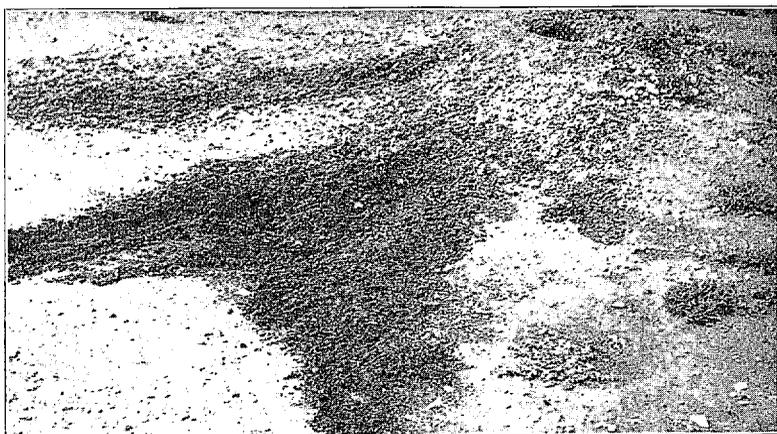
RESTING ON HIS OWN DOOR-STEP.

MOUNDS OF THE PLAINS PRAIRIE-DOG.

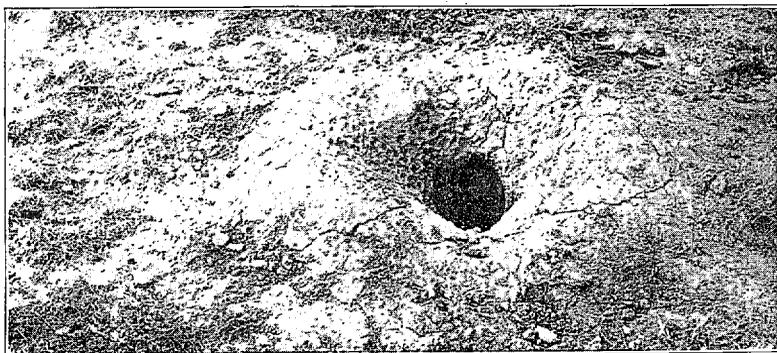
Illustrations from the "U. S. Year-book," 1901.



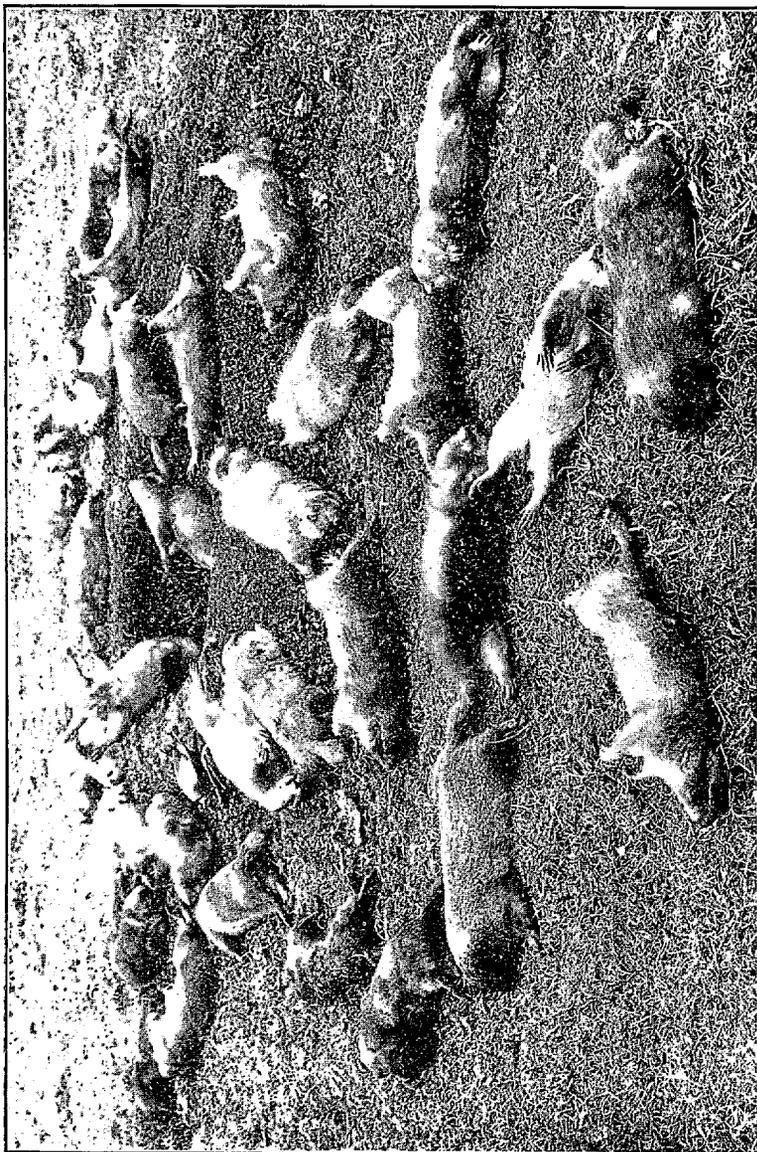
NORMAL MOUND OF PRAIRIE-DOG-IN NEW GROUND (an alfalfa field).



MOUND REPAIRED BY PRAIRIE-DOG SCRAPING UP EARTH FROM OUTSIDE.



INSIDE OF RIM OF PRAIRIE-DOG MOUND, SHOWING NOSE MARKS.



"AFTER TAKING."

The dead prairie-dogs shown were gathered up in a twenty-minute walk through the "town" that had been poisoned. Nearly all the animals die inside their burrows. The cost of destroying them is not over two cents per acre, not counting the labor. A man can distribute the poison over about a quarter-section in a day.