OREGON

Agricultural Experiment STATION.

BULLETIN NO. 6.

CHEMISTRY:

I.---Examination of Cattle Foods.

ECONOMIC ZOOLOGY:

II.---Circular No. 1. General Information.

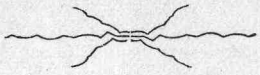
FOR JULY, 1890.

The Bulletins of this Station are sent free to all residents of the State who request them.

PORTLAND, OREGON:
SCHWAB BROS. PRINTING AND LITHO. CO.
1890

BOARD OF REGENTS.

W. S. LADD, President	*Portland*
T. E. CAUTHORN, Treasurer	*Corvallis*
WALLIS NASH, Secretary	*Corvallis*
GOV. SYLVESTER PENNOYER	*Salem*
G. W. McBRIDE, Sec'y of State	*Salem*
E. B. McELROY, Supt. Public Instruction	*Salem*
H. E. HAYES, Master State Grange	*Oswego*
J. W. GRIMM	*Aurora*
JOHN EMMETT	*Umpqua Ferry*
A. R. SHIPLEY	*Oswego*
W. P. KEADY	*Portland*
J. K. WEATHERFORD	*Albany*
J. T. APPERSON	*Oregon City*



OFFICERS OF THE STATION.

B. L. ARNOLD, A. M.	*Director*
H. T. FRENCH. M. S.	*Agriculturist*
E. R. LAKE, M. Sc.	*Botanist*
P. H. IRISH, Ph. D.	*Chemist*
F. L. WASHBURN, A. B.	*Entomologist*
GEO. COOTE,	*Horticulturist*
C. D. THOMPSON, A. B.	*Supt. of Farm*

EXAMINATION OF CATTLE FOODS.

P. H. IRISH.

The investigation described in the following paper was carried out, as the commencement of a series of experiments, planned to determine the comparative feeding value of the different cattle foods of the State. The conditions of soil and climate influencing the composition of our crops are so different from those found in other places that it is necessary to make special investigation on many points which have already been settled for other regions. The object of the work planned was to take up the cattle food stuffs, analyze them, prove the digestibility of their several constituents, and from the results formulate economical and rational methods of feeding, adapted to the conditions found in Oregon.

Before going into the details of the work described below, it will perhaps be well to give some idea of the constituents of a fodder, as shown by analysis. These materials can be separated by our present methods of analysis into several general classes of substances. We have nitrogenous substances. These are perhaps the most valuable portions of the product. In this class we have two divisions, the albumenoid and non-albumenoid, or soluble nitrogen compound. The albumenoids are the flesh formers. The exact function and use of the soluble nitrogen compounds in the animal economy is not very fully understood, but they are undoubtedly valuable. As examples of the albumenoid substances, familiar to us, are to be noted the compounds contained in the gluten of wheat.

Fats. Under this term we class those substances waich are obtained from the fodder by extraction with ether. Their use as food is to increase the amount of flesh laid on, both by preventing the waste of albumenoid compounds, and also becoming transformed into fat in the body.

Crude Fibre. This class of substances contains the woody matter.

Non-Nitrogenous Extract Matter. Under this head is included the carbohydrates, examples of which are starch and sugar. The function of these in the animal economy is to furnish the body heat by their oxydation. They also have a similar function to that of fat, when not present in too great quantity, in preventing waste of albumenoid matter.

It can be seen from what has gone before, that by our methods of analysis, agricultural products are, when examined, separated into the general classes of substances, not into the specific compounds, which enter into their composition. Hence in making comparison of the value of two foods, it is necessary not only to analyze them in the laboratory and find out how much of each class of substances they contain, but it is necessary to go further and determine what percentage of the totals of each class of

substances is actually made use of by the animal. Thus one fodder may contain a larger percentage of the albumenoids than another, but if on trial it were found that the latter contained a larger percentage of digestible, nitrogenous substance, this latter would have the greater value, other things being equal.

In the investigations given below we have tried to compare two fodders, with regard to their digestibility. The method of procedure is in brief: Weigh and analyze the fodder fed, calculate the weight of each class of constituents, weigh and analyze the dung of the animal fed, and calculate the amount passing through the body of each class of the fodder components. Subtracting the latter amounts from the former gives the amount of each substance which was digested. This, compared with the total amount eaten, gives the percentage of digestibility.

COMPARATIVE DIGESTIBILITY OF COOKED AND UNCOOKED ENSILAGE.

When preparation was commenced for carrying out the following experiments, it was the intention to make a comparison between ensilaged and field-cured corn. This could not be carried out owing to the fact that the field-cured fodder had not been properly cared for. The result of an experiment similar to the one first planned has since appeared, showing the field-cured fodder to be more digestible than that which was ensilaged.* It was then decided to determine the comparative digestibility of cooked and uncooked ensilage. The ensilage used was made from corn which was over-ripe, and had been somewhat frosted. The corn was a variety of dent corn, was cut into two-inch pieces by a cutter and placed in the silo as soon as cut, being well tramped down around the edge of the silo, which was a small one. The filling took place October 1, 1889.

The silo was opened in the latter part of December. The ensilage was in first class condition. Two grade Shropshire wethers were taken to carry out the experiment, but owing to various accidents happening to one of the animals it was decided to use but one of them.*

Before commencing the experiment proper a preliminary feeding period of fifteen days was entered upon in order that the stomachs of the sheep might be freed from all material other than the ensilage. At the beginning of the preliminary feeding the weight of the animal was 75 lbs. 15 oz. At the end of the same period it was 77 lbs. 10 oz. The feeding period, during which the dung was saved for analysis, lasted from January 30th to February 6th, 1890. The method of feeding was as follows: The sheep was tied in a tight stall, which had a feed box at one end. An apron made of canvas was fastened to the edge of this manger, and tied around the neck of the sheep. This made it impossible for anything to be dropped on the floor of the stall. Any of the ensilage left uneaten was carefully removed, weighed, and the amount

*Armsby, Bull. No. 9, Penn. Exp't Station.

*Thanks are due Mr M. D. Bigelow for assistance in the laboratory work, and to Mr. M. O. Wilkins for assistance in attending in a careful manner to the detail work of feeding and caring for the animals.

deducted from that fed. In order that the error arising from the different states of hygroscopicity of the fodder, might be as far as possible eliminated, a water determination was made in a sample from each amount fed, also from each amount weighed back. The necessary calculations were then made and the whole problem worked out on a water free basis for the ensilage. The manure was caught in rubber bags constructed for the purpose by the Goodyear Manufacturing Company. These were secured in position on the sheep by means of a harness constructed of canvas straps. The dung was dried each day at 100°c. so as to prevent as far as possible any fermentation, which might cause loss of nitrogen.

DIGESTION OF RAW ENSILAGE.

The ensilage had the following percentage composition calculated to substance dried at 100°c.

COMPOSITION OF ENSILAGE--CALCULATED TO DRY SUBSTANCE.

Total nitrogen	1.09 per cent.
Soluble nitrogen	0.66 per cent.
Albumenoid nitrogen	0.43 per cent.
Albumenoids	2.69 per cent.
Fat	6.10 per cent.
Crude fibre	28.43 per cent.
Crude ash	7.51 per cent.
Nitrogen, free extract	51.14 per cent.

The ensilage fed contained an average amount of 73.72 per cent. of moisture. In making the following calculations, the metric system of weights and measures is made use of, all rekoning being made in grams, a weight equal to 1-28,347th of an ounce. The amount of ensilage eaten was calculated to ensilage from silo, 11124,0417 grams, calculated to water free substance, 2922,9532 grams. This gives of each class of substances contained in the fodder eaten the following weights:

Total nitrogen	31.86 grams.
Soluble nitrogen	19.29 grams.
Fat	178.3001 grams.
Crude fibre	830.9956 grams.
Nitrogen, free extract	1494.7983 grams.
Crude ash	219.5138 grams.

The dung, which weighed, wet, 3827 grams, and dried 1054.4 grams, showed on analysis the following percentage composition:

COMPOSITION OF DUNG CALCULATED TO SAME DRIED AT 100°C.

Total nitrogen	1 65 per cent.

Fat . . . . . 2.35 per cent.
Crude fibre . . . . . 32.16 per cent.
Nitrogen, free extract . . . . . 41.02 per cent.
Crude ash . . . . . 14.16 per cent.

This gives in the amount of dung excreted the following amounts of each class of substances:

Total nitrogen . . . . . 17.39 grams.
Fat . . . . . 24.7645 grams.
Crude fibre . . . . . 339.0542 grams.
Nitrogen, free extract . . . . . 432.5715 grams.
Crude ash . . . . . 149.3012 grams.

Digestibility nitrogenous substances:—

Total amount of nitrogen eaten in fodder . . . . . 31.86 grams.
" " " excreted in dung . . . . . 17.39 grams.

" " " digested . . . . . 14.47 grams.
Percentage of digestibility . . . . . 45.41 per cent.

Digestibility of Crude Ash:—

Total amount of ash eaten in fodder . . . . . 219.5138 grams.
" " " excreted in dung . . . . . 149.3012 grams.

" " " digested . . . . . 70.2126 grams.
Percentage of digestibility . . . . . 31.98 per cent.

Digestibility of Crude Fibre:—

Total amount of crude fibre eaten in fodder . . . . . 830.9956 grams.
" " " " excreted in dung . . . . . 339.0542 grams.

" " " " digested . . . . . 491.9414 grams.
Percentage of digestibility . . . . . 59.19 per cent.

Digestibility of nitrogen free extract:—

Total amount of nitrogen free extract eaten in fodder . . 1494.7983 grams.
" " " " " excreted in dung . . 432.5715 grams.

" " " " " digested . . . . . 1062.2268 grams.
Percentage of digestibility . . . . . 71.06 per cent.

DIGESTIBILITY OF COOKED ENSILAGE.

The cooking was carried out by driving steam into a wooden box containing the

ensilage, until the kernels of corn in the fodder became cooked through and soft. The feeding was carried out in a manner similar to that noted in previous experiments.

The preliminary feeding extended from the 8th to the 13th of February, and the time during which the dung was collected extended from February 13th to February 20th. The weight of sheep at beginning of the latter period was 74 lbs. 6 oz.; at the end of the same, 74 lbs. 3 oz. The dry matter of the fodder had the same composition as that noted for the silage in the preceding experiment. The average percentage of water was 61.60 per cent.

Of the wet steamed silage was eaten 8599.5 grams, equal to 3302.2084 grams of dry matter. This dry matter contained the following amounts of the various classes of compounds given below:

Total nitrogen	35.994 grams.
Fat	201.4347 grams.
Crude fibre	938.8178 grams.
Nitrogen, free extract	1688.7494 grams.
Crude ash	247.9959 grams.

The dung excreted by the animal during the period of feeding weighed wet, 3676.5 grams; dried at 100°c., 1038.1 grams. It had the following percentage composition calculated to dry matter:

Total nitrogen	2.10 per cent.
Fat	2.48 per cent.
Crude fibre	26.83 per cent.
Nitrogen, free extract	41.07 per cent.
Crude ash	16.49 per cent.

By calculation this composition gives the following amounts excreted in the dung:

Total nitrogen	21.8 grams.
Fat	25.701 grams.
Crude fibre	278.4838 grams.
Nitrogen, free extract	426.392 grams.
Crude ash	171.229 grams.

Digestibility of Nitrogenous Matter:—

Amount of nitrogen eaten in fodder	35.994 grams.
" " excreted in dung	21.80 grams.
" " digested	14.194 grams.
Percentage of digestibility	39.43 per cent.

Digestibility of Fat:—

Amount of fat eaten in fodder	201.4347 grams.
" " excreted in dung	25.7010 grams.
" " digested	175.7337 grams.
Percentage of digestibility	87.24 per cent.

Digestibility of Ash:—

Amount of crude ash eaten in fodder	247.9959 grams.
" " " excreted in dung	171.2290 grams.
" " " digested	76.7669 grams.
Percentage of digestibility	30.96 per cent.

Digestibility of Crude Fibre:—

Amount of crude fibre eaten in fodder	938.8178 grams.
" " " excreted in dung	278.4838 grams.
" " " digested	660.3340 grams.
Percentage of digestibility	70.33 per cent.

Digestibility of Nitrogen, Free Extract:—

Amount of extract matter eaten in fodder	1688.7494 grams.
" " " excreted in dung	426.3920 grams.
" " " digested	1262.3574 grams.
Percentage of digestibility	74.75 per cent.

DIGESTIBILITY OF COOKED AND UNCOOKED ENSILAGE.

Percentage digestible of	Total Nit' Matter.	Fat.	Crude Fibre.	Nit', Free Extract.	Crude Ash.
In cooked ensilage is	39.43	87.24	70.33	74.75	30.96
In raw ensilage is	45.41	86.11	59.19	71.06	31.98

The tabulation of the above results makes it evident that cooking decreases the digestibility of the nitrogenous substances, increases markedly the digestibility of the crude fibre, to some extent also that of the fat and starchy matter. In this connection it is to be remarked that not all of the soluble nitrogen is digested, as assumed by Armsby*.

This would seem to follow from the fact that in the first experiment we have more soluble nitrogen eaten, than the total of that digested.

*Bull. No. 9, Penn. State College.

With regard to the composition of the ensilage as it comes from the silo, it appears from some observations made here that ordinary alcohol is a constituent of the substance, and is hence formed as a result of ensilaging. The observations on which this conclusion is based are as follows: 477 grams of wet ensilage were placed in a copper still and distilled by passing steam through. The distillate was treated with excess of sodic-hydroxide to neutralize any acid, and several times redistilled, making use each successive time of only the first half of the liquid passing over. It was then brought into an apparatus consisting of a distilling flask connected with a series of three bulb tubes, ending in a condenser, about which cold water was flowing. The distilling flask was gradually raised to 140°c. by means of a parrafin bath. The three bulbs were held, one at 105°c., one at 90°c., and the other at 65°c. The liquid collecting in the bulb whose temperature was 65°c. was treated with quick lime, allowed to stand, distilled over, and brought together with Benzoyl-chloride. The characteristic odor of Benzo-ethyl-ester obtained in this way would, taken together with the iodoform reaction, which was easily observed on bringing the liquid together with caustic potash and iodine, seem to prove the presence of ethyl alcohol in the ensilage.

In the receiver placed at the end of the condenser was obtained a few drops of a liquid having an odor similar that of wood alcohol.

Cooking increases the digestibility of the crude fibre, starch, etc., probably by converting these compounds, to some extent, into the readily soluble sugar. This would seem to follow from the fact that comparative determinations of the amount of sugar contained in the cooked and uncooked ensilage, gave the following result. The results are only comparative, the sugar having been extracted in each case by allowing the material to stand about 12 hours in cold water, pressing out the liquid, and determining the reducing power of an aliquot part of the solution.

The results calculated to dry matter were:

Cooked ensilage . . . . . 3.09 per cent. of glucose.
Uncooked ensilage . . . . . 1.86 per cent of glucose.

SUMMARY OF RESULTS.

The effect of cooking, on ensilage is:

First, to decrease digestibility of nitrogenous substances.
Second, to increase the digestibility of crude fibre.
Third, to increase the digestibility of nitrogen free extract.
Fourth, to increase the digestibility of fat.
Fifth, to increase the amount of sugar contained.

Alcoholic fermentation takes place in the silo by which ethyl alcohol is formed.

Soluble nitrogen may not be properly reckoned as completely digestible.

As far as can be concluded from the observations given above, cooking ensilage as a food for stock will not pay, on account of the decrease of digestibility of the nitrogenous substances.

P. H. IRISH, Chemist.

ECONOMIC ZOOLOGY.

CIRCULAR NO. 1. (GENERAL INFORMATION.)

F. L. WASHBURN.

For the purpose of emphasizing the importance of discriminating between injurious and beneficial birds and mammals, about 600 copies of the following circular, the first issued, were sent out in the fall of 1889, from the Department of Zoology and Entomology, connected with the experiment station.

CIRCULAR NO. 1. (GENERAL INFORMATION.

It is becoming generally well known that in levying war upon the supposed enemies to agriculture, many innocent or beneficial animals suffer with the guilty, and it is with this belief that we earnestly ask the co-operation of farmers, naturalists and others toward the solution of some questions of practical importance. Many hawks, owls, and even snakes, upon which relentless war has always been waged, are now known to assist the farmer materially by destroying noxious insects and vermin.

We therefore solicit information regarding the injuries or benefits caused by the following animals in your locality, the nature and extent of such injuries or benefits, and whether you think their beneficial traits are so much in excess of their injurious qualities that the animals deserve protection.

A. BIRDS.

1, Imported Chinese Pheasants; 2, Woodpeckers; 3, Owls; 4, Hawks; 5, Blackbirds; 6, King-bird or Bee-martin; 7, Shrikes; 8, Carolina Doves; 9, Pigeons; 10, Quail; 11, Grouse.

Can you say anything in favor of the Common Crow?

Has the English Sparrow appeared in your vicinity?

If so, how does it comport itself toward your grain or fruit?

In order to ascertain the food of the above birds throughout the year, i. e., what percentage of noxious insects they destroy as compared with grain or fruit or beneficial insects consumed, we earnestly solicit the sending of specimens of stomachs and crops, or better, the whole alimentary tract, to this station for examination. Each specimen, before being placed in strong alcohol (90 per cent. or 95 per cent.) for transportation, should have a piece of paper securely tied to it with the following data on it in PENCIL: 1, Collector's name; 2, locality; 3, date; 4, name of species, if known; 5, hour when secured. If the species is not known and the specimen is

small, it should be sent entire to the station. If too large for this, a head and a wing will serve to identify it.

Inasmuch as the food of birds varies throughout the year, and is largely affected by the age of the bird and other conditions, the importance of securing information and series of specimens running through many months, or the entire year, will be appreciated by all interested.

B. MAMMALS.

Information is desired concerning depredations on stock and poultry and upon grain and fruit by mammals in your locality. What is the nature and extent of the injury, if any, and what mammal or mammals are guilty?

Can you say anything regarding benefits or injuries caused by the following mammals: Foxes, Skunks, Minks, Weasels, Badgers, Raccoons, Squirrels, Gophers, Mice, Moles, Muskrats, Bats?

What is the nature and extent of such benefits or injuries?

The stomachs of the above mammals are desired, and the same directions apply to them as to those of birds. Where the identity of small species is uncertain they can be sent to the station in jars of strong alcohol (90 per cent. or 95 per cent.), a small jar holding a number of specimens. In the case of larger animals the rough skin is generally sufficient for identification.

Finally, any information of an economic nature regarding Birds and Mammals not mentioned in the above list, or statements regarding any insects and their depredations, facts of interest to the farmers of the State, and bearing upon the welfare of their crops, will be thankfully received.

Transportation charges and charges for alcohol will be paid by the station. The receipted bill for alcohol should be sent with the specimens, to be used as a voucher.

Communications and specimens should be sent to

F. L. WASHBURN,
Zoological Laboratory, State Experiment Station.
Corvallis, Oregon.

In reply to these only about 23 letters of information were received, and acknowledgments are due the following parties who gave the circular their thoughtful consideration: John Henry, Beaverton Station, Washington county; R. R. Laughlin, North Yamhill, Yamhill county; Marius Buchanan, Onion Peak, Tillamook county; Joseph Hutsby, Mehama, Marion county; C. Gaston, Gaston, Washington county; J. B. Hollingsworth, Condon, Gilliam county; F. A. Chenoworth, King's Valley, Benton county; Jerry Shea, Sweet Home, Linn county; A. H. Powell, Pittsburgh, Columbia county; A. T. Peterson, Mist, Columbia county; C. F. Knowles, Mist, Columbia county; Albert Starr, Corvallis, Benton county; W. M. Hilleary, Turner, Marion county; John Jacob Smith, George, Clackamas county; George W. Riddles,

Riddles, Douglas county; J. S. Linton, Bakeoven, Wasco county; Scott Morris, Spikenard, Jackson county; C. P. Fullerton, Alsea, Benton county; George Armstrong, Corvallis, Benton county; J. S. S. Powell, Philomath, Benton county; E. T. Hatch, McCoy, Polk county; C. E. Jones, Eight Mile, Morrow county; William C. Cusick, ~~Marion~~, Marion county.

It is to be regretted that the many others who received the circular did not deem it worth attention. No alcoholic specimens (alluded to in the circular) were received.

A glance at the above named counties will show that nearly all of the agricultural districts of the State have been heard from. The, as a rule, remarkable unanimity of statements in the letters from the above named gentlemen carries conviction, and much credit is due them for what is clearly the result of intelligent observation. To be sure, there are a few, who appear to be wide of the mark, and who condemn everything bearing fur or feathers as destructive, but such are very few, the majority showing a more fair and more intelligent discrimination.

Omitting oral communications and personal opinions, and *taking the record only from the above correspondence*, we deduce the following table relative to benefits and injuries caused by animals named in the circular:

	Benefits.	Injuries.
Pocket Gophers.	Their tunnels drain land.	Girdle and otherwise injure trees in orchards. Their mounds in gravelly meadows are in the way of the mowing knives.
		Injure timothy meadows and alfalfa. Their tunnels under root crops, which they feed upon, raise said root crops from the ground and thus injure them.
Gray gopher or "ground squirrel."		Destroy grain and garden crops. Bark and kill fruit trees.
Weasels.	Destroy burrowing animals. Eat rats and mice.	Destroy chickens and game.
Bats.	Eat flies and other insects.	
Mice.		Bad in warehouses. Eat holes in root crops and spoil them for market thereby. Destroy garden seeds when just planted. Eat grain. Damage timothy meadows.
Skunks.	Destroy yellow jackets. Eat grasshoppers and grubs.	Destroy young poultry. Eat eggs.
Moles.	Eat larvæ, worms and insects.	Injure gardens.
Foxes.	Kill rats, gophers and rabbits.	Eat chickens. Kill young lambs.

	Benefits.	Injuries.
*Rabbits.		Girdle and otherwise injure trees in young orchards.
Chipmunks.	Eat more or less thistle seed.	Injurious to grain.
Badgers.	Destroy squirrels.	Dig up roads and cultivated land.
Raccoons.		Rob henroosts and depredate on fruit and cornfields.
Minks.	Kill burrowing animals	Destroy fowl and game.
*Snakes.	Eat mice and insects.	
Hawks.	Destroy field mice.	Large hawks kill fowl and many kill beneficial birds.
Owls.	Destroy field mice.	Large varieties kill fowl.
Woodpeckers.	Destroy larvæ and insects. Useful in orchards in killing codling moth larvæ.	Very destructive to fruit grown near pine lands. Injure trees.
Crows.	Scavengers and bug-hunters. Kill insects on newly plowed fields.	Eat planted grain. Sometimes eat small chickens. Take fruit occasionally. Suck eggs. Kill young lambs.
Blackbirds.		Injure grain in harvest time. Eat corn when in roasting ear. Otherwise destructive in gardens.
Grouse.	Insect eaters.	Consume much grain.
China pheasants.	Destroy enough insects to pay for grain they eat.	Consume much grain and small fruits, berries, melons, etc.
Pigeons.	Insect eaters.	Destructive to fresh sown grain and at harvest time.
Quail.	Insect eaters.	Consume a little grain. Injurious to gardens.
Doves.	Insect eaters.	Eat a little grain.
*Blue Jays.		Eat eggs, young birds and corn.
*Robins.	Insect eaters.	Eat cherries and other fruit, and newly planted seed.

*Not mentioned in the circular.

It should be borne in mind in considering the above record that the entries have been made exactly as they were written, and further, that injuries ascribed to a bird or mammal, or reptile, in one section might be unheard of in another where said bird, mammal, or reptile is much less in numbers, and where other conditions are different.

Taking the foregoing as a basis it is easy to compute the percentage of benefit or injury caused by any one animal, viz:

	Benefits.	Injuries.
Pocket gophers	10 per ct.	90 per ct.
Gray gophers or "ground squirrels"		100 "

Weasels	50	per ct.	50	per ct.
Bats	100	"		
Mice			100	"
Skunks	50	"	50	"
Moles	25	"	75	"
Rabbits			100	"
Foxes	40	"	60	"
Chipmunks	30	"	70	"
Badgers	10	"	90	"
Raccoons			100	"
Minks	10	"	90	"
Snakes	100	"		
Hawks	50	"	50	"
Owls	75	"	25	"
Woodpeckers	80	"	20	"
Crows	30	"	70	"
Blackbirds	30	"	70	"
Grouse	30	"	70	"
China pheasant	50	"	50	"
Pigeons	10	"	90	"
Quail	70	"	30	"
Doves	90	"	10	"
Blue Jays			100	"
Robins	90	"	10	"

This result is arrived at by carefully counting the statements for or against a certain animal in the letters from the above mentioned correspondents. The authors of the letters very naturally might be cognizant of injuries done by one of these animals, while its good qualities had entirely escaped their notice. This would materially affect the result of the report. For instance, in the record of the Grouse we would, from what is known of their food habits, deem them worthy of a better showing than is here given them. Moreover, we should hardly credit the Pocket Gophers with 10 per cent of good qualities.

The very general condemnation of Moles is a surprise, for these animals belong to the order of Insectivors, or insect eaters, and many hundreds ot their stomachs which have been examined by scientists, have been found to contain only insects. Their teeth are not adapted to gnawing roots, etc., and we are forced to the conclusion that, in many cases, the deeds of another, possibly the Pocket Gopher, have been laid at their door. One correspondent urges more extensive use of poisoned wheat against Moles. As a matter of fact, while this agent has proved so effective against the "ground squirrel," and to some extent against the Pocket Gopher, it is doubtful if it would be efficacious in case of the Mole, whose food is so largely insects.

It is well to note that birds spoken of as "insect eaters," may not necessarily be especially useful thereby. That is, they may eat, and do eat, beneficial as well as in-

jurious insects. As a rule, however, the latter outnumber the former to such an extent that injurious species are the greater sufferers.

Again, Snakes, which have been credited with 100 per cent. of favorable points, by no means confine their attention solely to insects, but are very willing to occasionally eat young birds.

Woodpeckers should have been rated still higher on the red letter list, for, with the exception of one species, the yellow-bellied Woodpecker, or "sap-sucker," no order of birds is more useful to the agriculturist.

When Owls are quoted as preying on chicken roosts, one is tempted to inquire whether the fowls so troubled are carefully housed at night—as they should be.

Below are appended two letters, both characteristic of the replies sent, and both instructive:

1.

Dear Sir: The China Pheasant is not very plenty about here and I hear no complaint from neighbors regarding them. Woodpeckers I very seldom shoot as they do but little damage and much good. It is a mistake to class them with the sap-sucker. I think them very useful in the orchard, digging out the flat-headed borer.

Of Owls, we have two kinds that I am acquainted with, the Horned Owl and the small one which is so tame. I think they are useful in catching mice at night. We have four Hawks, the Fish Hawk, Red-tailed, Chicken Hawk, and a smaller variety. I never shoot the smaller hawk but the chicken hawk I occasionally kill as it attacks my chickens. The Red-tailed does not seem to trouble the chickens, but think they kill many quail and pheasants as they keep to the woods. But few blackbirds here. They come sometimes after hay harvest and gather few grasshoppers, but do no damage. Doves never seem to do any mischief. Pigeons do no damage with us. Quail, not many and not injurious. Grouse, not overstocked, as they are killed off too much. No damage caused by them. The Robin and "Flicker" are very good birds with us, for taking cut worms and grubs in the spring. The robin does not forget to get its share of strawberries, cherries, etc., and I am sometimes compelled to take the gun to him or I should lose them all. The Blue Jay is the worst of the lot. It is not content with what it wants to eat, but packs much away. It will carry off potatoes, drop them, and go back for more as long as there are any left; and will pull up many things apparently for mere mischief's sake.

Skunks are numerous. I cannot decide for or against them as I think they do lots of good in destroying many "yellow jackets" and other things, for which we do not give them credit.

The Gray Squirrel is bad on grain, but easily caught with the small steel trap. The Chipmunk is next in the line, but it destroys a great many thistle seeds.

Gophers are very troublesome, as they burrow under the apple trees and eat away the roots. They are also bad on clover and in grass land. I have caught upwards of twenty during the last few weeks.

Moles are plenty. I think they do much good to the farmer as they destroy many grubs and make a good surface drainage. It is disagreeable to have them in the garden at planting time. I think it pays to scatter the hills they throw up in the meadow, as they make a top dressing.

Bats—I am willing they should have all the flies they want.

Garter Snakes plentiful. I think they are a good help in keeping down insects and mice."

2.

"*Dear Sir:* I am glad to see this step taken by the College, and will do all I can to help you. I regard the China Pheasants, the native Pheasants, the Grouse and Oregon Quail as among the farmer's most useful friends. They are all great foragers; the amount of grubs and insects they destroy are incalculable, and the China Pheasant is the best of all our birds. The little grain they eat is nothing compared to the good they do in clearing the fields and fence-rows of insects, etc., and the close season for the protection of all these birds ought to be extended, and the law for their protection made more severe.

The Woodpeckers are useful in destroying timber grubs, borers and insects, and do no damage that I have observed.

The Owl destroys some game birds and chickens, and eats some mice and gophers. Benefits and injuries about equal. The Chicken Hawk is a bad neighbor, of which I can say nothing good; but the little burrowing hawk (owl), and the long-winged meadow hawk are both good friends. My meadow is daily covered with two or three hawks working on the field mice.

The meadows have been much injured by gophers and mice.

Blackbirds and Blue Jays are injurious birds, who meanly rob and destroy the nests and eggs of their more virtuous bird neighbors.

Doves and Pigeons are useful and should be protected by law. So also should the Robins, Larks, Thrushes, and all our native small birds.

The common crow does about as much good as harm.

No Foxes here. Skunks do no good except destroying nests of "yellow-jackets." They (the skunks) destroy game and chickens. Bats are useful in destroying insects. The gray ground squirrel, gophers and field mice, and moles, are all injurious."

The sentiment of most of the replies is encouraging, in that it indicates a wise discrimination borne of personal observation, between animals beneficial and injurious to the farmer.